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TimberTrader news

Mid-rise special – Page 16

FREE MAP!
Tall Timber Buildings

On the up

De Havilland Apartments in Fremantle used Wesbeam LVL.

Timber is increasingly being used as a major material for mid- and high-rise buildings in Australia. We asked the experts what could speed up the transition. BY DONYALE HARRISON

Brisbane's 25 King is both a record breaker and a popular hit.

Change is only ever smooth in retrospect. In the middle of the process, it tends to be much messier, with fits and starts only smoothed out into neat trend lines years later.

When it comes to the growth of timber mid-rise (4-8 storey) and high-rise (8+ storey) structures in Australia, we're still a way off the smooth part of the cycle, but it may now have reached the phase of more starts than fits, with strong increases in the number of timber-based builds in this sector over the past two years and more slated for the next two. There's still a long way to go before timber approaches the market share of steel and concrete. So how do we get there?

HISTORIC HEIGHT

Tall timber building isn't new. The Garden Pavilion, built in Sydney for the International Exhibition of 1879, was 47m high at its apex and topped by a 30.5m span dome. Brisbane's nine-storey Perry House from 1913 is still standing (now the Royal Albert Hotel). It was once a common construction method, but for much of the last century, we've seen steel and concrete dominate mid- and high-rise, with timber relegated mainly to domestic builds.

In 2012, Lendlease snaffled the record for what was then the tallest mass timber building in the world with Forte at Victoria Harbour in Melbourne. It used imported CLT to deliver a building that ticked a raft of sustainability and liveability boxes as well as showcasing a new building technique.

Immediately, the industry sat up and took notice. Several more builds turned to timber at the design stage – or shortly thereafter in some cases. One of these was Australand Property Group's The Green at Parkville.

"We were asked by TimberTruss to come up with an alternative proposal for The Green's construction, because it looked like it was being lost to steel," says Craig Kay, national product engineer at Tilling Group.

"We had just introduced the manufacture of TecBeam, so we raced to build some prototypes and had all the developers, designers and so on come here and jump on them to see how they performed. The next

PHOTOS: COURTESY LENDLEASE; WOODSOLUTIONS

> "We identified that we needed to make it as seamless as possible for them."

thing you know, we're madly constructing cassettes and designing all the attendant structural support and engineering."

It was a new concept, with a relatively short deadline, so the Tilling team worked closely with Australand, engineering consultants IrwinConsult and the architect firm SJB to get the job done. They knew the TecBeam and their LVL floor systems would work in this new application, but they needed to show how, and to come up with ways to make it easy for the builder.

"We went all-in," says Kay. "Testing, building… all the things that you perhaps shouldn't do, because it wasn't planned. But maybe that made things go better: everybody just got into it and we pulled it off."

The build represented more than just an engineering challenge for the Tilling team.

"It saw us move into the fabrication space," says Kay. "For The Green, it was all about time frames and experimenting, but on the builds we've done subsequently, we've seen that the fabricator and, even more so, the builder has been taken out of his or her comfort zone with this type of work. We know that human nature means that when you hit any impediment, you'll say 'Oh, that's all a bit too hard' and revert back to what you know. We identified that we needed to make it as seamless as possible for them and started fabricating elements such as our floor cassettes, so we can provide a one-stop shop for those elements."

***Above:** Melbourne's Treehaus in Parkville is a recently completed townhouse development where timber is a starring decorative as well as structural element.*

Australand came out of the build a strong supporter of timber materials and systems.

"They were big advocates," says Kay. "They were able to show the cost benefit analysis because they built another building in concrete beside it at the same time. The construction time on the timber build was so much better. It had one level of concrete at the base, then four levels timber-framed with 900m^2 per level residential, including 283 »

***Above:** A series of CLT pods ranging from two to four storeys deliver 62 guest rooms at Taronga Zoo's recently completed Australian Habitat and Wildlife Retreat.*

The WoodSolutions Demonstration Model at Holmesglen.

prefabricated TecBeam and LVL floor cassettes and prefabricated timber wall framing. Those four levels of timber were constructed in six weeks. Some of the studs in the very lowest sections were LVL, as the build moved up and the stresses became less, we were able to go to framing timber."

