

CROSS-LAMINATED TIMBER MEETING MINUTES

May 30, 2013

1st Presenter: Joe Mayo

- 10-story Forte building in Australia is complete. The crew consisted of 4 people and the construction of the CLT timber frame took only 10 weeks
- 10-story partial CLT building currently under development in Germany
- 8-story Life Cycle Tower building in Austria which is using a wood-concrete hybrid system. Arup is adapting this system of construction to West Coast seismic standards.
- Other uses of CLT in North America: UBCO Fitness Center
- 7-story massive wood building in Zurich
- 10-story CLT building in Milan
- Northern Italy: similar seismic category as Seattle. Code Officials are interested in talking with this Seattle CLT group/Code Officials

2nd Presenter: Hans-Erik Blomgren

The U.S. version of the CLT Handbook was released in January. It is available for free .pdf download at (<http://www.masstimber.com/>)

General overview:

- The document addresses issues identified in the August 2012 CLT discussion but does not in all instances provide definitive design guidance for immediate implementation.

Seismic:

- The summarized seismic shear wall tests address only 1 or 2-story structures
- The ductility in these shear walls is provided via base clip angles and nails that flexurally bend. Hysteresis curves are 'pinched'
- The CLT USA Handbook indicates a Response Modification factor of 2 should be conservative.
- The tested CLT systems would be classified as High strength low ductility systems. The CLT wall is very strong in shear, but not inherently ductile.
- Full-Scale 7-story CLT Shake table test conducted in Japan in 2008; building walls performed well. Could be too much acceleration at the top due to the light mass
- Germany: 100 meter wind turbine tower built on site from panels and completed in 2012.
 - Used an adhesive-timber-dowel "zipper" system where metal plates connected the pieces

Fire Safety

- The U.S. version of the CLT Handbook (www.massivetimber.com) describes 4 objectives of fire safety including life safety for people and protection of property
- A proposed project in Oakland/SF area will use concrete/timber compositely and classify it as equivalent to heavy timber type IV
- FP Innovations fire test per ASTM E 119/ULC S101/ISO 834 time-temperature curve.
- The handbook provides design guidance on char loss and structural capacity remaining.

- Bullitt Center has custom 1 hr rated headers; requires the same bearing connection for the beams
- Fire protection
 - 4 Objectives
- Drift is the same; not a problem
- Fire resistance from GWB, then char, then wood
- Structure in Germany: Because of the light mass, they have opted to use a concrete slab topping over a wood composite. Addresses vibration and sound transmission
- Question: How about testing for creep?
 - Code allows wood to support concrete if creep is accounted for; some testing has been done in this area.

3rd Presenter: BJ Yeh

- In the 2015 IBC, CLT is classified as type IV. CLT standard will be referenced in the 2015 IRC. The APA is willing to be involved with selected CLT buildings in the Seattle area for those interested. The USDA Forest Products Laboratory in Madison, WI, is interested in collaboration with property owners to monitor long-term CLT building performance by instrumentation of new CLT buildings during construction.
- Portland is planning a small CLT building.
- The Bullitt Center is a hybrid CLT system with a steel moment frame.
- The WSU Visitors Center CLT roof will be finished this summer. KPFF is the engineering consultant.
- Another system example made of mass wood but is not CLT is LSL combined with steel or concrete

Open Discussion:

Jon Siu: Many of these systems are already covered by code; others are addressed/proven through engineering

Greg: Concern with ductility and fire rating of the connections

Dan Dolan (to Jon Siu): Testing in Japan recorded 4g acceleration at top story of multi-story wood frame building. If there are 4 g's at the building top, is that really life safety?

Jon Siu: Frame systems (i.e. glulam) are a different system, but if we focus on CLT, it will answer questions for other similar materials. DPD would probably allow a CLT structure if it complies with the 2012 SRC, but cannot speak at this time to a CLT structure proposed under the SBC if it exceeds the code allowable for Type IV construction. Jon answers, "It depends...." to a question about whether CLT could substitute for tilt-up in a warehouse structure.

Michael Aoki-Kramer: FP Innovations has a guide called "Energy Efficient Building End Design" that addresses moisture but not structural:

<http://www.fpinnovations.ca/ResearchProgram/AdvancedBuildingSystem/designing-energy-efficient-building-enclosures.pdf>

Jon Siu: The philosophical issue is really about non-combustible vs. combustible: how important is it that the structural frame is not part of or will add to the fire load? Otherwise, the rest is just engineering.

Tom Kinsman: What if the structure is less than 85' but greater than 6-stories?

Comment: How were height and area values determined in IBC Table 503? What would be the rationale for changing the values in this table?

Jon Siu: Possible approach: ASCE 7-2016 will have an appendix for the fire design of buildings. One criteria would be that the building could survive full burnout of the floor.

Joe Mayo: A possible next step could be to evaluate CLT buildings across the globe and examine local codes allowing these structures or components of structures?

Arup is doing a lit review.

Question: what weight does that hold for Jurisdictions?

NFPA Paper:

- R/seismic
- Fire at the connections
- Acceleration
- Penetrations, perimeter joints (vibration testing has been done)
- Justify wood where new construction is required

Steve Pfeiffer: If CLT buildings are constructed within the height limits allowed by current code, then maybe that will help answer some of the easier questions.

Jon Siu: One way to move forward would be to develop the methodology to set performance goals.

Hans-Erik Blomgren: The Canadian Tall Wood Handbook will provide some design guidance; it will be 90% complete in August 2013.

Greg Gilda: There's not enough detail or depth of information about performance.

P695 testing is in the works at Colorado State University, Fort Collins, CO, with funding support from the USDA Forest Products Laboratory in Madison, WI.

Simpson is looking at the ductility of connections.

Next Steps:

Next CLT Discussion to be scheduled for November 2013

In preparation for the November meeting, interested CLT discussion participants shall:

- Review the following materials:
 - The Canadian Tall Wood Handbook (90% draft available August 2013)
 - NFPA Arup paper will be complete in November 2013

- Conduct outreach to jurisdictions (worldwide) that have allowed “tall” CLT buildings
 - Hans-Erik has contact with Canada Handbook project
 - KPFF and MKA both have projects using CLT in portions of buildings out of Seattle

November Meeting focus:

- See which of the identified issues have been addressed by all the materials that have become available in 2013 (CLT Handbook, Canadian Tall Wood Handbook, Arup paper, etc.)
- Participants who contacted other jurisdictions allowing CLT will share their findings