WCTE 2016 IN REVIEW

S. Chung

Structural Engineer, Opus International Consultants Ltd.

Email: stanley.chung@opus.co.nz

FOREWORD

The 2016 World Conference in Timber Engineering (WCTE) was held in Vienna, Austria from 22nd to 25th August. Over the four days there were over 500 presentations. Following the conference there were technical tours that varied from half a day to two days in length. I was also given the opportunity to attend the two day tour around Graz and Carinthia which showcased some of the timber construction in the area and included visits to production plants.

I would like to acknowledge the Timber Design Society (TDS) and the management committee for granting me the scholarship. This scholarship involved a significant financial contribution which covered my attendance to the conference. Thank you for this unique opportunity to attend this conference.

CONFERENCE IMPRESSIONS

The World Conference of Timber Engineering (WCTE) was held at the University of Vienna from 22nd to 25th August. There were over 1200 registered attendees from all over the world making this one the largest yet. In total, there were over 500 presentations of various lengths given over the four days.

The conference opened and closed with plenary lectures from keynote speakers. Between these there were sessions that were run in parallel (mini symposium, general session, semi plenary and poster sessions). Generally, there were two morning sessions, two afternoon sessions, and an evening session. There were five key topics covered over the conference:

- Wood products and components (MAT)
- Computer based methods (COM)
- Timber Architecture (ARC)
- Timber Engineering (ENG)
- Implementation (IMP)

Each session had a key theme based on a key topic (above) so that it was evident what to expect from each session. For example, for ENG sessions the topics covered included: fire, seismic design and composite structures to name a few. There was a strong focus on engineering related topics as implied by the conference's name. There were also several architecture focused sessions with particular focus on façade design, building envelope, and realized examples that I found interesting.

NEW ZEALAND REPRESENTATION

There was a good variety of presentations from New Zealand presenters that attended as well. The presenters were generally from the University of Auckland and University of Canterbury.

It was good to hear about the research that was undertaken at the universities around New Zealand. A lot of it focussed around connections, and it was interesting to hear the results of these experiments. One that I found most interesting was presented by Lisa-Maireke Ottenhaus (University of Canterbury) about the ductility and overstrength of dowelled LVL and CLT connections under cyclic loading. The research presented was relevant for many applications, and the ideas raised were of interest to a wide range of people. It would interesting to hear about how the ideas will develop.

Full-scale testing of timber school buildings (Avalon and Dominion) was presented by David Carradine from BRANZ. I had previously observed the same test being done on a Housing New Zealand building so it was interesting to learn that this was happening to the Ministry of Education stock as well, and provided some improved insight into how timber buildings respond under lateral loading.

Finally, it was good to hear that we are involved in the design and development of tall buildings. Francesco Sarti (University of Canterbury) presented on Pres-Lam technology in a couple of instances. These were on the long-term dynamic effects of Pres-Lam structures and also the lateral design of Cathedral Hill 2. He also presented a semi plenary lecture on behalf of Andy Buchanan which was on the challenges for designers of tall timber buildings. It is good to know that we have this knowledge locally and can provide expertise in this area despite not having many projects of this nature in New Zealand.

PROJECTS AROUND THE WORLD

Sessions that involved realised building projects were well attended, and these normally had people overflowing the lecture theatres. I will go through a couple of examples in the following paragraphs.

There were several presentations on the Brock Commons Building at the University of British Columbia. This 18 storey tall hybrid building will be the tallest timber building when constructed, and will be used as student accommodation. The building highlighted some challenges in using timber, but also provided some innovations. The building relies on two concrete shear cores to provide the lateral resistance, while the floor plates and gravity structure are provided by mass timber elements thus creating the hybrid system. The main gravity system was tied to the shear cores using steel drag ties. The flat plate construction using CLT provided a few design challenges; a key concern was rolling shear which involves the panels delaminating. This was modelled using FEM, and was tested to ensure that this would work adequately.