In 2015, Australand was acquired by Singapore-based Frasers Centrepoint, and the team that had helped pioneer the system was no longer there to show off the building and spread the word. The success of the program had already garnered wide attention, though – and the Judges' Innovation award in the 2014 Australian Timber awards – and more designers and builders were set to follow. They just needed a little guidance.

GOOD ADVICE

"In 2016, the National Construction Code changed in our favour," says Laurence Ritchie, cost and program estimator on the Mid-Rise Advisory Program at WoodSolutions.

"Previous to that you could potentially build a range of projects in timber, subject to an often lengthy and complex approvals process reliant on test data. The approvals process for Forte required significant testing, and therefore incurred additional costs and use of resources. It was worth it as an experiment for a huge company like Lendlease, but it was inaccessible for smaller builders in the sector."

The 2016 NCC changes saw Forte, The Green and a couple of other early projects used as case studies in conjunction with overseas builds to justify a reasoning for allowing that style of construction. Instead of requiring complex testing for each build, a set of four main criteria were established and a deemed to satisfy solution – with the resulting easy sign off – could be achieved by building to them.

"The Mid-Rise Advisory Program was set up on the back of those changes," says Ritchie. "We started as a pilot program to get that knowledge out into the industry, because nothing happens if people don't know the code has changed. We made sure that the specifiers – architects, engineers and developers – actually knew they could be building these projects with timber; what the benefits were and how that might impact their projects."

Founded under and administered by WoodSolutions, the Mid-Rise Advisory Program is now no longer a pilot and was renewed for another three years in June. It runs under a joint funding model where 17 industry partners contribute to a central pot, which the Federal Government matches dollar for dollar.

Last May the NCC expanded the deemed to satisfy conditions, previously only applicable to Classes 2, 3 and 5, to all classes of building in Australia

"Up till now, the focus of our work has predominantly been on the people who are the first decision makers, the ones doing that concept design," Ritchie says. "We try to make sure they design it for timber rather than beginning with a concrete design and then later deciding to change to timber – and then having it be a non-efficient design with problems that come with that.

"We've had very good brand penetration into those markets, so now we're moving across to the next step in that food chain, looking at builders, building surveyors, fire engineers. Essentially it's all the people who – after the idea to build in timber has been had – can veto it."

Conscious their funding is from multiple, sometimes competing commercial sources, and the public purse, the Mid-Rise Advisory Program doesn't promote any specific product or system. "We're just looking for the right solution," Ritchie says. "Sometimes light weight framing is the best option, sometimes CLT or glulam. And other times it's a mix. As advisors, we're now at a point where for more and more projects we can say that a fully optimised option would be a mix of products, using light weight where you need it and mass timber where you need it. But while that's the best-practice option, it really depends on the project team also getting to that point.

"Often the starting point for designers or builders is to simply say, 'we'll just use one

PHOTOS: COURTESY MID-RISE ADVISORY SERVICE; TILLING GROUP

system and we'll do it the whole way throughout. Easy.' And then a few projects later, they'll start customising and finding all those little efficiencies that are available."

The relationship between the Mid-Rise Advisory Program and industry works in both directions. The program disseminates research and testing, while relevant and publicly available real-world data from suppliers, builders and fabricators is shared in a bid to grow confidence in the use of timber and assure various regulatory bodies that it performs effectively.

Sometimes the shifts between the two sides are even more immediate. Architect Dr David Bylund was a member of the Mid-Rise Advisory team in its early days and Perth-based LVL manufacturer Wesbeam was a gold sponsor, which gave the company a seat on a quarterly committee listening to reports.

About halfway through the pilot phase, Wesbeam decided to move from this somewhat passive role to a more active one. Denis Cullity, Wesbeam's marketing director offered Bylund a role heading up a new, special division within the company that would focus on improving their part of the supply chain into the sector

"At that point, they didn't know what it would look like or quite how that would impact their business model at the time," Bylund says. "So when I decided to take the opportunity, because it would allow me to develop Australian-specific systems rather than just stay in an advisory role, I proposed a division within Wesbeam specifically tasked with growing these opportunities, which is how Wesbeam Tall Timber Building Systems (TTBS) came about."

Although anchored within a material supplier, TTBS focuses on education, with multiple publications available for free download. Recently *An Open Source Guide to the Wesbeam LVL Tall Timber Building Systems* was released. It details not only the full specifications of Wesbeam product for ready integration into design models, but also mass timber design principles and connection details, etc.

