NEWBuildS

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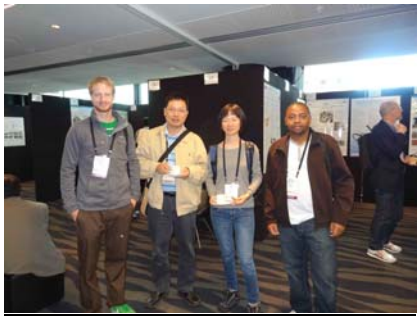
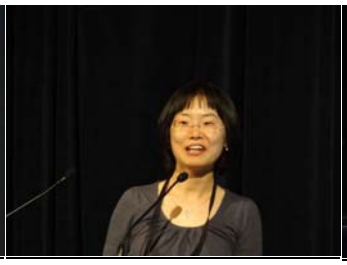
NEWS BULLETIN #5: FALL 2012

NEWBuildS Activities:

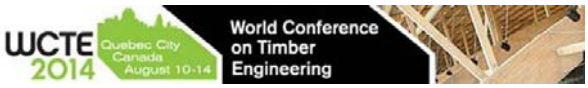



World Conference on Timber Engineering (WCTE) 2012 - Auckland, New Zealand

- The 2012 World Conference on Timber Engineering took place on July 15 to 19 in Auckland, New Zealand. There were 240 presentations and 140 posters on various research topics in timber engineering, including material, designs, connections, fire, codes and standards with emphasis on lateral-load resisting systems from 25 countries.
- 10 researchers from NEWBuildS network presented 13 posters and oral presentations at this conference. The topics cover Cross Laminated Timber (CLT), multi-function interface, wood-steel hybrid system, seismic performance, moisture induced stresses and deformations in structures, wood portal frame system and vibration performance.
- All documents are now available @ http://newbuildscanada.ca/publications/presentations/.

- After the 2011 Christchurch earthquake, the resilience and post disaster performance offered by timber structures has gathered interest with emphasis in seismic design. The program of this Conference has been designed to accommodate such focus and interest.
- The Chair, Mr.. Hugh Morris, used the term of "de-construction" to describe the current state in Christchurch, NZ. Up to 1,300 commercial and 6,500 residential buildings will be demolished and the Christchurch rebuilding will be the biggest economic undertaking in New Zealand's history.
- The WCTE 2014 will be held in Québec City (QC) from 10-14 August, 2014 and hosted by FPInnovations, Cecobois, and Université Laval and its industry partners; Québec Forest Industry Council, the Canadian Wood Council, the Québec Wood Export Bureau, as well as its network of university collaborators: the University of New Brunswick, McGill University, Ottawa University, Carleton University.



Meeting with Structural Timber Innovation Company (STIC)

- After the WCTE Conference, a delegation consisting of Scientific Director, Network Liaison Manager and Theme III FPInnovations Leader (Christian Dagenais) visited University of Canterbury in Christchurch, NZ, where STIC is based.
- STIC is a similar research network in New Zealand and has close collaboration and working relationship with its commercial partners. It is a research consortium developing and commercializing new technologies and currently has seven shareholders and two financial stakeholders.
- NEWBuildS and STIC exchanged information on on-going research programs with a view to explore collaboration opportunities, including data-sharing, exchange of HQP and research personnel, sharing of resources and test work.

Theme II Workshop 2012

- Prof. Stiemer, Theme II University Leader, hosted the 2nd Theme II Hybrid Building Systems on October 20th, 2012 in Kelowna, B.C. It was attended by Theme II professors, structural engineer, and 2 scientists from FPInnovations. They shared current research information with discussion to focus next directions.
- Objectives identified are the need for benchmark hybrid buildings, in timber with steel and concrete, integrate and correlate the different research activities and explore possibility of external funding to improve and ensure the research outcome will have code change impact
- A strong consensus existed for such meetings and closer cooperation with other themes or group is of high importance in the future.

Update: New University Network Partner & Research Projects

- With the latest NBCC objectives and need to address Energy Performance, 2 new NEWBuildS Research Projects are initiated by University of Waterloo/Ryerson University and University of Alberta.
- NEWBuildS SSC and BoD approved and welcomed University of Alberta as a new University Research Partner.
- Dr. John Straube and Dr. Hua Ge are the PIs for T4-7-C10 'Developing durable wood-frame building envelope systems for net-zero energy ready buildings'.
- Dr. Mohamed Al-Hussein and Dr. Mustafa Gul, University of Alberta, are the PIs for T4-8-C10 'Evaluation of energy efficient wall systems for mid-rise wood frame buildings (Phase II)'.
- Concordia University is now a new University Research Partner, following the appointment of Dr Hua Ge as a new faculty member at that university.

