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FALL/WINTER 2017

BC BEC

ELEMENTS

A BCBEC PUBLICATION

TALL WOOD BUILDING ENCLOSURES

A RACE TO THE TOP

Depreciation Reports and Energy Conservation/ Compliance

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FEATURES

DEPARTMENTS

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Samer Daibess,
President,
BCBEC

Welcome to BCBEC Elements!

Welcome to our exciting Fall/Winter issue! Of special interest to members with strata council clients, we're featuring discussions on compliance versus relevance related to depreciation reports. For those of you interested in new applications in wood-based construction, the popular 20+ storey wood frame building under construction at UBC is showcased. As well, interviews with BCBEC founding members, a helpful overview of BC's Energy Step Code, plus the announcement of the BCBEC Foundation awards are also offered.

There's exciting event news too: our much anticipated and most prestigious event, proudly hosted by BCBEC, the 15th Canadian Conference on Building Science and Technology (#CCBST2017) is set to begin soon: November 6-8, 2017. Registration is filling up fast and our industry, education and government sponsors have provided exceptional support and sponsorship. This special, biennial building science best practices event also includes BCBEC's annual AGM, a chance for B.C.-based members to get together and plan our agenda for next year. I encourage you to join us at the Hyatt Regency Vancouver for both events. Share good times with colleagues and meet some of the finest building science expertise in the world today.

I am proud to share that recently BCBEC officially partnered with the University of British Columbia (UBC) to promote building science education and professional opportunities for engineering students. This most welcome collaboration is especially important; along with growing innovation we want to help attract and mentor new engineers to our fast-growing field. BCBEC looks forward to working with other B.C.-based post-secondary institutions; our long-time successful relationship with the British Columbia Institute of Technology (BCIT) is a fine example of ideal collaboration.

As always, my grateful appreciation and thanks to our advertising partners for their essential financial support and endorsement of our magazine, *BCBEC Elements.*

Thank you! I hope you enjoy this issue.

Kind regards,

Samer (Sam) Daibess, P.Eng.
BCBEC President
Principal, LDR Engineering Group

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DEPRECIATION REPORTS AND ENERGY CONSERVATION/COMPLIANCE

By Kelly Parker

A few years ago, the British Columbia government passed legislation designed to encourage strata building managers to retain engineers or other qualified consultants to conduct depreciation reports. The reports – conducted every three years – analyze every component of the structure for current efficacy, and indicate when they'll need to be replaced so that budget contingencies can be put in place for that. However, most often, little consideration is given to the benefits to both budget and environment of replacement with the latest energy efficient technology as opposed to replacement to basic code only.

According to data from the Condominium Home Owners Association of B.C. (CHOA), uptake on reports is growing by about five per cent per year. There are around 32,000 strata corporations in B.C., and of those that are captured by the legislative requirement, there are probably about 24,000 buildings. Not every strata is required to conform. "Every strata that is five lots or more is required to do it," explains CHOA Executive Director Tony Gioventu, "unless they pass a three-quarters vote to exempt, and a lot of small communities that are five or six units (will vote to opt out) because of the cost, and because it's easy to do a complete building inspection on a small building, they'll choose to exempt in the short-term on the cycle."

The benefits of the reports are quickly becoming apparent. "If you have a depreciation report," notes Gioventu, "and you have money in your reserve fund, and there is a recommended repair that comes up, it only takes a majority vote to approve those funds, so everyone has really stepped back to a democratic majority process, and it's been a real incentive for people to contribute more, so we're seeing much better cycles of funding, repairs, and planning all around. From a market perspective, the market is starting to show that buyers are being very discerning when they are purchasing in a building without a depreciation report."

This maintenance – repair or replacement – is funded either by one-time assessment or monthly contribution to a reserve fund, most often by the assessment because monthly contributions would drive monthly fees too high (especially in a region where housing affordability is at crisis levels). "The average contribution per unit pre-depreciation reports," says Gioventu, "was about 12 dollars a month. The average contribution per unit post-depreciation reports jumps up to almost 50 dollars a month. The best trend is that people realize that they now have future obligations that they can put a dollar and face to, and they can start to make some conscious decisions about how they are funding."

Andrew Pape-Salmon, Executive Director of the Building and Safety Standards Branch in the Ministry Responsible for Housing with the Province of British Columbia, stresses, "The missing opportunity from many depreciation report studies is to identify opportunities to invest in improving energy efficiency beyond "like-for-like" replacement that provide a net financial benefit for owners with future lower energy bills, not just a current capital cost."

Typically, at the end of the life cycle of windows, for example, "like for like" windows – that are very similar to the old windows with the stipulation that they meet current minimum codes and standards – namely, double-glazed with a thermal break, will be installed. "What's often missing from that discussion," says Pape-Salmon, "is that if the strata chose to invest an additional two per cent on their overall building renewal expenditure, they could get a significant energy payback. For example, instead of putting in double-glazed aluminum windows, they could put in triple-glazed fibreglass windows that are (so much more efficient), the payback is about three years! That type of window upgrade enables about a 60 per cent reduction in electric baseboard heating – a massive benefit for both individual strata owners and the environment." Micah Lang, Senior Green Building Planner for the City of Vancouver, concurs, adding, "From the standpoint of a place where we're interested in reducing greenhouse gas emissions and energy efficiency, it's clear that it is a lost opportunity right now for addressing a really important issue."

To that end, the city is in the process of designing a program to address the issue to the extent that it can within its jurisdiction. Consultants are in the process of being brought on board to help roll out the program. "As part of the program," says Lang, "we anticipate providing guidance to strata buildings on depreciation reports, and how they can potentially include energy upgrade considerations as a part of the depreciation report process. We hope to do that, but we're not sure if that is going to happen in year one, or potentially in a future year of the program, but it was identified in the research as being quite important, and therefore it's something that we want to action."

That action does face challenges, however, one being that the average occupancy in strata buildings is five to seven years, so that on a retrofit or upgrade that might not see an ROI for 10, the motivation is lacking. "What we're seeing is a real balancing act between affordability and future use," notes Gioventu, "with strata trying to balance out the financial implications of using up contingency funds that they're planning for special levies. That's shortsighted, because in a five-year cycle, on a lighting retrofit in most buildings, if they use that contingency money, it's about a 20 to 25 per cent return. It's incredibly worth looking at, but it's a hard sell. For the communities that have done it, we've had great success literally on the next hydro bill, so the mass and evidence are there."