Like the Mid-Rise Advisory Program, TTBS began by targeting specifiers. "They're still very important to us," says Bylund, "but we also talk with pre-fabricators, because they're a very important link between supply of the raw material and the knowledge around what to do with that raw material. And the third group we target is builders. I like to use the word 'montage', because it is an assembly process: they bring the different trades and skills together but it's all done around a prefabrication philosophy. They're working under the assumption that the building will be delivered with a fairly large component being manufactured offsite and then installed or assembled onsite. And that's a new

Clockwise from above: *Services and penetrations form part of the Demonstration Model; lifting Tilling floor cassettes into place at The Green; SmartJoist and TecBeam formed the floor joists and roof for the four-storey DHHS Preston Renewal Stage 1 in Melbourne.*

> "I like to use the word montage, because it is an assembly process: they bring the different trades together around a prefabrication philosophy."

philosophy, one where we can help with their education and show how prefabrication fits into their particular business model and delivery methods."

A hands-on example of this cooperation sits at Holmesglen Institute in Victoria. The Mid-Rise Demonstration Model is a three-storey build by WoodSolutions that incorporates multiple materials, connections, penetrations and building systems, fitting the equivalent of a seven-storey tower into its height. LVL and expertise from Wesbeam form part of the building, along with materials supplied by other WoodSolutions partners.

A MATERIAL WORLD

"It's fair to say that a lot of the costs of testing and information dispersal are being met by manufacturers and suppliers in the Australian market," Bylund says. »

> There is no 'proper' material for timber mid-rise. The majority are hybrid builds.

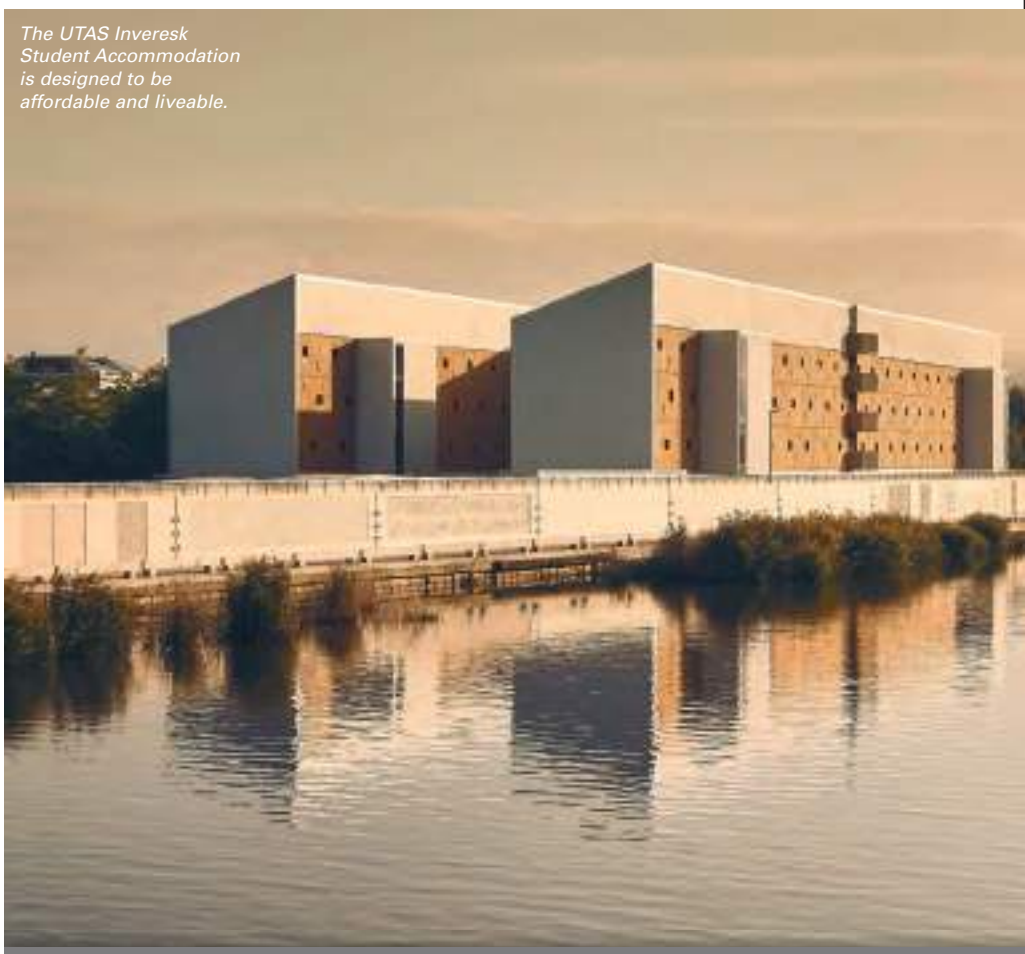
Along with Wesbeam and Tilling, other established companies have invested strongly in helping to grow the sector. Hyne has published BIM content – Building Information Modelling that gives accurate data and a virtual 'product' for both design and asset management models – for all its glulam products. Dindas, Hyne, Tilling and Wesbeam all provide design and engineering support for their range. And a new CLT manufacturer, CLTP Tasmania, is currently gearing up to start operations, adding to the small set of local mass timber producers.

