



Blog for Show Number: 705

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Building Science & Wood; a Balanced Design Approach

This week we welcomed Rob Jonkman VP of Codes and Engineering at the Canadian Wood Council www.cwc.ca to discuss Building Science, Wood and A Balanced Design Approach. The Canadian wood industry is a huge driver of construction practices in the US and beyond. We learned about how wood is part of a balanced design approach from someone that has been a mover in the area for years.

After completing a Bachelor of Civil Engineering and Management degree at McMaster University in 1994, Robert worked for one year at a structural engineering consulting firm and over nine years as “Design and Engineering Supervisor” at a Canadian timber frame manufacturer. He joined the Canadian Wood Council in 2005, progressing to “Director, Codes and Standards -Structural Engineering” in 2014, and VP Codes Engineering in 2021. Robert has expertise in structural engineering, building science, and energy issues and active in the Codes and Standards development and with the Canadian Home Builders

Nuggets mined from today’s show:

Please tell us about the Canadian Wood Council- The Canadian Wood Council is an Association of Associations?

Founded in 1959, the Canadian Wood Council (CWC) is Canada’s unifying voice for the wood products industry. As a national federation of associations, our 14 members represent hundreds of manufacturers across the country. For over 60 years, we have supported our members by accelerating market demand for wood products and championing responsible leadership through excellence in codes,

standards, and regulations. We also deliver technical knowledge for the construction sector through our market-leading Wood WORKS! initiative.

The CWC provides technical and knowledge transfer services relating to building codes, standards and regulations. The CWC is active in a technical capacity in all areas of the Regulatory System:

- **BUILDING CODES** – CWC participates extensively in the development process of the Building Codes in Canada.
- **DESIGN STANDARDS** – CWC holds the Secretariat for Canada’s wood design standard (CSA O86 “Engineering Design in Wood”), providing both technical expertise and administrative support for its development.
- **PRODUCT STANDARDS** – CWC is involved in the development of Canadian, U.S. and international standards for its wood building product producers.
- **TEST STANDARDS** – CWC is involved in developing Canadian, U.S. and international test standards in areas that affect wood products, such as fire performance.

There is also an American Wood Council (AWC) how are they different and how do you work together if you do? CWC is a member of AWC. CWC and AWC work closely together. We both are involved in codes and standards efforts but also work with a lot of other associations in both Canada and the US, each with their specialties. These include:



Codes and standards



Technical Information
engineered wood
products

Conversions / Technical



Communications

Education



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Podcast Canadian Wood Council



[Woodworks Innovation Network](#)

Browse projects and connect with a pro
in both the US and Canada



Local: training, networking and
direct technical support



Research



Educator's resources



Forestry, forest certification

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What is the most common wood used in construction? In Canada --Spruce, Pine and Fir is the most common species used in lumber. Canada has simplified speciation by classifying Canadian wood into 4 species groups. In Canada, Spruce, Pine and Fir wood have similar properties and are combined together in one species group

called (S-P-F). This makes design easier as specifiers design with compared to looking up the design properties of each species independently. .

What effect are the 2023 Canadian Wildfires having on Canadian wood resources?

The 2023 have so far (by July 10) taken the equivalent of approximately 12X the annual harvest. Significantly larger than normal!

What is meant by a balanced design approach? Balancing competing interests when designing buildings:

Resilient Design, Energy Efficient Design, Carbon, Affordable Design, Fire Resistance, Durability.

All six are growing in emphasis. Competing interests may include Wind Resilience and Climate Resilience, where in some locations builders replace wood sheathing with non-structural continuous insulation to comply with energy efficiency codes, forgetting about the increased vulnerability to wind and earthquake loads the building now has, instead considering the offset costs in an attempt to develop the most affordable housing. The carbon story also competes with energy efficiency in that more insulation (usually a good thing, used to achieve net zero energy) may actually result in a worse carbon story, depending on the insulation material and quantity.

How To Build-In Wind Resistance? In summary, make sure the entire uplift load path is accounted for from roof to foundation.

Attach roof sheathing to the roof framing robustly , Beef-up gable ends (typically constructed less strong than the walls below, but experiences higher wind loads), Connect upper roof framing and components to lower roof framing robustly (with, for example, hurricane straps or hurricane screws), Use sufficient structural wall sheathing to resist racking and fasten sufficiently to resist suction, Use wall sheathing or other methods to bridge assemblies to resist wind uplift, Make sure roof underlayment is used under shingles so that even if the shingles are blown off the building stays dry, Where possible use high strength garage doors and use high impact resistance windows. These recommendations are aligned by the Florida Building Code but informed by work done at Western University in London Ontario Canada and the Northern Tornadoes Project [The Northern Tornadoes Project \(NTP\) - Western University \(uwo.ca\)](#) that formed the basis of a new Canadian standard (CSA S413 – free online view available [CSA S520:22 | Product |](#)

[CSA Group](#)). The concept of the standard: prescriptive solutions for wood frame buildings to resist wind loads associated with EF-2 tornados (200 kph+ 124.27 mph)

Why care about carbon?