Another factor in play is what Gioventu calls "consultant fatigue": "It's a little bit hard to get the public to trust consultants after 15 years of leaky condos, envelope failures, and building failures and

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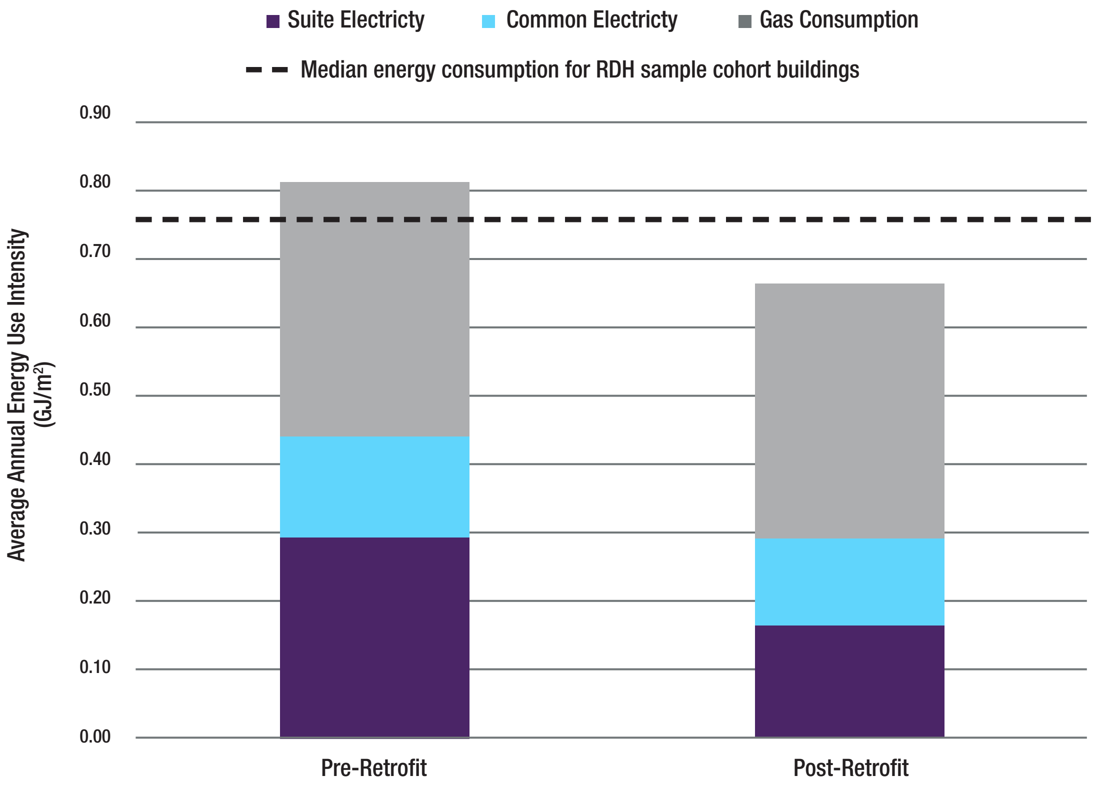

repairs," he says, "and so it's going to take a little time to rebuild confidence with consultants as well because they were part of that entire system."

Gioventu also claims that no one has been able to deliver a confident renewal plan that states what levels of renewals will be possible to the strata communities. "When you start challenging and testing the claims that are being made by some of the consultants," he explains, "there are big gaps in the information that is being delivered, and a lot of ambiguity in what the expected savings are going to be and what the cost recoveries are going to be. Some of the early studies have been a little ambiguous as well, so it's kind of hard to build public confidence unless you can have some sort of evidence showing that this is going to actually provide returns in a specific time period."

Pape-Salmon feels a two-pronged approach would overcome the current resistance. "BCBEC could publish voluntary guidelines for strata owners on best practices for energy assessments at the time of a depreciation report, because I think BCBEC is in a very good position as an industry association, to pull all of its great minds together and prepare draft guidelines, and frankly, just put them out there and let the strata corporations and strata associations like CHOA and VISOA and other groups reference them. The other advantage would be, by putting out guidelines, stratas could align with energy utility incentive programs like FortisBC's Commercial Custom Design Program – Retrofit Projects." Pape-Salmon also highlighted utility financing programs "the way Manitoba Hydro does, so those that are unable to afford that extra two per cent incremental capital cost can now get financing; FortisBC's rebate takes it part of the way there."

Gioventu is quick to point out the potential benefit to the province of Pape-Salmon's second suggestion. "The less electricity that we consume internally, the more the province can actually sell to other jurisdictions that do rely on GHGs. If anyone who is relying on any type of carbon fuel or unclean fuel to generate electricity, can buy affordable electricity from the province, it's good for the province, for the other jurisdictions, and good for the environment, and maybe the province can be looking at some way of increasing rebates to consumers to motivate them to look at energy upgrades."

According to Lang, expanding the dialogue will go a long way. "We would like to convene folks from the industry that are providing depreciation report services. I think there would be a lot of benefit," he stresses, "in hearing from them about how we – as a local government interested in building renewal and energy efficiency – should advise strata building to request the energy-related assessment services. That dialogue could include ways to create a template, or a short list of criteria to put into a depreciation report contract so that stratas can be sure they're getting the information required to make those planning decisions for energy efficiency upgrades in the future."

Ultimately, Gioventu can see the wheels of change slowly turning. "The economics are there, and I think that we can see easily into the future that there is going to be a transformation, I would say, in the next five years." ■

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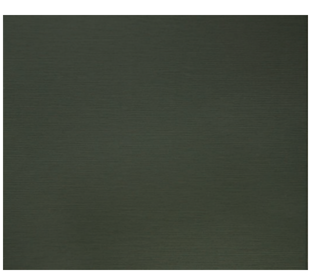
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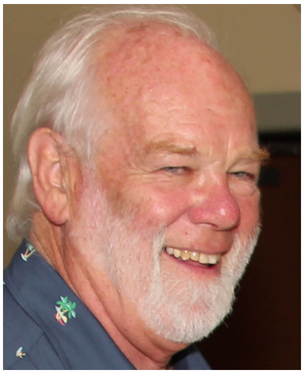
IN THE BEGINNING...

A trip down memory lane with BCBEC founders

By Matthew Bradford

In 1990, BCBEC was registered under the *Societies Act,* and the articles of incorporation were signed by Bill Clayton, Alan Toon, Ken Halldorson, Gary Barr and John Wells. In a special edition of People Power, *BCBEC Elements* takes a trip down memory lane with some of the founding members of BCBEC to gain insight on how BCBEC came about, the vision for the association at the time, and the future of BCBEC.

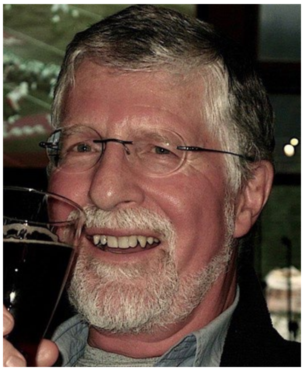


Bill Clayton

Becoming the first registered home inspector in B.C. is just one of the highlights from Bill Clayton's resume. His career includes work with Transport Canada Airports as Superintendent of Buildings, where he was in charge of all airport buildings in British Columbia. Bill also amassed years as a home inspector, and as a roofing inspector with J. W. Wells Consulting and Wells Klein before retiring in 2015 as their specification writer.

