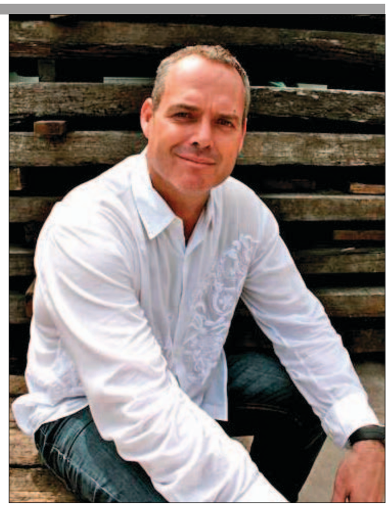
CROSS LAMINATED TIMBER



Kevin Hill, Managing Director, Venturer Pte Ltd

The building and construction industry in Europe and the US is no amateur in using timber to build superstructures. This trend is just beginning to take off in Asia, as legislation eases up to include engineered wood as a structural element in high-rise buildings. Kevin Hill, Managing Director of Venturer Pte Ltd, shares about unlocking the future for engineered wood structures in Asia.

Structural beams made from glulam for the construction of Paultons Park in Romsey, UK

Photo Credit: Timber Concept GmbH

THE UNLOCKED POTENTIAL FOR ENGINEERED WOOD STRUCTURES IN ASIA

1. What are some of the benefits of building structures with wood?

Wood has a very complicated and efficient micro-structure engineered by nature. When we look to the forest, we see many examples of impossibly high, skinny, bushy trees that appear to defy gravity. The key to unlocking their building engineering potential requires intricate knowledge of each species' particular properties that can vary tremendously.

With this understanding, we can extract the best from a particular species targeted for a variety of its advantages such as abundance, strength, durability and stability.

Modern wood engineering in essence manipulates timber's natural properties by disassembling the wood fibre and reassembling it in a given format, then combining it with high technology adhesives and immense pressures to make 'super' timber components.

This high tech approach to wood engineering creates structurally efficient, highly stable, strong and very light building components that can be formed into very large members or panels.

These panels perform well in both tension and compression. More importantly, they are very efficient in terms of their strength-to-weight, in many cases, less than a quarter of the weight of reinforced concrete.

Lightweight building is core to the advantages in the use of these products. This inevitably means less foundations, easier to handle, lift and erect components, with much better tolerances, negligible thermal movement and hence, a high-quality prefabricated component as opposed to traditional cast on-site components.

2. What are some examples of engineered wood products?

Both glue-laminated (or glulam) beams and Cross-Laminated Timber (CLT) are steadily growing in their adoption in Europe and the US. These products are capable of faster construction times—about 30%—without the increase in cost if buildings are designed with the technology at the get go.

Glulam is a structural timber product manufactured by gluing together individual pieces of dimensioned and strength graded timber under stringent manufacturing conditions. It is ideal for load bearing structures where long spans are desired. It offers the architect artistic innovation freedom without the constraints of structural requirement.

CLT on the other hand, is made of five to seven layers of lumber boards stacked and glued perpendicularly to one another, resulting in structural strength across two dimensions.

3. Do you have a dream or vision of a future city built on wood?

CLT and glulam have their role to play in this vision, but we are not so naïve as to think they are the single answer in making the built environment more efficient and sustainable.

Our approach is one of a hybrid methodology that new software systems like BIM (Building Information Modeling) are unlocking. This allows the seamless integration of steel (very good in tension) with concrete (very good in compression) with CLT and glulam (quite good in both tension and compression).

In the past it was very difficult to model these components holistically especially when trying to overcome the challenges in the connection details. BIM has, to a large extent, achieved this. Engineering software now allows for the engineer's design to be uploaded directly to CNC machines that fabricate components, without the need to draw and redraw components in different formats, a common problem in building design.