It's time to consider the impact of materials used in construction. We don't want to choose solutions with high negative impact on the environment just to reduce operational energy. The focus is decarbonization. Ensuring new buildings are sustainable and energy-efficient will be key to our efforts to tackle climate change

50% of wood is carbon. A tree is a self replicating solar powered carbon dioxide sucking machine that stores carbon and energy in a building material while producing oxygen as a waste product.

The tree from which 1kg of dry wood is harvested has sequestered 1.83kg of CO².

<https://www.weforum.org › agenda › 2021 › 02 › why-the-buildings-of-the-future-are-key-to-an-efficient-energy-ecosystem>

Buildings are the foundation of our energy-efficient future.

Buildings are responsible for 40% of global energy consumption and 33% of greenhouse gas emissions...

What is the life expectancy of a tree? The optimal harvesting of a tree takes place when the tree is 40-80 years old. Harvest at the peak of carbon sequestration phase is important.

What is cross laminated timber? <https://www.apawood.org › cross-laminated-timber>

Cross-Laminated Timber (CLT) - APA - The Engineered Wood Association

Cross-laminated timber (CLT) is a large-scale, prefabricated, solid engineered wood panel. Lightweight yet very strong, with superior acoustic, fire, seismic and thermal performance, CLT is also fast and easy to install, generating almost no waste onsite. CLT offers design flexibility and low environmental impacts.

Started in Europe about 15 years ago and in Canada more than 5 years ago. Very little waste. A wheelbarrow full of sawdust is all the waste from constructing a 9 story building.

What is Mass Timber Construction?

Manufacturers use products such as cross-laminated timber (CLT), laminated veneer lumber (LVL), and glue laminated timber (“glulam”) to produce wood panels and beams, which can replace concrete, steel, and masonry as building materials. Because it displaces emissions-intensive steel and concrete, mass timber can significantly reduce the “embodied carbon” in buildings. Because the wood stores carbon dioxide (CO₂) that was captured from the atmosphere via photosynthesis, mass timber construction can function as a form of carbon removal when combined with sustainable timber production and building deconstruction practices.

Nail Laminated Timber (NLT) and Dowel Laminated Timber (DLT) also exist. From a re-use perspective, DLT is advantageous because while the nails in NLT can damage saws and tools, while wood dowels used in DLT doesn’t. There is a new standard for nail laminated timber (NLT) and DLT: CSA O125 [CSA O125:23 | Product | CSA Group](#).

How high can you build with wood? Royal Albert Hotel in Australia is 9 stories and over 100 years old. A warehouse in Vancouver, Canada is 7 stories and over 100 years old. Brock Commons UBC, Vancouver, Canada is 18 stories, 1 concrete and 17 wood. Construction of a 300 meter building is planned for London, England.

Why Wood? Benefits include: Carbon sequestering, Natural insulator, Good strength-to-weight ratio, lightweight, Wood is healthy to have in a home.

Wood as an insulator? Wood’s insulating capabilities are due to air pockets. The R value of wood is 1.2. Wood is 20X better insulator than concrete and 400X better than steel.

Fire resistance of wood? The heat of a fire drives moisture into the center of wood. Char forms a protective layer. The world’s largest wood fire test was performed on

a 2 story, 4 bay structure measuring 334 M² (3,595.15 F²). The building self-extinguished after 25 minutes.

How does wood frame construction stack up affordability wise compared to other methods? Costs are comparable. Wood will be cheaper in the future. Price including the cost of carbon will be a definite win.

Environmental product declarations (EPDs)? EPDs for wood building products are similar to Nutrition Facts on Food Label. When comparing different products the use application needs to be the same, apples-to-apples. CWC publishes EPDs on a variety of wood products.

What type of wall design do you recommend for a Net Zero building? Good wall, R30 insulation, wood frame + external insulation. Sheathing (OSB or plywood) to resist wind and earthquake and with an insulation with a good environmental impact, as determined with EPDs. One example is rockwool. Wood fiber insulation (both rigid and soft) are available and being made in the US. Diminishing returns beyond R30 wall.

Do wood treatments weaken wood? No, there is usually no weakening of wood, except if incising of the wood is used to ensure a deeper penetration of the treatments, and even then only sometimes. Telephone poles, permanent wood foundations (PWFs) in northern Canada use treated lumber. Wood foundations are used in Northern Canada due to unavailability of concrete.

Robert Jonkman's Final Thoughts & Comments:

- Wood is a buffer for excess moisture, allowing the occupants to have a better indoor air quality. The wood absorbs moisture when the RH is high and releases when low.
- Bringing nature into hospitals through the use of exposed wood makes people feel better and heal faster. This concept is called biophilia and is being researched increasingly in Australia and Canada.

Z-Man Signing Off

Trivia

Name the hard and durable wood that sinks in water due to its density, has a class A fire rating and was used to Build the Coney Island Boardwalk?

Answer: Ipe

Answered by: Doug Kohnen, ERAtech Environmental