Ken Halldorson

Ken Halldorson worked for over 40 years as a specification writer and consultant in the building industry and is now retired. He is a Registered Specification Writer and Fellow with Construction Specifications Canada and Technologist with the Applied Science Technologists and Technicians of British Columbia.



Alan Toon

Alan Toon's decades-long career in Edmonton's precast concrete industry includes work with Public Works Canada and Con-Force Products, before being recruited to lead the National Research Council's (NRC's) B.C. Field Station of the Division of Building Research (DBR). When DBR evolved into the Industrial Research Assistance Program (IRAP), he followed suit, working with IRAP in technology transfer to a wide range of industries, including construction. It was through the DBR that he met like-minded building envelope professionals, and played a role in laying the foundation of BCBEC.

John Wells

John is President of J. W. Wells Consulting Inc., and presently works with Read Jones Christoffersen Ltd. in Victoria. John has 50-plus years of construction experience including roles with Sarnafil Canada Ltd., W. R. Grace Construction Products Division and the Roofing Contractors Association of British Columbia. John was the founding President of BCBEC, a long-time member and former Director of RCI Incorporated, and a past member and past chapter executive of the Vancouver Chapter of Construction Specifications Canada.

BCBEC Elements: What was your motivation behind creating a BCBEC group?

Bill Clayton: As I recall, we all wanted to improve the knowledge of all the various players and the industry as a whole. There was more and more information becoming available to the industry, and we wanted to try to get that out there into mainstream design.

Ken Halldorson: My motivation came from working in Edmonton from 1977-1984 when building science understanding was further ahead of British Columbia. I was exposed to experts in this growing field, including JC Perrault, Kirby Garden, and many others from the NRC. I brought what I had learned to B.C. and saw a need to use the same principles in my work in designing better building envelopes.

Alan Toon: I arrived in B.C. at the height of the "leaky condo" problem. I set about meeting the parties most interested in solving these problems. I encountered some old friends from the Alberta construction scene in various roles in Vancouver, and we noted that water penetration was a more significant issue in the coastal climate. The DBR ran annual seminars across the country to discuss various aspects of building science. Through one of these events, I met John Wells, then at the RCABC. Gary Barr and Bill Clayton were in Public Works Canada. Ken Halldorson was with an Architect's Office. We all saw the need to develop a continuing means of educating the industry on best practices for our climate.

John Wells: Certainly, BCBEC wasn't my idea; it was more of a mutual thing between some people with similar interests. As I recall, it was sometime in late 1986 that a small group of people met a few times in a dungeon meeting room at the University of British Columbia. Alan Toon from NRC, Maxwell C. Baker from NRC (retired at the time), William Clayton (then) with Transport Canada, Gordon Spratt from Spratt Engineering, and Murray Frank. That's all I can remember, but I'm an old guy now!

BE: What was your initial vision for the organization?

BC: I don't think there was an official vision, per se, other than getting like-minded people together and working on the problems we were all facing.

KH: The vision was to create a forum for the exchange of ideas amongst design professionals, manufacturers, associations, contractors, regulatory bodies, and others wanting to pursue the design of a better building envelope based on scientific principles tested and reported by the NRC.

AT: The aim was to educate the industry, to improve the built infrastructure for the good of society, although we probably did not think in such grand terms at the time. It was important that this be an industry-led organization, not another government effort.

I believe we have certainly improved the understanding of the issues, but the prevalence of blue tarps indicates that there is more to do. To be realistic, some of the tarps are there to remedy the issues of buildings built many years ago; however, there are still too many showing up on newish buildings.

The message to be conveyed is that "the devil is in the details." Very few materials fail in the body of the material; the failures occur at the interfaces and intersections of systems.

JW: The original vision for BCBEC was as an independent forum to discuss, present, address, and investigate building envelope issues – particularly the wall and window issues at the time. It was not to be a forum for product promotion, and we were adamant about that. I believe that was achieved and hopefully continues to be so.

BE: How did you start growing BCBEC?

BC: In the very beginning, we had two or three initial meetings of people who were interested, and then we went on to have a conference. That was after Expo '86 when we held our first meeting in one of the expo buildings. From there, we started to further build BCBEC, thanks to a lot of word of mouth.

KH: We put on a number of seminars inviting experts from NRC to make presentations on building envelope science. These were well attended by design professionals, contractors, and manufacturers. One of our presenters in particular, JC Perrault, was able to simplify the understanding of the science of building envelope design between the scientists and the practitioners.

AT: I think we must have started with a local day-long seminar. My role at NRC allowed me time to help organize the event. John Wells and RCABC were completely involved in the organization, and Klaus Thiel of RCABC lent us their admin staff to assist. I am not sure when we started the lunchtime sessions, but they were an immediate success. We incorporated and were soon building a surplus in the bank.

JW: Our early events were just lunch meetings and a presenter and we quickly got the yearly conference and Annual General Meeting going. We ran it all like a proper business, meetings and all. I cannot recall subject matter, but it was anything to do with leaky condos. I did some presentations on roofing, of course, and we had many other well-qualified presenters.

I don't remember how many we started with. There were quite a few, as I recall, because the envelope industry then was quite small and everyone knew everyone. We had support from ABEC as well.

BE: What challenges did you face, both for BCBEC and the roofing industry?

BC: Probably the biggest challenge at the time was getting people to realize that we had a lot of good knowledge to share and things were not being done as best as they could for the longevity of buildings. There were new projects coming on stream all the time and lots of them weren't surviving due to lack of knowledge and poor quality materials.

KH: The biggest challenge I faced was convincing designers, owners, and contractors to get on board with designing and building a better building envelope based on scientific principles that had been around since the 1950s. Increased construction cost, allowance for increased wall thicknesses, and pursuing better windows and doors were significant obstacles that I encountered regularly.

AT: The challenge was reaching the parts of the industry that did not know, or did not care, that they were doing things wrong. We tended to attract those who understood that they needed to know more about building science and the details that must be paid attention to (in order to) ensure a functioning building. Sometimes we felt we were repeating ourselves, but that is the role of education: the next generation needs to know what we already understood. At this time, there were no formal building science courses in the B.C. institutions.

Also, one thing that I wanted to see during my year as president was for the organization to have some continuing impact on improving the technical capacity of the industry. We started by making an award to a student undertaking studies in building science. I think we took the funds from our surplus that first year. Later, this evolved into the BCBEC Foundation.

JW: There were challenges in those days, but in the early days of BCBEC, as previously mentioned, this "leaky condo crisis" had not hit the newspaper or TV and there was no Internet or social media.

BE: Any advice to pass along?

BC: I'd say keep going – keep raising that bar.

KH: I hope BCBEC continues to educate and engage the industry, and my hope is that we see an end to tarped buildings with building envelope issues and lawsuits. Every building structure that is designed and built is a prototype in its own right; buildings do not come off an assembly line and it is little wonder that we have problems.