As Ritchie says, there is no one 'proper' material for timber mid-rise. The vast majority represent hybrid technologies, with light weight or mass timber, even concrete and steel used as needed to meet design needs from site requirements to budgets (see Case study, right.) For the local industry, that means the sector is ripe for investment and growth, with many of the materials and technologies required for these builds already in place, but there are a few hurdles to clear.

Tim Rossiter is the GM of MiTek's Building Solutions Asia Pacific division. "Our parent company, MiTek US, owns USP Structural Connectors," Rossiter says. "So that gives us great insight into what is possible. I did a TDA tour with some colleagues a couple of years ago, into the Northwest of the US to investigate this new thing called multi-storey timber framing. And the biggest takeaway I had from that experience was that in the US, it isn't unusual, it's not difficult. All the problems that we raised weren't really problems at all. It's just a matter of our market getting itself to that stage."

Here, MiTek has worked with several fabrication clients on mid-rise projects. "We're in a very good position to provide solutions into that space," Rossiter says, "But we're not doing a great deal there yet."

He points to the small number of fabricators currently able to move into the space. "While there are a few in Victoria, such as TimberTruss, who are heavily involved in commercial work, the problem across much of Australia is the size of the businesses available to tap into these styles of projects. You need someone with a reasonable amount of capital and some groundswell of existing work to move into multi-storey, otherwise you're tying up your whole business in one or two projects. So it's a bit of a chicken and »



The UTAS Inveresk Student Accommodation is designed to be affordable and liveable.

CASE STUDY: ENGINEERING ON THE NORTH ESK

The University of Tasmania's Inveresk Student Accommodation is located on the banks of the North Esk River, which is a challenge in itself. The constrained site has complex geology and a potential for flooding. To this were added the client requirements of ecologically sustainable development (ESD) principles and a very tight construction program.

From the start, a desire for timber was part of the design mix thanks to the University's Centre for Sustainable Architecture with Wood (CSAW) being a core part of the project team. But realising the goals of the Morrison & Breytenbach Architects design was a challenge until Aldanmark Consulting Engineers came on board.