Update: NEWBuildS Outreach Committee

- The membership of Outreach Committee, a sub-committee of BoD, has been updated to include the four FPInnovations Theme Leaders; Dr. Mohammad Mohammad, Mr. Conroy Lum, Mr. Christian Dagenais and Dr. Robert Knudson.

- The Flow Chart from Output from NEWBuildS Research Project has identified 4 types of Outreach Activities and related Receptors. An Output template will be used to evaluate and determine the appropriate outreach path.

Update: New member of Board of Directors

- NEWBuildS is pleased to welcome a new member to its Board of Directors; Mr. James Orr, Director, Codes and Standards, Municipal Affairs, Government of Alberta. The Board of Directors had approved the recommendation from the Nomination Committee.
- The Board of Directors would like to thank Ms Dennis Evans and Ms Jostna Delvi, who have resigned from NEWBuildS BoD due to change in the work status, for their contributions to NEWBuildS.

NEWBuildS Workshop 2013 & Joint FIBRE Conference

- NEWBuildS is pleased to announce that the NEWBuildS Workshop 2013 will held on Friday May 17th, 2013 at NAV Center, Cornwall, ON in conjunction with Joint FBRE Conference which will take place on May 13 to 16, 2013.
- This Workshop and Joint Conference will provide a good opportunity for the HQPs to mingle and network with each other as well as with HQPs of other networks which would fulfill the intent of a Joint Conference. There will be student focused activities such as skill training and workshops.
- FIBRE is now administrated by a Council consisting of all the scientific directors and representatives from FPInnovations and Natural Resources Canada. The joint application to NSERC for funding under the Strategic Network Enhancement Initiative (SNEI) by 6 of the FIBRE eligible member networks was approved for $600,000. This additional funding will support interaction with other networks' projects that will enhance the research work of NEWBuildS, and the dissemination of research results to the industry such as this Joint Conference.
- With this funding, FIBRE had committed to 2 industrial Workshops in Edmonton and Quebec City respectively.

FIBRE Workshop: *From Trees to Buildings*

- The FIBRE Workshop: *From Trees to buildings,* will be held on February 18-19, 2013 @ Château Frontenac, Quebec City, Quebec. It is organized jointly by FIBRE Networks in collaboration with FPInnovations.
- This workshop will focus on innovative wood products and building systems, with a strong emphasis on non-residential construction. The importance of optimizing the wood products value chain across all activities and partners from trees to the customer will be discussed along with various issues such as sustainability, agility and alignment among partners in the value chain will be investigated.
- NEWBuildS networks researchers will have major presence in this workshop in both oral presentation and poster sessions. The Scientific Director and Scientific Steering Committee will identify the projects and invite the researchers to participate in the Workshop.

Graduated Researchers with NEWBuildS Funding

NEWBuildS would like to congratulate the following graduated researchers on their successful completion of graduate studies and research projects in the past 6 months.

Mr. Jeffrey R. L. Blaylock	Master of Engineering Science	Western University	T2-2-C4: Wood infill walls in Reinforced Concrete Frame Structures: A Wood/Concrete Niche
Ms. Carla Dickof	Master of Applied Science	University of British Columbia	T2–3–C4: Wood Infill Panels in Steel Moment Resisting Frames as a Hybrid Seismic Force Resisting System
Mr. Abdullah Al Mamun	Master of Applied Science in Civil Engineering	University of Ottawa	T2-13-C3: Investigating the Performance of Wood Portal Frames as Alternative Bracing Systems in Light-Frame Wood Buildings
Ms. Sheeba Vilakkathu Saidu	Master in Engineering	Carleton University	T3-1-C7: Fire Performance of Materials- Wood, Gypsum Board, Limestone, Concrete and Steel
Ms. Naki Ocran	Master of Applied Science in Civil Engineering	Carleton University	T3-2-C9: Fire Loads and Design Fires for Mid-Rise Buildings
Mr. Nazmus Saadat	Masters of Science in Forestry	University of Toronto	T4–4–C11: Factors affecting distribution of borate to protect building envelope components from biodegradation
Ms. Victoria Ruth McClung	Master of Applied Science	Ryerson University	T4–5–C10: Field Study of Hygrothermal Performance of Cross Laminated Timber Wall Assemblies with built in Moisture

Titles of Thesis and links *(if available)* are @ http://newbuildscanada.ca/publications/thesis/

A *special* THANK YOU to postdoctoral fellow Dr. Jan Weckendorf

Dr. Jan Weckendorf has completed his two year appointment as a NEWBuildS postdoctoral fellow on October 31, 2012. He worked on Theme 2 projects and contributed to detailed articulation of the scope and thrust of Theme 2 with emphasis on serviceability problems associated with employing CLT panels as structural skeletons of long-span floor slabs. Jan has returned to his homeland (Germany) but will keep contact with Professor Smith, UNB, and others researchers in Canada.