AT: Stick to the aims laid out in Article 2 of the constitution and you will not go wrong:

The purpose of the society is to promote the pursuit of excellence by all individuals and groups having an interest or involvement in the design, construction or other technical aspects of the "building envelope," and includes the organization and/or sponsorship of meetings, seminars and other activities for the education and professional advancement of those individuals and groups.

JW: Always remember: "Without the benefit of history, there is no future."

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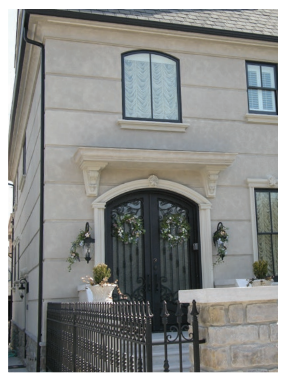
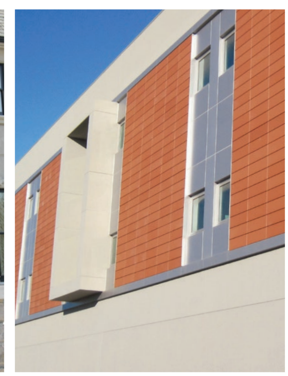
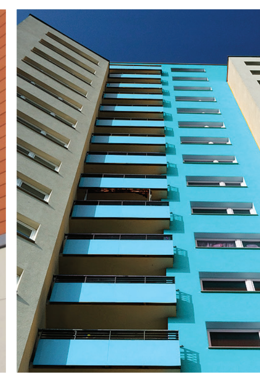

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TALL WOOD BUILDING ENCLOSURES A RACE TO THE TOP

By Graham Finch, MASc, P.Eng and Brian Hubbs, P.Eng – RDH Building Science, Vancouver, BC

Interest in taller wood buildings utilizing cross laminated timber (CLT), nail laminated timber (NLT) and structural glued laminated timber (glulam) is growing rapidly in Canada and the United States. On the West Coast, recently completed projects – including the 97-foot tall, six-storey Wood Innovation and Design Center (WIDC) in Prince George, BC; the 180-foot tall, 18-storey UBC Brock Commons Tallwood House in Vancouver, BC; and the upcoming 12-storey Framework project in Portland, OR – have captured the attention of the international construction industry. Several other taller wood buildings are on the horizon and feasibility studies are currently being performed for mass timber buildings over 30 stories in height. Tall wood buildings have been a reality in Europe longer than North America, and there is much to learn from the European experience. However, conditions unique to the North American construction industry create many challenges for the design team in demonstrating the safety, durability, and economics of these buildings, all while forming public perception of wood at taller heights.

WOOD STRUCTURE AND BUILDING ENCLOSURE – A RACE TO THE TOP

Structural systems for tall wood buildings are new to the industry and are unique in their design and construction. Heavy use of CLT or NLT panels and glulam beams/columns along with innovative connectors are features of taller wood buildings. Concrete and steel are also utilized with mass timber elements to create "hybrid tall wood structures." Tall mass timber wood structures have the benefit of prefabrication and can be installed very quickly, saving

Credit: naturallywood.com

construction time and cost. To achieve this time savings, advanced computer models are often utilized to draw all components individually in 3D and combined to model the completed building. The 3D model for each component part is then linked directly to the wood and connector fabrication facilities to ensure the perfect fit of all components on site. Once complete, the model is then used to simulate construction of the building in 4D to optimize the on-site build schedule. An example for the UBC Tallwood House is shown in this video by CadMakers:
https://www.youtube.com/watch?v=ATKpFtzCVFU.

Tall wood structures have many challenges that need to be overcome prior to construction. The greatest challenges include public perception and gaining acceptance with local code authorities. The most significant issues that need to be addressed to achieve this acceptance are fire safety, building movement and durability. Wood is more sensitive to moisture than concrete or steel, especially during construction if not properly protected. This is where the integration of building enclosure and façade elements come into play. On tall wood buildings in North America, the integrated design and erection of the building enclosure and façade components to protect mass wood structures during construction is critical to the economics, durability and overall success of these buildings. *This is where the notion of a race to the top arises – build the structure fast, but build the enclosure just as fast to protect the wood structure and take full advantage of the time saving benefits of a prefabricated building.*

WET WEST COAST CHALLENGES

The Pacific Northwest of Canada and the U.S. is a temperate rainforest climate where persistent rain is expected for most of the fall, winter and spring months. In this climate, construction can proceed 12 months per year due to relatively mild temperatures. In this region, tall buildings are typically constructed of cast in place concrete that is poured year-round without the need for hoarding and heating. Building façades are installed in a vertical assembly line many floors below the concrete operations typically using moisture tolerant unitized curtain wall, window wall or steel stud assemblies. During construction, it is common for water to wet the structure and façade systems during and after installation from both the interior and exterior as rainwater flow is managed inside the building.

On tall wood buildings, mass timber elements including CLT, NLT, glulam and other engineered components absolutely need to be protected from excessive wetting during construction. This requirement precludes the use of many conventional cladding systems unless the building is fully hoarded during construction. On buildings such as UBC Tallwood House, where scaffolding and hoarding is not practical or economical, the following risk mitigation strategies can be employed to help prevent heavy timber components from getting wet during construction:

1. Build and enclose very rapidly during the summer dry season;
2. Pre-protect heavy timber elements with appropriate membranes;
3. Prefabricate enclosures for quick installation;
4. Install factory finishes or coatings to reduce water absorption;
5. Employ an effective construction site water management plan.

NLT as a floor and roof panel is particularly challenging in rainy and damp coastal environments due to the tendency for the nailed framing to swell when wetted. The *Nail Laminated Timber Design Guide* recently published by the Binational Softwood Lumber Council (2017) provides practical guidance on avoiding these problems with considerations for climate and assembly design. CLT can handle wetting much better than NLT as it does not swell along the length or width; however, research and field experience over the past few years strongly suggests that panels should be coated with a factory applied water repellant, particularly at the edges and exposed end grain to reduce the amount of wetting during construction. If NLT or CLT gets too wet during construction, it will take significant time for the wood to dry out and this can result in costly construction delays.

Simple design strategies that allow wood that is wetted during construction (or could become wetted in-service due to leaks) the ability to dry out go a long way in making these buildings more durable. On WIDC, the roof system was installed over strapping over the CLT roof beams and open to the interior above the mass timber structure. When the plywood was wetted during construction as a result of snow melt, it was easily and quickly dried out from the interior by moving interior air between the plywood roof sheathing and the CLT beams.

PREFABRICATION AND DETAILING OF THE FAÇADE

The two key differences that need to be considered early in design for tall wood buildings which are unique from other building types are summarized as follows:

1. Need for Speed

The building enclosure for larger and taller mass timber buildings should be erected and sealed water-tight as fast as possible following the erection of the wood structure. This necessitates the use of offsite prefabrication and minimal site work to prepare for installation of wall and roof panels. In addition, materials used within the enclosure panels – whether they are structurally fabricated of wood, steel or concrete – need to be accommodating of inclement weather and tolerant of moisture during construction. Pre-installation of windows and thoughtful design of panel joints and interfaces for ease of sealing is therefore crucial.