In construction, some efficiencies were realised with the prefabricated timber units. A storey could be lifted and fixed into place within a week due to the lightweight nature of the timber. Glulam columns were stood up with minimal effort and CLT panels were lifted in place using a tower crane. Fire provisions meant that the timber elements could not be exposed. This is very disappointing as the beautiful characteristic of the timber is not exposed, and also the additional linings added a significant cost to the project.

Another example was Via Cenni located in Milan. This project consists of four residential towers constructed using CLT. The four towers are nine storeys tall with a concrete basement. This example highlights what is possible using a pure timber solution. The building is located in a high seismic region so demonstrates that this form of construction can be used in these areas. The panels were modelled numerically to demonstrate that these work in their intended manner. This included modelling of the connections as these will affect the stiffness of the panels. The connections between walls and floors are significant, and careful consideration should be made when designing buildings of this type.

Other projects that were presented that were of interest include:

- Cathedral Hill 2: 15 Storey timber building planned for construction in Canada. Uses Pres-Lam shear walls which is a system that has been used in New Zealand projects
- T3 Minneapolis: 7 storey mass timber building. It has exposed timber elements throughout, and highlights the advantages of using timber.
- The Parish Church of Gallspach: Single storey timber portal frame building. Portal frames form an ellipse in plan and showcases the aesthetic quality of timber.

KEYNOTE SPEAKERS

Plenary sessions opened and closed the conference covering a key message or item of note.

On the opening morning there were three keynote speakers. First was Dr Ingo Burgert (ETH Zurich) who discussed the challenges of using timber as a construction material. It was interesting to hear that there is some research being undertaken to modify the properties of timber by impregnation as we do with our timber treatments in New Zealand. Some modifications discussed include making the timber hydrophobic and making them resistant to UV so that they do not discolour (facade applications).

Next was Erik Serrano (Lund University) who discussed the use of finite element modelling, and the two examples presented included a beam with holes, and glued in rods. I like how this is being done to further understand how the timber acts in such an application. Good for use in verification for research, however as a consulting engineer I did not find this too applicable.

Finally it was Hermann Kaufmann (TU Munchen) who

discussed the progression of timber construction. He discussed projects that are in progress or completed. These included the 9 storey residential CLT building Via Cenni in Milan, and the 18 storey tall hybrid building, Brock Commons building in British Columbia. With the use of CLT in these buildings speed of construction can be realised as the elements are essentially prefabricated and just lifted into place on site. Modular construction was also discussed with whole units fabricated with finishes, plumbing, electrical, etc. in place, and units stacked on top of each other reducing the amount of time on site.

The final closing keynote for the conference was by Gerald Epp (Structurecraft) and covered the emergence of timber in North America and especially Canada. It would seem that this area is leading the way in timber construction and this is demonstrated by the Brock Commons building. They are pushing the boundaries of timber and they are embracing the use of this material. The developments of mass timber elements in Europe have allowed this to occur and with the aesthetic and sustainability features it is fast becoming the choice of material for architects.

KEY THEMES AND IDEAS

Timber is a material that most people are familiar with and the benefits of this material are widely known. The material is sustainable. Exposed timber is aesthetically pleasing due to the natural feel that it provides. As a material it is lightweight which reduces seismic demands and in turn reduces foundation sizes. “Wood is Good” and this was a theme reiterated throughout the conference. With the abundance of timber there is no reason why it should not be used more often in construction.

CLT featured heavily in presentations and it would seem that this is the way people are heading towards when considering building taller. There were several presentations about connections into CLT and fire resistance of the panels. In Japan they have done full scale shake table tests of two sample buildings (3 and 5 storey). The results showed some surprising results with some brittle failure modes. The tests done on wall panels highlight that the connections provide stiffness to the system and particular attention needs to be paid when designing these.