NEWBuildS & Professor Smith salutes Jan for his contributions and wishes him all the best in the future.

Upcoming Network and related events:

- FIBRE Workshop: *"From Trees to Buildings"* - February 18-19, 2013 @ Château Frontenac, Quebec City, QC
- Joint FIBRE Conference - May 13 to 16, 2013 @ NAV Center, Cornwall, ON
- NEWBuildS Workshop 2013 – May 17, 2013 @ NAV Center, Cornwall, ON
- Large Wood Structures Symposium - February 20, 2013 @ Vancouver Convention Centre, Vancouver, B.C.

Featured Project:

PROJECT T4–5–C10b: Field Study of Hygrothermal Performance of Cross-Laminated Timber Wall Assemblies with built-in Moisture (Ms. McClung)

Lead Investigator: **Dr. Hua Ge, Ryerson University**
Dr. John Straube, University of Waterloo

HQP: **Ms. Victoria Ruth McClung, MSc**
Mr. Robert Lepage, MSc

FPInnovations Co-Investigator(s): **Dr. Paul Morris, Dr. Jieying Wang & Ms. Constance Thivierge**

The objective of this research project is to develop durable building envelopes for the successful use of CLT (Cross-Laminated Timber) construction in North America. It involves investigating the one-dimensional wetting and drying behaviour of CLT to provide guidance for field testing of CLT panels and to evaluate the thermal and moisture performance of CLT assemblies (Mr. Lepage). A field study using a building envelope test hut will assess the long-term hygrothermal performances of CLT constructions of various configurations in different climates. (Ms. McClung).

Exposure to moisture before and during construction and in service can be a durability concern for most wood products including CLT. Specifically, CLT panels stored on unprotected construction sites can be exposed to rain and sitting water, leading to built-in moisture after erection. If this built-in moisture cannot dry out within a reasonable time period, potential damage as a result of excessive moisture may occur. To ensure long-term durability and improve the design of CLT assemblies, the hygrothermal performance of CLT wall assemblies with a variety of configurations and materials needs to be evaluated in terms of drying and wetting potential.

Experimental Method

The project was to evaluate the drying potential of a variety of wall assemblies including CLT panels manufactured with North American wood species, in a Southern Ontario climate. A test wall was constructed in a field exposure building envelope test facility in Waterloo, Ontario. It is comprised of sixteen 0.6 m × 0.6 m CLT panels with five wood species, four different wall assembly

configurations with varying levels of vapour permeance. The panels were soaked in water for one week, attaining moisture content levels above 30%MC in the first 25 mm of each panel face.

Four categories of wall assemblies were studied: high, medium, or low vapour permeance materials outside of the CLT panels (with unobstructed interior wall cavity to permit drying to interior) and medium permeance with interior polyethylene (low interior permeance condition).

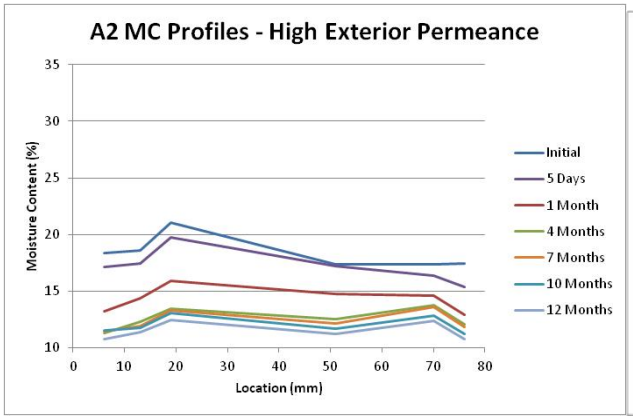
The vapour permeance variations are created with the following material combinations; :

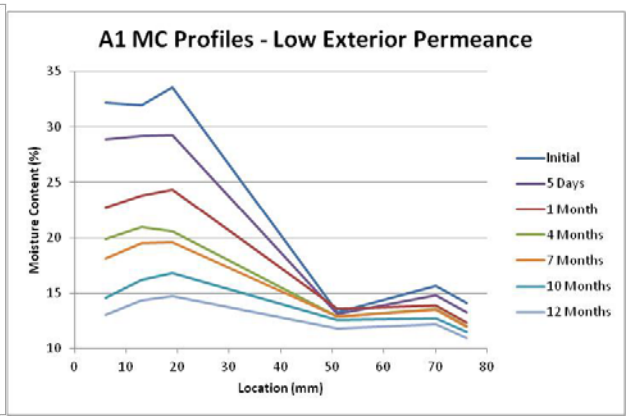
1. Low Exterior – NVP membrane and mineral wool (1.6 ng/Pa.s.m2 combined)
2. High Exterior – VP membrane and mineral wool (1670 ng/Pa.s.m2 combined)
3. Medium Exterior – VP membrane and EPS (64.4 ng/Pa.s.m2 combined)
4. Medium Exterior and Low Interior – VP membrane and EPS (64.4 ng/Pa.s.m2 combined) plus 0.15 mm polyethylene sheet on interior (3 ng/Pa.s.m2)