Credit: naturallywood.com

2. Ensure Durability

Materials used within the building enclosure need to be robust and essentially "high-rise appropriate." Given the potential short- and long-term vertical expansion/contraction and lateral drift of the wood structure, they also need to be more tolerant of movement. Thermal efficiency is necessary for code compliance, as is the use of non-combustible materials. Wood structural components can be just as durable as steel or concrete when properly protected and have the added benefit of being more thermally efficient when bypassing installed insulation.

UBC BROCK COMMONS TALLWOOD HOUSE – WORLD'S TALLEST WOOD BUILDING

The building enclosure and façade of UBC Tallwood House consist of an innovative prefabricated steel stud rainscreen curtain-wall assembly that is pre-insulated, pre-clad, and has factory installed windows. Design of connections and air and water sealing of panel joints and interfaces was carefully considered given the tall wood structure they were designed to protect. While steel studs were utilized in the panelized structure, feasible curtain-wall designs were also developed and prototyped for wood-framing, CLT, and precast concrete as part of the project.

During the early schematic design phase for the UBC Tallwood House, the following criteria were outlined by the design and construction team for the façade system:

- A panelized façade that could be installed and sealed air and water tight at a pace of one floor per day.
- A durable moisture tolerant panel with windows pre-installed that could be installed and sealed without access to the exterior side.

UBC BROCK COMMONS TALLWOOD HOUSE

Owner
University of British Columbia, Student Housing and Hospitality Services

Owner's Representative
University of British Columbia, Infrastructure Development

Project Manager
UBC Properties Trust

Architect of Record
Acton Ostry Architects Inc.

Tall Wood Advisor
Architekten Hermann Kaufmann ZT GmbH

Structural Engineer
Fast + Epp

Mechanical, Electrical, Fire Protection Engineer / Leed Consultant
Stantec

Building Code & Fire Engineering
GHL Consultants Ltd.

Building Envelope & Building Sciences
RDH Building Science Inc.

Acoustical Engineer
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Civil Engineer
Kamps Engineering Ltd.

Landscape Architect
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Seagate Structures

Whitewater Concrete Ltd.

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Commissioning Consultant
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Timber Erector
Seagate Structures

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Concrete Trade
Whitewater Concrete Ltd.

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Lafarge

Steel Reinforcing
LMS Reinforcing Steel Group

Steel Supplier
Bar None Metalworks Inc.

Building Envelope Fabricator
Centura Building Systems Ltd.

Roofing Trade
Raven Metapro Systems Ltd.

Mechanical Trade
Trotter & Morton Building Technologies

Electrical
Protec Installations Group

Drywall
Power Drywall Ltd.

Credit: naturallywood.com

- A wall assembly that met the current energy code target (R-16 effective) but could easily be scaled up if needed to meet more aggressive overall building energy performance targets.
- Be constructed of non-combustible materials or where wood is used, meet fire code requirements.
- Economical, and for this project, an installed cost of less than $50/square foot, which locally at the time was in line with pre-cast sandwich panel and aluminum window-wall systems.

With these criteria in mind, various prefabricated wall panel design options were explored for the project. These included both a bottom bearing small panel option which could be installed using small hoists like a window wall, and a larger top-hung curtain-wall panel option with pre-installed punched windows mounted using the site crane. A costing and scheduling assessment of both panel concepts by the construction team favoured the larger panel option, given the anticipated installation of the structural members and the significantly reduced level of slab edge preparation and membrane work required.

Given the preference for a larger hung prefabricated panel, the architectural design of the façade proceeded with this concept and aesthetic. The next step in the design process was to select a structural system for the panels and work with a local contractor to design a façade system to meet the project criteria. To spur design innovation and in the spirit of competition, three sub-contractors were tasked with the design and mock-up construction of a wood-frame/CLT, steel stud, and pre-cast sandwich panel. Each team fully designed their panel, installed a set of panels on an offsite mock-up and submitted a tender for their system. Ultimately the exterior insulated steel stud backup wall was selected as it met the project criteria and budget.

Once the steel stud unitized curtain-wall approach was selected, the design was finalized and a full-scale Performance Mock-up (PMU) was constructed and tested for assembly time, air, water, structural, seismic drift/deflection and condensation performance. The performance mock-up testing identified improvements to panel connections, windows, air and water seals, and corner panel connections. The panel cladding was also changed from light gauge steel to a high-pressure wood-fibre laminate for aesthetic reasons. The mock-up was installed in a record 60 minutes and is the fastest PMU installation that the authors have ever witnessed.

Image provided by Graham Finch – RDH

Upon the successful completion of the performance mock-up, full scale assembly of the panels was started in the manufacturer's facility.

During the summer of 2016, 24 prefabricated panels per floor were successfully installed at a speed of two floors per week (instead of the initially anticipated one floor per week), closely trailing the CLT floor and glulam column structural system. The strategically designed panel joints were sealed from the building interior following panel installation and tolerances were such that these panel joints are difficult to distinguish from other cladding joints. After the building was closed in and the roof installed, additional batt insulation within the stud cavities was installed followed by a vapour barrier membrane and drywall. Onsite commissioning was performed to confirm that the panel and window air and water tightness met project performance specifications. This fast and simple installation of the prefabricated panel system allowed the structure and façade of the world's current tallest modern wood building to be installed in a record-breaking nine weeks and contributed to the overall success of this project.

ONWARD AND UPWARDS

Looking ahead, there will continue to be innovation in design and construction of fast and durable façades for taller wood buildings. New prefabricated panel designs incorporating CLT panels and connection technologies from unitized curtain-wall systems are already being developed for the "next tallest" wood buildings in North America. ■

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- CadMakers 4D construction sequence: https://www.youtube.com/watch?v=ATKpFtzCVFU

Brian Hubbs is a Managing Principal and Senior Building Science Specialist at RDH. He has over 25 years' experience as a consultant practising exclusively in the field of building science. Brian is recognized by his peers as being a practical façade engineer and researcher. He has a unique blend of theoretical and hands-on knowledge gained from designing façades for new buildings, as well as completing hundreds of forensic investigations, rehabilitation projects and research projects. Brian has extensive experience with high-rise façade systems, components and materials. An engaging and vibrant presenter, he regularly speaks at seminars, conferences and guest lectures on a range of building science topics.

Graham Finch is a Principal and Building Science Specialist with RDH. He has a passion for technology and improving energy efficiency in new and existing buildings. He leads RDH's building science research group and is actively involved in numerous projects ranging from building research studies to forensic investigations, building monitoring, hygrothermal modelling, and new construction across North America. Graham has co-authored several publications and practical industry guideline documents on wood building enclosures including the Guide for Designing Energy-Efficient Building Enclosures, *the* Guide for Tall Wood Buildings in Canada, *and the Building Enclosure chapters for both the* CLT Handbook *and the* NLT Design and Construction Guide.