A new concept that I was introduced to was using timber in a hybrid manner. This is highlighted by the Brock Commons building which is a concrete timber solution. Composite floors which reduce vibrations and improve acoustics were touched on as well. The most interesting application I found was using steel elements at the end of (CLT) wall elements acting as the hold down and tension element instead of relying on several fixings. This concept highlights that we should consider materials based on their merits and use them where appropriate. A timber building should not necessarily be limited to timber.

GRAZ AND CARINTHIA TECHNICAL EXCURSION

As part of the conference I had the opportunity to do a technical excursion around Graz and Carinthia in the South of Austria. The two day tour highlighted the fabrication of timber elements and showcased the use of timber in the area.

On the first day there were tours of three production sites: Kulmer Bau, Stora Enso, and Velox Werk. Kulmer Bau produced prefabricated timber frames, trusses and glulam elements. They also had a product called Kielsteg which is cassette floor or roof system. It is a mass timber element consisting of timber flanges and a plywood web creating a very efficient system. Large spans with a low overall profile can be achieved. Stora Enso is a large fabricator of CLT panels. It was impressive to see the process of the panels being pieced together from individual timber members and the efficiency of the machinery. Velox produced wood based building and insulation boards from a combination of wood chips and cement that are compressed into panels. While travelling these could be seen alongside the motorway creating an acoustic barrier.

On the second day we visited buildings that highlighted the use of timber. First stop was the Pyramidenkogel, the tallest timber tower in the world. The 100 metre tall observation tower was constructed in 2013, replacing the concrete tower on the same site. The tower consists of glulam columns with steel elements tying the structure together. There is some interesting detailing especially around the connections to the glulam columns. This is a gap between the connection and the glulam so that water does not remain stagnant and cause durability issues. Due to the difficulty of the site the glulam sections were lifted up the site using a series of cranes. The tower offered 360 degree views of Carinthia and Lake Worthersee. It also had a

slide running through the centre, a mini bungee, and a zip line for thrill seekers.

After that visit we went to a residential neighbourhood in Graz where there are several examples of CLT being used in multi storey residential units. Finally, we went to the headquarters of Meier-Meinhof Holz where they showcase their products being used in a commercial space. They have used CLT floors and LVL members throughout showcasing the structure where possible. The architecture of the building is striking, and the feature of having the exposed timber throughout really emphasises the use of timber.

I found the technical tour beneficial. I learnt about the process of fabrication of structural timber elements, and got exposed to products that I was not previously aware of. It also highlighted how people are currently using timber in construction and the possibility to use this material in multi-storey residential and commercial buildings, and tall towers. It showed that timber construction is not just limited to the single storey houses that we are more accustomed to in New Zealand.

FINAL WORDS

WCTE has been an eye opening experience. It has been interesting to hear how other countries are approaching and embracing design using timber. Construction using timber is only going to get bigger and there are several examples of this already as has been discussed. Timber has a reputation of being green in comparison with other materials and with this in mind it will surely play a big part of the construction industry in the future.

I would like to think that every design out there could be alternatively done in timber. However, there are challenges when using the material that designers must be aware of, including connections, fire, acoustics and vibration, to name a few. Conferences like the WCTE are forums that the industry needs to inform how researchers and consulting engineers are addressing these challenges.

For New Zealand, I do not believe we should be concerned about going bigger and taller using timber as projects here are generally of low to medium rise. We should rather realise how timber can be utilised and know its limitations so sound solutions are developed. When given the opportunity to design in timber we should embrace it and showcase the use of it.

The next WCTE is to be held in Seoul in 2018. I am excited by how timber will be further developed in the next two years and where research will be further progressed. I would like again to thank TDS for the opportunity to attend this conference and hope the scholarship is offered for the next edition of WCTE so someone can have the experience I have had.

APPENDIX: Photos from Technical Excursion

Pyramidenkogel




Residential Neighbourhood of Graz





Meier-Meinhof Holz Office