This translates into a vast potential in terms of cities made with wood as a significant contributor of the overall structure, potentially displacing millions of tonnes of concrete and steel, which means enormous savings in embedded energy, with massive amounts of stored carbon, whilst making better, more efficient and cost-effective structures. To put this into perspective, wooden buildings sequester approximately 160kg for each cubic metre of material used, versus concrete that produces around 560kg of carbon for every cubic metre.

4. How far along is Asia in coming up with its first wooden building? For that matter, which country do you think will get there first?

In terms of tall buildings, Asia is a thousand years or so ahead. The Sakyamuni pagoda in Yingxian province, China, built in 1056 is 56m high (excluding the spire). It has survived numerous fires and earthquakes.

Excluding Australia that now has several examples—such as Forte, a 10-storey CLT building and Library at the Dock in Melbourne—Singapore may be the first to build Asia's first engineered wood building. The Nanyang Technological University has submitted a tender for the construction of a new five-storey sports hall with glulam trusses spanning 72m, 2m longer than the longest span in the UK.

Currently, construction is also under way for a glulam bridge in Putrajaya, Malaysia. The bridge will be completed in the second half of 2016.

Japan has a standard to produce CLT but cannot build with it yet, as they have no standards

Nanyang Technological University Hall of Residence 5 under construction: The new canopy features the first European Spruce glulam beam imported to Singapore with local regulatory approval.

for its use within the structural fabric of buildings. This will only be scheduled for sometime in 2016.

5. Why is Asia so behind Europe in using wood as a structural component in buildings?

There is a certain stigma about the use of timber as a structural component in buildings, perhaps because it was such a prolific material before the boom of reinforced concrete in the 50s and 60s. Coupled with a lack of understanding in its properties when engineered in particular, it has led to harsh legislative restrictions in its use here and the region, thus its overall adoption in the region.

However, legislation for their wider uptake is happening around the world, including Asia. Singapore has acted quickly to reassess this long-established mindset, overturning a ban on the use of structural timber under the revised January 2013 fire codes. Last year Singapore sanctioned the use of CLT and glulam from approved European sources in multi-storey structures up to 24m high (approximately seven storeys), or up to 12 metres for healthcare projects. This reversal in policy has happened in less than 18 months.

In Singapore, the Eurocodes have replaced the British Standards as Singapore's prescribed building codes for structural design, since April 1, 2015. Similar to concrete and steel, the use of engineered timber has to comply with the provisions of the Eurocodes.

In fall 2015, Treet, the world's tallest timber building will be completed in Bergen, Norway. At a towering height of almost 50m, this high-rise residence will topple Forte in Melbourne, which currently holds the world record.

6.Can you share some of your projects that are in the pipeline now?

Venturer is one of the first companies to gain approval for European Softwood glulam used as structural components for an expansive canopy for the Nanyang Technological University Hall of Residence 5 in Singapore, under QXY Construction. This will be completed in the second quarter of this year. We are also hopeful of constructing the new NTU sports hall mentioned earlier.

We are also in the midst of a design-and-build contract for four public area buildings at the new St Regis Maldives, designed by WoW Architects of Singapore. These are constructed from CLT and glulam prefabricated kits made in Austria. These will then be clad with Canadian western Red Cedar.

We are engaged with several government-linked agencies and private sector developers in Singapore and the wider region, with the view to undertake full feasibility studies across numerous sectors including link bridges, recreation, research facilities and hospitality. The purpose of the feasibility study is to give the customer a workable design solution for any given project opportunity, complete with costs and performance criteria so they can compare this with more traditional methods of construction.

Fortunately the Singapore government has offered grants that bear up to 70% of the cost of such studies for projects carried out in Singapore. These studies are essential for any client seeing the real detail behind what these systems have to offer.

7.What are some of the challenges in trying to push for these wood-based construction to happen?

As expected we have heard concerns with fire, moisture, termites and our local humidity. There is an extensive mitigation strategy for these but in summary:

•Fire

The design allows for the fact that wood will char or form a layer that helps protect the structural material below it, this means the component is accepted to burn or char at 0.7mm per minute.