CONFERENCE DAY 1 / MONDAY NOV 6

TIME	Track 1		Track 2		Track 3	
7:00 AM	**Registration**					
7:30 AM - 8:30 AM	**Breakfast**					
8:30 AM - 10:00 AM	**Welcome Message & Opening Presentation with Dr. Kim Pressnail of University of Toronto, 3rd Floor Ballroom**					
10:00 AM	**Break & Tradeshow**					
	Arctic Building Enclosures Session Chair - Juergen Korn		**Building Retrofits** Session Chair - Leslie Peer		**Presentation - Case Study** Session Chair - Catherine Lemieux	
10:30 AM	1.1.1	Field Monitoring of Hygrothermal Performance of Attic Venting Systems in Extremely Cold Climates *Ms. Ruolin Wang*	1.2.1	Retrofitting Resilience into Buildings in a Mixed Humid Climate *Ms. Sarah Buffaloe*	1.3.1	Forensic Whole-Building Simulation *Mr. Alex McGowan P.Eng*
11:00 AM	1.1.2	Attic Ventilation in Northern Canadian Climates *Mr. Ahmad Kayello*	1.2.2	Restoration of a Heritage Log Church *Mr. Mike Rekker*	1.3.2	Regal Place Hotel - Cost-Effective Heritage Facade Rehabilitation *Mr. Brenden David*
11:30 AM	1.1.3	In Situ Thermal Performance of VIPs in Northern Canada *Phalguni Mukhopadhyaya*	1.2.3	The Best Made Plans: The Challenges of Retrofitting an Historic Single Family Home Using Nested Thermal Envelopes *Kim Pressnail*	1.3.3	Comparing the Effectiveness of Reducing Interior Overheating with High Performance Low-E Glass versus Smart Shading Glass *Mrs. Alana Frost*
12:00 PM - 12:30 PM	**Lunch & Tradeshow**					
	Building Enclosure Assemblies Session Chair - Kim Pressnail		**Building Retrofits** Session Chair - Leslie Peer		**Presentation - Case Study** Session Chair- Catherine Lemieux	
1:00 PM	1.1.4	Field Evaluation of Hygrothermal Performance and Constructability of Vacuum-Insulated, Thin Wood-Frame Wall Assembly *Mr. Mark Carver*	1.2.4	Challenges Associated with High RSI-value Building Envelope Retrofits *Mr. Brock Conley*	1.3.4	Scoring Big on Façade Without Skipping a Beat on Safety *Ms. Nicole Parsons*
1:30 PM	1.1.5	Condensation in Wall Assemblies: Maintaining Low Levels of Risk through Non-Traditional Insulation Packages *Dr. Jean-François Côté*	1.2.5	Assessing the Economic and Environmental Case for Window Retrofits in Single Family Homes *Ms. Amy Chitilian*	1.3.5	Implementing Compartmentalization and Ventilation Strategies in Tall Multi-Use Buildings to Control Stack-Effect Related Performance Issues *Mr. David De Rose*
2:00 PM	1.1.6	An Overview of Studies to Assess the Thermal and Hygrothermal Performance of Highly Insulated and Zero-Ready Wall Assemblies *Dr. Michal Bartko*	1.2.6	Safe, Effective & Affordable Retrofits for Cold Climates *Robbin Garber-Slaght*	1.3.6	BC HYDRO HQ: Design and Construction Challenges on a Barrel Arch Canopy Replacement Project *Paul Creighton, P.Eng*
2:30 PM	**Break & Tradeshow**					
	Building Enclosure Materials Session Chair - Anil Parehk		**Presentation - Retrofits**		**Presentation - Building Technology & Equipment** Session Chair - Remi Charon	
3:00 PM	1.1.7	Wood Preservation and its Corrosive Effects on Metal Fasteners *Mr. Wesley Narciso*	1.2.7	The Real Estate Hot Potato - Challenges and Solutions for Whole-Building Re-Cladding Projects *Mr. Scott Armstrong*	1.3.7	Real-Time Monitoring for Leak Locating with Wireless Moisture Content Sensors in Non-Combustible Construction *Mr. Jason Teetaert P.Eng*
3:30 PM	1.1.8	The Effect of the Temperature Dependency of Building Insulation Conductivity and Energy Consumption *Dr. Umberto Berardi*	1.2.8	Hygrothermal Performance of Exterior Blanket Insulation *Dr. Tareq Baker*	1.3.8	Impact of Insulated Concrete Balcony Curb on Interior Concrete Surface Temperature *Mr. Chafik a.k.a. Chuck Murad*
4:00 PM	1.1.9	Window Sill Pan Flashings - Vapour Impermeable or Permeable? *Mr. Michael Wilkinson*	1.2.9	Retrofitting Canadian Style Window Walls to Address Performance Failure and Increased Performance Need *Mr. George Torok*	1.3.9	Monitoring of Various Non-Vented and Vented Vaulted Roofing Systems in Vancouver *Mr. Jason Teetaert P.Eng*
4:30 PM - 5:30 PM	**Reception - 34th Floor**					

