The Future of Office Buildings

Jonathan Evans
Principal | Tzannes
Sydney, Australia

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1. Offices for a new generation

The Australian government, and most governments around the world, are not adequately recognising or addressing the advance of climate change. The current baby boomer generation of politicians and captains of industry are, on the whole, encouraging of overt consumption and high levels of waste, the destruction of ecosystems and the replacement of the natural environments with man-made and controlled ones. The result is a clear and present threat to human existence on the planet - rather than the planet itself which will adapt and regenerate.

A systematic change in the way we build our ever expanding cities is required to meet the needs of future generations and ongoing human existence, in harmony with the planet rather than dominion. Office building to conduct continuing business and commerce will be required by our society, though it is essential for this building typology to rapidly shift to a more sustainable position, including:

- Carbon neutral in construction and operation
- Located with access to public transport to reduce reliance on cars
- Constructed from renewable materials which do not release stored greenhouse gases into the atmosphere
- Generate on-site renewable energy and harvest water to be self-sustaining
- Efficient use of space to encourage agile and communal workplaces

As a multi-disciplinary design practice, we at Tzannes have dedicated research and design time to develop solutions to build innovative and sustainable office projects for future generations. The basis of these projects has been the use of mass timber, as the only primary structural material available to us which is renewable and sequesters carbon dioxide. To date there have been fine examples of purpose built timber offices for owner / occupiers with a vested interest to showcase wood, however to be expandable and easily replicable this form of construction needs to be attractive and desirable on the open market, vying against other premium grade office spaces on offer, even with their significantly higher carbon footprints.

Figure 1 and 2: International House Sydney, completed 2017 at Barangaroo

2. Benefits of mass timber for office buildings

Advances in engineered timber products have permitted a new way of constructing office towers, a new form of beauty for office buildings, which positively contribute to the public domain and support the wellbeing of its users. I would like to explore the benefits of mass timber and responsible innovation for office buildings, using a number of our built and in design projects to illustrate where we believe there are current opportunities and further benefits to be made.

To date three timber commercial projects have been designed for Lendlease, totaling 38,000 square meters of gross floor area and utilising approx. 15,000 cubic meters of engineered softwood and recycled hardwood timber.

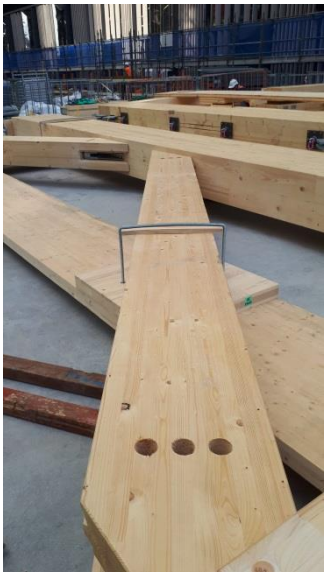

Figure 3 and 4: Daramu House ("tree house" in local Sydney aboriginal language), under construction at Barangaroo

2.1. Public Domain Benefits

The ultimate public benefit is for the construction and operation of our buildings to not contribute towards global warming. Timber is a replenishable material made from carbon sourced from the atmosphere, with very low energy requirements for manufacture of high value structural members. It is our hope that this new use for timber will attract further investment to greatly expand certified and responsibly managed Australian forestry and create a better purpose for the trees than low value wood chipping and pulp.

All buildings, and especially those constructed in dense urban environments, need to make a positive contribution to the surrounding community and built environment. International House introduces a new piazza to the Barangaroo precinct, as well as a colonnade to provide undercover access along the edge of the precinct. Timber forming the colonnade is solid recycled ironbark, supporting the 7 storey building without internal steel reinforcement.

Daramu House will include a bio-fuel generator, sourcing fuel from recycled cooking oil used on-site to supplement roof mounted photo voltaic solar panels to provide for the buildings energy demands greatly mitigating reliance on fossil fuels.