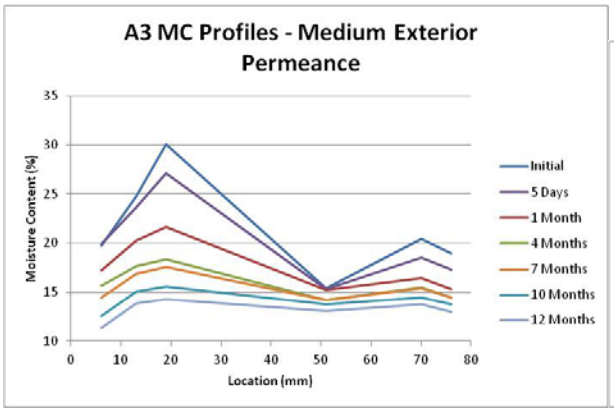
A variety of sensors were installed within the assembly, the most important of which were moisture content sensors located typically 6, 13, and 19 mm in from the exterior CLT panel face, 13 and 19 mm in from the interior CLT panel face, and one in the centre of the panel. The wall was monitored for one year, beginning in late August 2011.

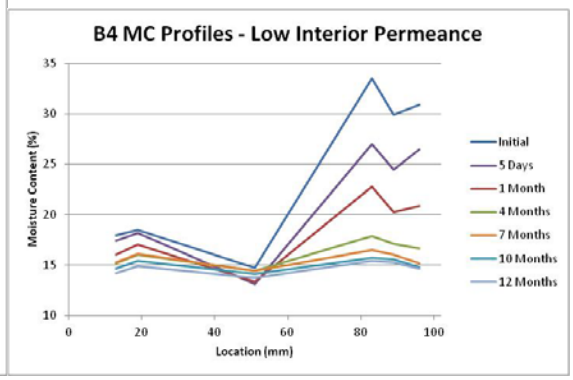
Results and Conclusions

The following figures show the moisture content profile from the exterior to the interior of a typical example from each wall assembly type.









The field study has provided an opportunity to determine the behaviour of wetted cross-laminated timber panels within a variety of wall assemblies, and to verify the behaviour of the hygrothermal models in these extreme cases.

The most important conclusions are:

- Elevated moisture contents which allow for future decay are not likely to be developed due to typical environmental exposure to moisture on a construction site.
- Low permeance materials such as polyethylene sheeting and other non-vapour permeable water resistive barriers cause lower drying potential. The field data shows these panels did dry in sufficient time to prevent decay initiation.

One of the first insights of this study during construction is that the unprotected, wetted panels dried very quickly under typical southern Ontario summer conditions. While for this field test, this behaviour made it difficult to capture the initial drying phase, it does indicate that during a typical construction project, where efforts are made to protect wood on construction sites, the highest possible initial moisture content at the time of enclosure of the CLT panels due to accidental moisture exposure can be low enough to reduce potential durability problems under normal operating conditions. However, more work is required to determine the extent to which on-site exposure can cause excessive moisture accumulation under a variety of climates, and with different wood species, exposure times, and CLT manufacturing methods. Overall, it seems unlikely that if reasonable measures are taken to protect cross laminated timber panels from wetting, construction moisture alone is not likely to be a cause of long term moisture durability issues.

In terms of suitable wall assemblies, the use of high permeance envelope materials can effectively promote drying of CLT panels.

The medium permeance wall configurations are sufficiently vapour permeable to prevent moisture durability issues under normal circumstances with initially dry panels.

Low permeance materials, especially to the exterior, are to be used with more caution, not only because they prolonged the time period required for wetted panels to dry to a safe level in some cases, but also because the lack of steep rise in the moisture content in the centre of the panel, further indicates that the CLT panel itself is a good vapour retarder. Therefore any additional vapour barrier is unnecessary in a CLT assembly. While in the test wall, both the interior and exterior low permeance wall panels dried sufficiently quickly to prevent decay initiation, the low permeance material may have a more deleterious effect if an incidental moisture source is present, enabling a rise of local moisture content over time.

Finally, the wood species does not appear to have a significant effect on the drying rate of the CLT panels, though it appears as though the plantation grown European spruce panels tend to reach slightly higher moisture contents when exposed to ongoing moisture sources.