CONFERENCE DAY 2 / TUESDAY NOV 7

TIME	Track 1	Track 2	Track 3
7:00 AM	**Registration**		
7:30 AM - 8:30AM	**Breakfast**		
	Insulation Materials Session Chair: Phalguni Mukhopadhyaya	**Fenestration** Session Chair: Mark Lawton	**Building Airtightness and Air Leakage** Session Chair: Gary Proskiw
8:30 AM	2.1.1 Analysis of Wood Framed Sloped and Low Sloped Residential Unvented Roof Assemblies With Spray Foam *Dr. John Straube (JSmegal)*	2.2.1 The Effect of Boiler and Chiller Oversizing on Greenhouse Gas Emissions in High-Rise Residential Building *Ms. Helen Stopps*	2.3.1 Building Envelope Thermal and Air Leakage Characteristics of Canadian Housing *Ms. Julia Purdy*
9:00 AM	2.1.2 Long Term Performance: Unventilated Wood Framed Roofs Using Polyurethane Foam *Hamid Heidarali*	2.2.2 Energy and Indoor Air Quality Impacts of DOAS Retrofits in Small Commercial Buildings *James Montgomery*	2.3.2 Critical Review of a Whole Building Air Leakage Testing Requirement *Mr. J. Lee Durston*
9:30 AM	2.1.3 Temperature-Dependent Apparent Thermal Conductivity of Insulation Materials for Transient Energy and Hygrothermal Simulations *Chris Schumacher*	2.2.3 Experimental Investigation and Implementation of a Multiple-Inlet BIPV/T System in a Curtain Wall *Ms. Olesia Kruglov*	2.3.3 Multivariate Statistical Analysis on Blower Door Testing Population *Mr. Bomani Khemet P.Eng*
10:00 AM 10:30 AM	**Break & Tradeshow**		
	Thermal Comfort and Indoor Environment Session Chair: Terri Meyer Boake	**Energy Use in Buildings - Modeling and Measurements** Session Chair: Graham Finch	**Building Airtightness and Air Leakage** Session Chair: Rachel Smith
10:30 AM	2.1.4 It's Time to Change Bait: Why and How to use Thermal Comfort Analysis in Design Stage to Influence Enclosure and HVAC Designs *Mr. Robert Bean*	2.2.4 Building Envelope Energy Optimization for Multistory Buildings *Mr. Robert Beckett*	2.3.4 Airtightness Testing of Occupied, Multi-Unit Residential Buildings (MURBs) - Lessons Learned *Mr.Cory Carson*
11:00 AM	2.1.5 A Laboratory Study: Examining the Use of Mineral Fibre Insulation to Assist the Ventilation Drying of Internally Insulated Walls *David Wach*	2.2.5 The Potential of Latent Thermal Energy Storage as an Energy Retrofit Measure for High-Rise Residential Buildings in Canada *Dr. Umberto Berardi*	2.3.5 Impact of Air Intrusion on Moisture Performance of Mechanically Attached Roofing Systems *Sudhakar Molleti*
11:30 AM	2.1.6 Investigating Wintertime Thermal Comfort of Post-War Multi-Unit Residential Buildings Using Resident Surveys and In-Suite Monitoring Data *Mr. Chia Chang / Marianne Touchie*	2.2.6 Experimental Investigation of Latent Thermal Energy Storage for Energy Retrofit in High-Rise Residential Buildings in Toronto *Shahrzad Soudian*	2.3.6 An Improved Airtightness Test Procedure for Multi-Unit Residential Buildings *Mr. Gary Proskiw*
12:00 PM	**Lunch & Tradeshow**		
	Thermal Comfort and Indoor Environment Session Chair: Sophie Mercer	**Energy Use in Buildings - Modeling and Measurements** Session Chair: Marianne Touchie	**Wood Buildings - Movement, Moisture and Wetting** Session Chair: Robert Lepage
1:00 PM	2.1.7 A Compartmentalization and Ventilation Retrofit Strategy for High-Rise Residential Buildings in Cold Climates *Mr. Mathew Carlsson P.Eng*	2.2.7 Dynamic Effect of Thermal Bridges on the Energy Load of Residential Buildings in British Columbia *Dr. Hua Ge*	2.3.7 Controlling Construction Moisture in Cross Laminated Timber Structures *Mr. Robert Lepage*
1:30 PM	2.1.8 The Sound Transmission Loss of Wood-Frame Wall Assemblies with Rainscreen Cavity and Optional Split Insulation *Mr. Eduardo Stehling*	2.2.8 Economic Optimization of Building Envelope for a High Performance Multi-Family Residential Building *Mr. Byron Enns*	2.3.8 Wetting and Drying Performance of Wood-Based Assemblies related to On-Site Moisture Management *Dr. Jieying Wang*
2:00 PM	2.1.9 Achieving Comfort: Energy Model Validation of Historic Building Renovation *Mr. Jason Der Ananian*	2.2.9 Energy Consumption of Low- to Mid-Rise Wood-Frame Multi-Unit Residential Buildings *Elyse Henderson*	2.3.9 Moisture Buffering and Ventilation Strategies to Control Indoor Humidity in a Marine Environment: A Field Experimental Study *Ms. Shahrzad Pedram*
2:30 PM	**Break & Tradeshow**		
	Passive House Session Chair: Russell Richman	**Numerical Simulation - IAQ and Ventilation** Session Chair: Hua Ge	**Wood Buildings - Movement, Moisture and Wetting** Session Chair: Graham Finch
3:00 PM	2.1.10 Structural Testing of Screws through Thick Exterior Insulation *Jun Tatara*	2.2.10 Impact of Heat and Moisture Transfer Through a Multilayer Wall on the HVAC System Response *M. Rudy Bui*	2.3.10 Vertical Movement and Moisture Performance Monitoring of Pre-Fabricated Cross Laminate Timber – Featured Case Study: UBC Tallwood House *Mr. Gamal Mustapha*
3:30 PM	2.1.11 In-Depth Analysis of Passive House Performance - A Case Study *Mr. Robert Lepage*	2.2.11 Numerical Study of the Effect of Fenestration Configuration on the Convective Heat Transfer Rate of a Building *Mr. Meseret Kahsay*	2.3.11 Field Measurement of Vertical Movement in Wood-Framed Buildings *Dr. Jieying Wang*
4:00 PM	2.1.12 Determining Total-Assembly R-Values *Mr. Alex McGowan P.Eng*	2.2.12 Using Airflow Modelling Software To Predict Airtightness Improvements in a High-Rise Residential Building: A Case Study *Mr. David Stanton B.Sc, B.ASc, M.ASc (Cand)*	
4:30 - 5:30 PM	**Reception - 34th Floor**		
6 - 9:00 PM	**Dinner Gala with Keynote Speaker Colin Angus - 3rd floor ballroom**		