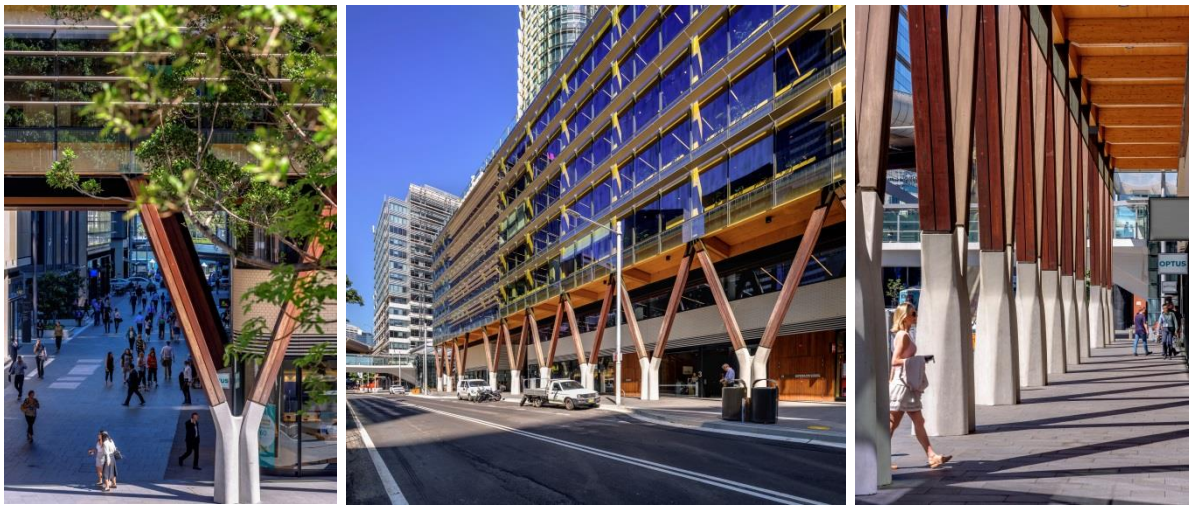

Figure 5 – 7: International House Sydney colonnade with Y columns constructed from solid recycled ironbark hardwood

2.2. Biophilic Design – Connection to Nature

Buildings in which we spend half of our waking hours should provide a positive contribution to the health and wellbeing of its occupants. Sadly, the opposite is more common, with drab, dull synthetic interior environments controlled by mechanical ventilation and artificial lighting contributing to stress, dissatisfaction and the poor health of users.

Modern research into the positive effects of biophilic design elements on humans, such as daylight, views of nature, and being surrounded by natural materials – has demonstrated improvements to physical and mental wellbeing. The use of wood in the workplace has proven to increase satisfaction with the workplace, leading to reduced absenteeism, and higher productivity. Which corporation wouldn't want to embrace all of those attributes for their workforce?

Timber interiors stimulate the human senses and provide a workplace environment like no other. Sweet smelling, warm, tactile and inviting to touch, beautiful to look at - the office spaces engender health and calmness. Post-occupancy feedback from users to date is extremely positive, with the nurturing character of the spaces featuring in responses.

With all of our commercial timber projects we have relied upon the natural charring of timber to provide the required fire protection of the structure rather than encapsulation with finishing materials, allowing the beauty of the wood to be clear and present in the interior of the spaces.

Figure 8 and 9: Interiors of International House express the beauty and warmth of natural timber throughout

2.3. Authentic and Efficient

No special governmental financial support is on offer for the construction of innovative sustainable buildings in Australia, so we have needed to design for structural and installation efficiency to maximise the benefits of the timber pre-fabrication process in a very competitive commercial environment. Another fundamental difference with the Barangaroo projects is that they are speculative projects to be leased on the open market, rather than for owner / occupier who may have a vested interest.

As the first commercial building of its kind, we also sought a very authentic representation of mass timber construction to explore the limits. In all 3 projects the ground level is constructed from reinforced concrete to provide physical protection from ground water, impact and termites whilst affording higher fire protection for the more public ground level uses like retail and entertainment. Above this floor all elements are timber construction - including floors, walls, columns, beams, lift shafts, egress stairs and the roof - removing wet trades from the site.