• Moisture

Products made in Europe with a CE rating allow for products being exposed to 85% Relative Humidity (RH) for prolonged periods of time. Exposed glulam beams for example, can be constructed with higher service classes for permanent exposure of 85% RH which is the highest RH we see in Singapore.

• Termites

There are a number of factory applied preservatives that resist termites. These are coupled with traditional methods such as anti-termite mesh, traps and soil treatment.

8.Given the expected increased consumption of wood in future, how can our wood resources in Asia be better utilised?

In theory if we convert 10% of all of Asia's plantations to the production of engineered timber suitable species, such as some Eucalyptus varieties, there is the potential to build 40 million m^2 of Building Gross Floor Area (or GFA) per year.

There are however numerous obstacles to overcome:

•The cost of producing European engineered wood products is low as the forests and mills there are highly efficient and mechanised, coupled with the fact that shipping is inexpensive on the way back to Asia from Europe, so price point is a challenge.

•Plantations in Asia do not currently grow efficiently, particularly the target tropical plantation hardwood species we need to make tropical engineered wood products.

•The factories and resources in Asia are largely disjointed, adding to cost inefficiencies.

•The research and testing has a tremendous way to go

•The market for these products is not yet established, thus producers are unlikely to financially commit to change or invest in their operations to suit undetermined demand.

However the potential is:

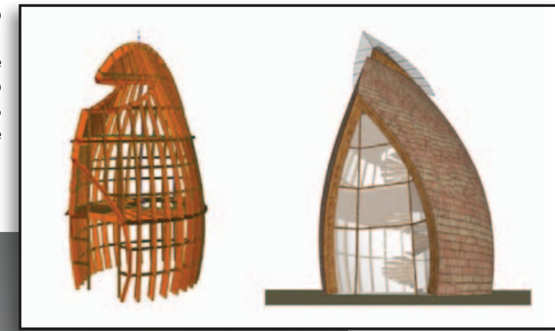
•Plantation hardwoods are potentially two or three times faster growing than softwood alternatives

•Generally, these hardwoods are naturally durable and performs better in fire as it chars slower

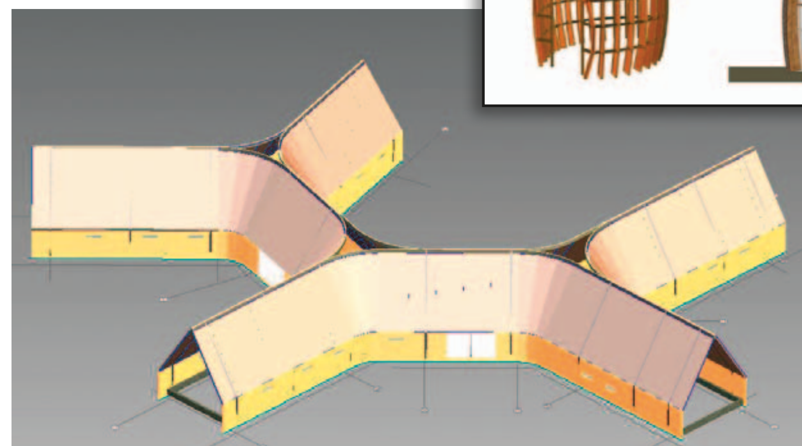
•There is the potential for it to be up to 30% stronger

Finally, the real potential to unlocking the future lies with a technology in its final phase of development currently being pioneered by Lignor Pte Ltd in Australia. This involves stranding the whole tree (80% use as opposed to 30% with solid wood products), and reconstituting it with special resins, making it highly efficient and a super strong tropical engineered wood product. PFA

Observation Point & Gift Shop



Designs for the Nature & Wellness Centre (below) and Observation Point & Gift Shop (right) for the new St Regis Maldives by EWS Consultants Pte Ltd. The structures are made from CLT and glulam.



Nature & Wellness Centre