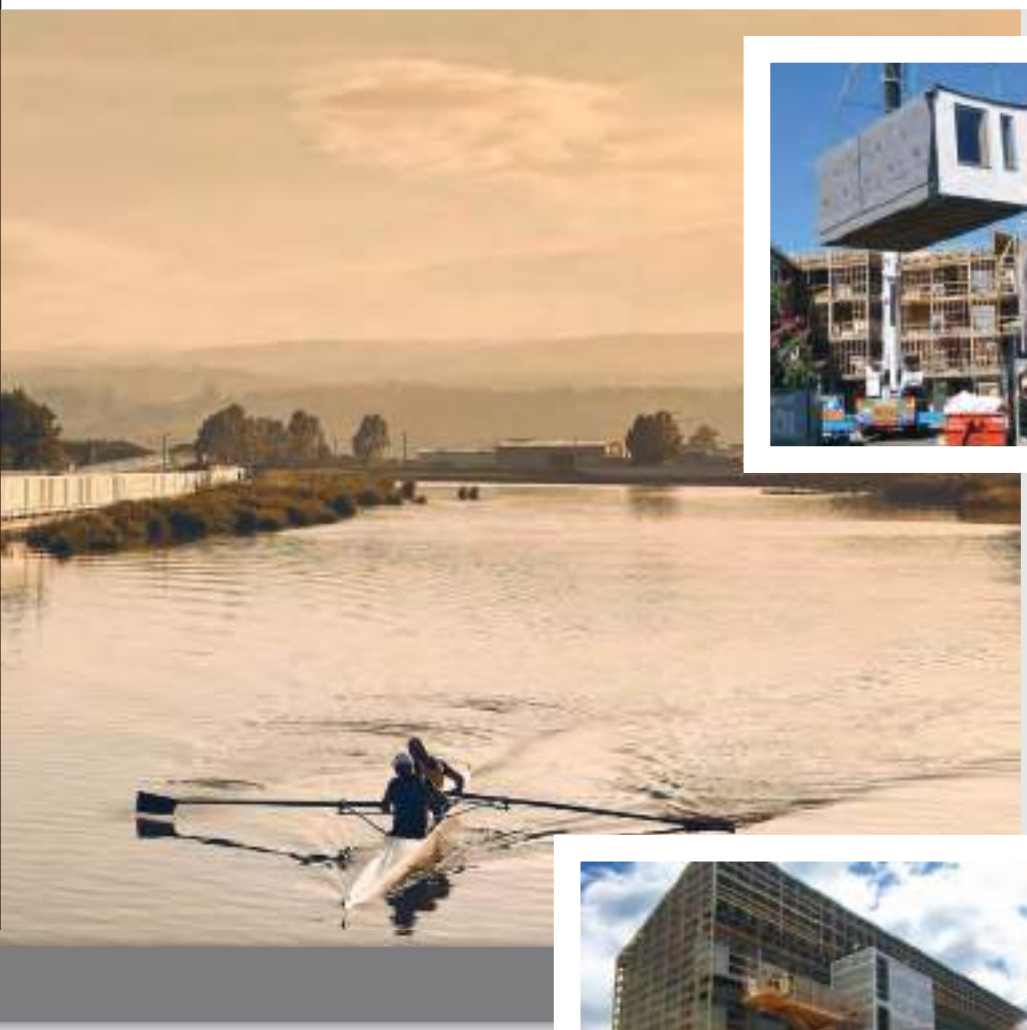
"We knew straight away that light timber had to be the mainstay of the residences," says Aldanmark structural engineer Tim Watson. "The soil conditions were terrible, so we had to minimise the weight of the building as much as possible. At the same time, the Esk is still a major flood risk, so we needed a non-inhabitable concrete ground floor to essentially 'float' the building above the one in one-hundred-year flood level."

A post tensioned slab was used to create a raft with minimum thickness and avoid joints over its 80m length. Timber piles were used to carry the concentrated column loads for this car park ground floor and precast concrete beams kept maximum head room with minimum overall height.

All other challenges aside, this was Tasmania's first multi-storey timber residential development, and many contractors balked at the magnitude of the job – 120 apartments in a novel building style with a focus on prefabrication. In response, Aldanmark showed how the majority of the build could be broken down into lightweight timber apartment modules (complete with kitchenette and ensuite) that could be constructed offsite, with CLT communal areas and linking walkways.

Watson had seen what went into London's first CLT highrise building – Murray Grove – at his old engineering firm and so had practical ideas for dealing with multiple problems at once. "We actually built a prototype module prior to starting onsite," he says. "Doing that solved our issues. We could optimise the structural design and lifting points, see precisely how much of each material was required, which

PHOTOS: COURTESY ALDANMARK CONSULTING ENGINEERS/PHOTOGRAPHER DAVE GROVES



minimised waste as well as cost, and provide a template for every element and process for our contractors."

Once the prototype module existed, the nerves that had accompanied the tendering process disappeared as every question now had an answer. It was even used for a test lift to show the build team how the final structure would come together and to model the transport for each unit.

"One contractor worked on everything, from building modules offsite to carrying out site works plus installing CLT," says Watson.

The modules were built in a vacant shed 500m down the road from the site, with a 10-day assembly line from initial framing to completed internal finishes and external cladding. "Each of them was 99% finished (including wiring, plumbing, fixings etc) in the warehouse," Watson says.