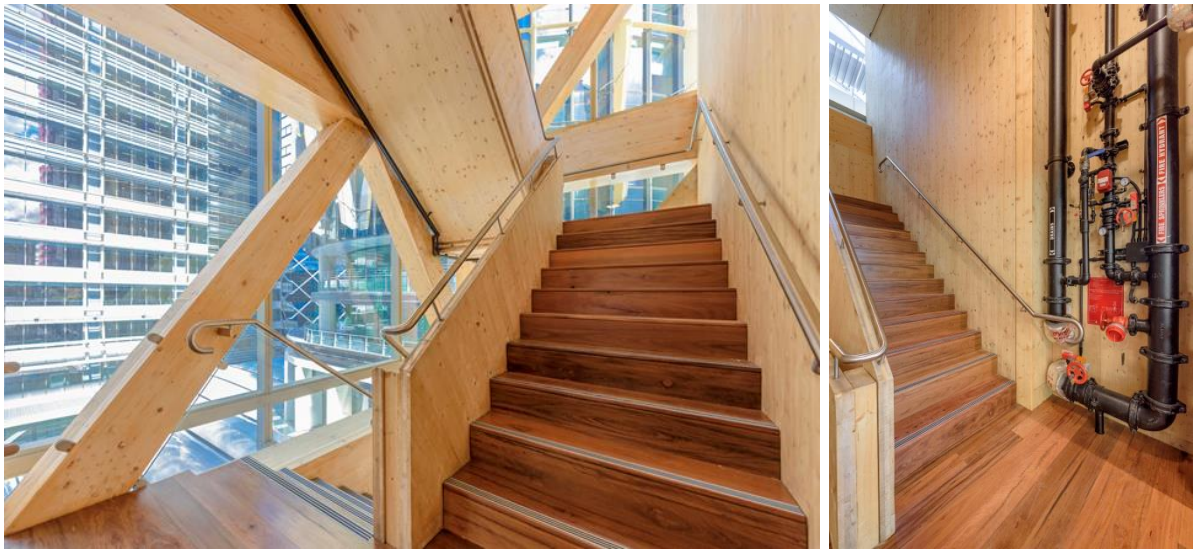

Figure 10 and 11: Internal egress stairs invite use for movement between floors – constructed from CLT and treads and risers lined with recycled hardwood

2.4. Precise and Robust

Quality-controlled factory prefabrication processes, using very precise cnc machinery fed information from our initial digital models, resulted in an accurate representation of the design teams intent. Full CAD BIM modelling and clash detection in digital format has resulted in an accurate and waste free installation of structure and services.

Projects completed to date express the ceiling services as part of the character of the workplace, complementing the warm CLT timber soffits with black mechanical, hydraulic, fire and electrical services. The lack of ceilings also: reduce cost; reduce use of earth's resources; provide greater spatial volume; and also facilitate easier maintenance and re-location of services when required.

Where timber is exposed to the weather externally, Australian recycled hardwood timbers have been employed. On International House, this timber was sourced from either dismantled road bridges, or from wharf timber retrieved from the very same site that the building stands. In the late 1800's and early 1900's, the harbour front area was a major port for Sydney, with wharfs and piers for the loading and unloading of varied goods, all constructed from solid timber. During the 1960's these timber wharfs were demolished and replaced with a concrete slab to suit container ships. As an urban renewal site, the 1km long slab was removed with part of the site returned to natural landscape. The 100 year old timbers retrieved from in-ground harbour sea bed have been milled and re-used as beautiful seasoned hardwood cladding on the building and a testament to the resilience and potential of timber to be recycled many times over in various forms.

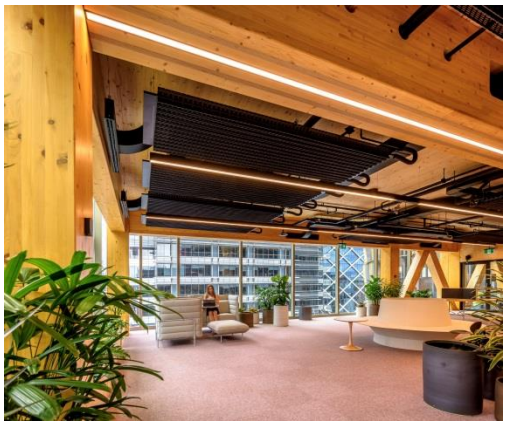
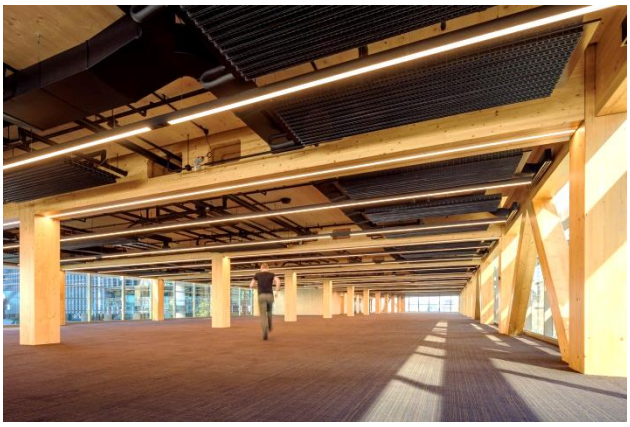

Figure 12 and 13: Exposed timber and expressed services provide the character and interior quality to the workplace

3. Conclusion

We have been excited and challenged to design with timber for a mid-rise commercial form, which demonstrates a credible sustainable future for unique and desirable office buildings around the world

Barangaroo Project Team

- Architect: Tzannes
- Client and contractor: Lendlease
- Timber engineers: Lendlease Design Make
- Concrete engineers: Arcadis
- Services: AECOM / WSP

Barangaroo Suppliers

- CLT: Stora Enso
- Glulam: Hess Timber
- Recycled hardwood: Australian Architectural Hardwood