"The builders were hesitant to start with, but when we broke the construction down into processes they were familiar with, showing how the components matched to standard floor, walls and roof, they realised it was actually quite straightforward."

The modules were craned onto the first-floor post-tensioned concrete beams and then stacked like Lego above. Some of the communal area CLT is supported on steel frame, and some has a less-standard installation method.

"The corridor walkways were an interesting challenge," says Watson. "The construction sequence meant we couldn't cantilever them from the modules, and the design meant we couldn't support them on columns beneath. So we hung the three levels of CLT walkways from timber truss at the top. We designed the trusses to support a tension member and that did the job."

Completed in the 10 months available from installation of the first pile to the start of Semester 1, the project was within budget as well as on time. "It all came down to showing that it was doable with the prototype," Watson says. "We haven't done a lot of complex prefabrication in Australia at this point. Most of our fabricators focus on small to medium residential. But we were able to show there was nothing foreign or difficult about moving to advanced timber prefabrication. It was just an extension of skills they already had, using slightly more complex engineering."

While some of the factors that went into the success of the build were luck – the residences are within walking distance of Launceston, which meant there was ready access to a pool of skilled tradespeople as well as a facility of adequate size for the prefab work – most came down to heavily detailed planning and then a willingness to test and refine the plan at an early stage.

"We worked closely with CSAW on the prototype," Watson says, "and that delivered benefits to every part of the build. We realised we could complete 80% of the construction at ground level, which is a huge reduction in the working at height risk, especially for a 16m-plus building. And because most of the building was constructed indoors, we eliminated most of the risks to structure and workers associated with wet weather, which Tasmania still gets. Once we had finished with it, that prototype module went into the final building."

The Aldanmark team used an Austrian-designed absorber strip to avoid airborne and structural acoustic transmission and lined each module with two layers of Fyrchek plasterboard to self-contain any potential fires. "Fire risk was one of the reasons we used CLT for the communal areas and walkways," says Watson, "because it has such a good performance with its charring and self-extinguishing qualities."

The result is not just a successful, affordable university residence that is already improving life for students, but a successful, affordable build that has shown what can be done in the sector. "We'd love to work on something similar again," Watson says. "Especially since we now have more data on taller timber structures that could well make the next project even faster."

For more details, visit www.aldanmark.com.au

Above: *BVN's design uses CLT to construct two residential halls – one seven storeys and one nine – and a new five-storey teaching building in the Kambri development at ANU.*

egg: we need enough buildings happening that there's a market pool, and we need enough people willing to do the work that there's a supply availability. Right now we're trying to find that balance," says Rossiter.

They're not alone. "Our fabricator customers have historically been focussed on the detached home market," says Christine Briggs, national marketing manager at AKD Softwoods. "But future housing in Australia will be more about medium-density development. When it comes to the mid-rise market, the supply chain is still evolving and often new market access requires unique or different approaches."

AKD's response has been to create a series of partnerships to help their customers.

"Building this joint capability means that in some instances AKD may seek to bring project opportunities to our fabricator customers and offer special support to quote these jobs," Briggs says. "Vertical extension projects are of particular interest here as we understand the need for a structural solution going up above existing developments but with a light weight footprint. Our partnership with the WoodSolutions Mid-Rise Advisory Program is designed to help give us access to these project opportunities and better understand what the builders and developers are requiring from fabricators and installers."

Rossiter is cautious. "We have fabricators telling us they just don't have the cashflow depth. They remember Strongbuild."

PROBLEMS HAVE SOLUTIONS

Flagged as a salutary lesson by some, the demise of high-profile timber mid-rise company Strongbuild in 2018 was due to unique issues, but focused on cashflow.

"Cashflow is one of the two major barriers we see for fabricators, "says Rossiter. "When you have someone who's specifically set up to do this sort of work exhibit that cashflow problem, some in the industry respond, 'Ooh, look, see, told you so!' But that's why firms like TimberTruss and Drouin West Timber & Truss in Victoria have been successful: they have enough backbone of other work to deliver the cashflow in one part of the business to prop up the longer-term projects in the other part of the business."

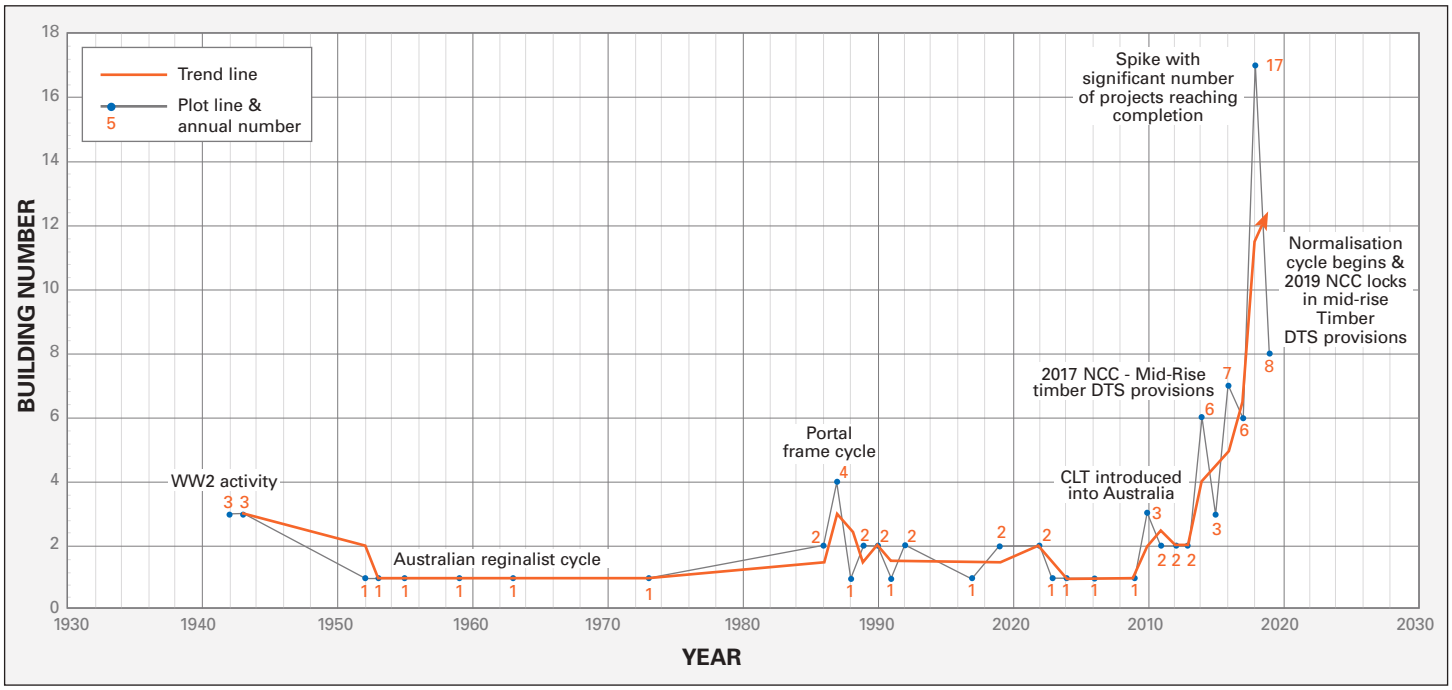
Because mid-rise projects can take months to finish, and the Australian payment model is on completion, fabricators can be left out of pocket for longer than they can bear. "There needs to be a change of finance model and potentially a change of concept of ownership," Rossiter says. "It's going to be hard to sort out because it will mean builders paying for items they don't yet have."

The other barrier for fabricators is space, as these can be very large jobs with sizable components and many firms are running at or near capacity. Here design can come to the rescue, with a schedule such as the Inveresk build that takes each section of the build at completion and gives the fabricator space to start the next.

Builders have also been reticent to move away from traditional materials.

"The industry typically has very low margins and can be risk averse," says Ritchie. "Even if it's the best product in the

Significant Timber Buildings in Australia: 1942 to 2019



Above: *Significant timber building construction in Australia since 1930 (includes some sub-four-storey buildings) by Dr David Bylund of Wesbeam.*

DIAGRAM: DR DAVID BYLUND; PHOTO: COURTESY BVN

world, when we're bringing a new product, it's still an unknown risk to many builders. We're very fortunate to have a leader in the space like Lendlease. Recently Multiplex, another very big, tier one builder, has seen this as a space where they can specialise as well. They're into project number three in Melbourne and keenly looking to use timber wherever they can to differentiate themselves. Those companies have really acted as great case studies and a great precedent for the rest of the industry."

One factor that should help to entice builders is the superior safety of timber building models, especially panelised and modularised designs. "Safety is probably the biggest driver in construction," says Ritchie. "Especially when you start looking at projects over $15 million. Safety eats up much of the costs for the builder – quite rightly, because every construction task is a high-risk task. So there is a huge benefit when you can have the majority of your work from a structural point of view completed in a factory and then crane and screw panels into place on site. Lendlease Australia has completed eight timber projects in Australia and they haven't had a lost-time injury (LTI) on any of those projects. Typically every traditional project in the mid-rise space will have at least one LTI due to the high risk."

Kay suggests easing builders into timber. "We have to be practical. It may be that a steel skeleton for a building is the most efficient way to do it. But we could drop timber floor cassettes into that steel grid and still achieve significant program and cost savings for them. We're not going to say, 'we're timber building people, so unless you build it all out of timber, we're not interested.' Because 20% of something is something; 100% of nothing is nothing. We're better off doing 20% and letting people see how good the product is."

Bylund and Ritchie both agree that designers are already excited about the possibilities of timber. "I've got an adjunct research position at UWA," says Bylund "and the other day one of my colleagues informed me that about 25% of the 2019 fifth-year architecture Masters theses involved mass timber building elements. It's moving towards what we would call normalised already. The new crop of architecture graduates will take a certain degree of knowledge into the industry – they'll drag the engineers kicking and screaming, but they will follow.

"It's definitely changing towards a much broader baseline of knowledge, similar to what we have with other materials. When I was an architecture student, precast concrete was just starting to come on and I remember learning about it and thinking, 'Wow!' The whole notion of creating a whole wall panel somewhere else, and putting up

> "Lendlease Australia has completed six to 10 timber projects in Australia and they haven't had a lost-time injury on any of those projects."

and having an instant wall just fascinated me. And now look at it, it's ubiquitous."

Bylund points to the considerable corporate knowledge in the sector that is growing day by day. "Everybody is learning from each other, even high-performing companies in this space such as Lendlease, Multiplex, XLam and Wesbeam. And much of that knowledge is shared in a bid to grow the sector. I'm working on another open source design guide at the moment for light weight structures and, like the mass timber one, it will be a living and evolving document that people can comment on as well as use."

Overall, there's optimism tempered with experience among the people we spoke with. "The intel we have from resources like the WoodSolutions design guides is great for helping build local solutions," Rossiter says. "In the longer term we're going to be building that style of structure and we already have the know-how and the supply side sorted. So now it's a matter of waiting for more brave fabricators – and builders – and when they are able to get in that space, it'll be waiting for them."

Talking with Ritchie about the list of four-storey and more Australian timber buildings that forms the basis of the map included in this issue, he spouts off multiple reasons for why there will soon be more, from sustainability to cost, safety and speed of construction. And then he pauses.

"Every six months or so, I hear someone say, 'this is the point where we've finally turned the corner and timber is becoming the standard,'" he says. "David Bylund's chart shows that we've had exponential growth recently. But in reality, there's hundreds of mid-rise projects in Australia completed every year. We're looking at 25 of them happening in timber this year. It will continue to increase, but it's still a small percentage of the total number."

He notes that confidence in the material is growing as more case studies are built and more research, such as fire testing, is disseminated. "It's moving in the right direction," Ritchie says. "Everyone is working very hard to make sure timber becomes as close to a standard building material in the mid-rise space as it can be, but I think we've probably got a bit longer to go." T

For more, visit www.akd.com.au, www.mitek.com.au, www.tilling.com.au, www.wesbeam.com and www.woodsolutions.com.au/mid-rise For more on early Australian timber building, see GB Nolan's 'The forgotten long span timber structures of Australia' at https://eprints.utas.edu.au/ (search whole-Nolan-thesis).

Gillies Hall at Monash, where CLT delivered a saving of 50% CO_2 over a concrete building.

PHOTO: COURTESY WOODSOLUTIONS