CONFERENCE DAY 3 / WEDNESDAY NOV 8

TIME	Track 1		Track 2		Track 3	
7:00 AM	**Registration**					
7:30 AM - 8:30 AM	**Breakfast**					
	AGM					
	Roofing Materials Session Chair: Suda Molleti		**Fenestration** Session Chair: Alex McGowan		**Presentation - Enclosure Design and Materials** Session Chair: Lorne Ricketts	
8:30 AM	3.1.1	Adhesion of Roofing Materials to Green Concrete *Mr. Laurence Matzek*	3.2.1	A Study of the Variability of In-Situ Window Air Leakage Characteristics Compared to the Certified Air Leakage Characteristics *Mrs. Negar Pakzadianmoghaddam*	3.3.1	Insulated Metal Panels - Design and Construction Challenges *Mr. Harold Louwerse*
9:00 AM	3.1.2	Moisture Accumulation in Closed Cell Insulation - Field Data from Western Canada *Mr. Colin Tougas*	3.2.2	Thermal Performance of Spandrel Panels in Curtain Walls *Mr. Jacee Tan*	3.3.2	Hygrothermal Performance of Hempcrete for Ontario (Canada) Buildings *Mr. Ujwal Dhakal*
9:30 AM	3.1.3	Solutions to Address Osmosis and the Blistering Liquid Applied Waterproofing Membranes *Elyse Henderson/Graham Finch*	3.2.3	A Case History Review of ETFE on Today's Projects *Mr. J. Lee Durston*	3.3.3	Building Enclosures for Mid- and High-Rise Wood Buildings *Mr. Brian Hubbs*
10:00 AM 10:30 AM	**Break & Tradeshow**					
	Roofing Assemblies Session Chair: Suda Molleti		**Fenestration** Session Chair: Alex McGowan		**Construction Business** Session Chair: Remi Charron	
10:30 AM	3.1.4	Sources of Error and Uncertainty in UAV Based Infrared Thermographic Building Inspections *Prof. Phalguni Mukhopadhyaya*	3.2.4	Quantifying the Benefit of Venting Glazing Spandrels to Reduce Glass Breakage and Control Moisture *Mr. Julien Schwartz*	3.3.4	Addressing Procurement Barriers to Innovative Wood Buildings *Ms. Helen Goodland*
11:00 AM	3.1.5	Impact of Material Dimensional Stability on Conventional Roof Performance *Lorne Ricketts*	3.2.5	Impact of Fenestration on the Overall Thermal Performance of the Building Envelope *Robert Jutras*	3.3.5	Life-Cycle House Quality: A Communication Platform for the Housing Industry in British Columbia *Miss Lien Tran M.Eng.*
11:30 AM	3.1.6	Performance Assessment of Energy Positive Roofs *Sudhakar Molleti*	3.2.6	Guideline for the Two-Dimensional Simulation of Spandrel Panel Thermal Performance for Improved Accuracy and Consistency *Mr. Daniel Haaland*	3.3.6	NBC 2015 Subsection 5.9.3 Other Fenestration Assemblies - The Intent Behind the New Code Provisions *Mr. David Kayll FMA, P.Eng.*
12:00 PM	**Lunch & Tradeshow**					
	Numerical Simulation - Exterior Environment Session Chair: Jieying Wang		**Presentation - Fenestration** Session Chair: Christopher Black		**Hygrothermal Modeling** Session Chair: Wahid Maref	
1:00 PM	3.1.7	Effect of Overhang on Wind-Driven Rain Load of a Mid-Rise Building: Field Measurements *Dr. Hua Ge*	3.2.7	Fenestration Systems – It Is All About the Plumbing *Peter Adams, P.Eng.*	3.3.7	Enhanced Source and Sink Ventilation Model for WUFI *Mr. Stephen McNeil*
1:30 PM	3.1.8	Impacts of Climate Change on Building Envelope Energy Efficiency *Mr. Paul Carter B.Arch.Sc., C.E.T.*	3.2.8	Lessons Learned from Lab Testing Failures of Glazing Systems *Mr. Andy Lang AScT*	3.3.8	Risk Assessment of Water Accumulation in Walls with Exterior Continuous Insulation *Dr. Theresa Weston*
2:00 PM	3.1.9	Numerical Modeling of Natural Ventilation Strategies to Improve Thermal Comfort for Multi-Unit Residential Buildings in India *Mr. Wei-Chih Huang*	3.2.9	The Real Estate Hot Potato - Challenges and Solutions for Whole-Building Re-Cladding Projects	3.3.9	Design Limits for Framed Wall Assemblies Dependent on Material Choices for Sheathing Membranes and Exterior Insulation *Mr. Ivan Lee*
2:30 PM - 3:30 PM	**Closing Presentation with Terry Petkau of Habitat for Humanity Canada & Goodbye Message** 3rd Floor Ballroom					

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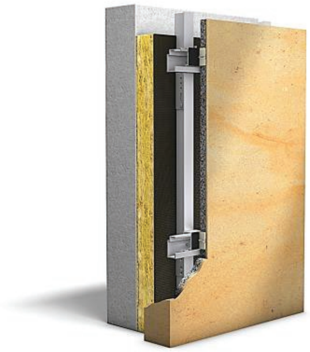
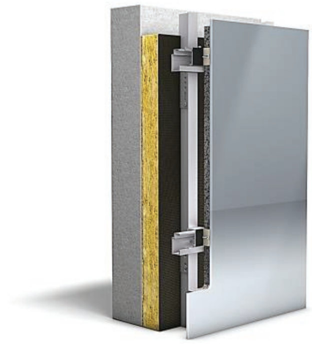


Lightweight Stone

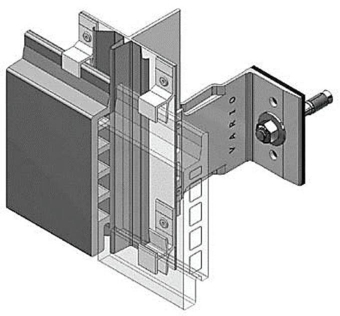


Glass Rainscreen

BIPV Rainscreen

Porcelain Rainscreen

UHPC Rainscreen



Terracotta Rainscreen

IT'S WHAT'S INSIDE THAT COUNTS

The new BC Energy Step Code takes an envelope-first approach to gradually increase building performance between today and 2032. Here's what practitioners need to know.

By Bob Deeks, Christian Cianfrone and Gary Hamer

ENERGY STEPCODE
BUILDING BEYOND THE STANDARD

Earlier this year, the Province of British Columbia signed off on a new regulation designed to forever transform the way we build new homes, offices, stores, and other buildings. The BC Energy Step Code aims to help both government and industry chart a course to 2032, when all new construction must reach a "net zero ready" level of energy performance.

Local governments that would like to incentivize or require better-than-code performance requirements can now reference the new regulation in their policies and bylaws, and begin enforcing them as of December 15, 2017. By gradually adopting one or more "steps" of the new standard – and ratcheting up the requirements in the years ahead – these governments can help both the province and the communities they serve meet energy conservation goals and greenhouse gas targets.

SERVING MANY MASTERS

The BC Energy Step Code is an elegant and flexible policy tool that serves many masters. As noted above, it offers local governments a mechanism to reduce energy use and greenhouse gas emissions. It provides industry with a clear sense of where the province is heading on energy efficiency, while giving builders a welcome level of consistency via standardized performance metrics. It also supports a variety of co-benefits, such as improved occupant comfort, lower utility bills and reduced noise inside buildings. Along the way, the regulation is expected to help grow the market for energy-efficient buildings and boost industry capacity for high-performance products and practices across British Columbia.

The BC Energy Step Code is available to

PATHWAY TO 2032: **PART 3 (WOOD-FRAME RESIDENTIAL)**

PATHWAY TO 2032: **PART 3 (CONCRETE RESIDENTIAL)**

PATHWAY TO 2032: **PART 9 (HOMES)**

communities that choose to use it for any new construction of Part 9 residential buildings – with different targets set for Climate Zones 4, 5, and 6/7/8. It's also an option for local governments that wish to increase performance of Part 3 multi-unit residential and certain commercial buildings in Climate Zone 4. Targets for Part 3 buildings in other climate zones may be added in the future. Local governments choose whether or not to require the BC Energy Step Code while industry can voluntarily use it as a compliance path in the BC Building Code.

The new regulation is also a bit of a crystal ball, in that it offers industry a glimpse of what's to come on efficiency. By 2032, the BC Building Code will adopt the Upper Steps of the BC Energy Step Code as a minimum requirement. The National Building Code of Canada will also be moving towards this outcome by 2030.

A HIGH-PERFORMANCE STAIRCASE

The BC Energy Step Code establishes requirements for whole-building energy modelling, including modelling the performance of building envelopes, equipment, and heating systems. The energy model must demonstrate how the building design will meet a set of requirements that represent increasing levels of energy efficiency. To ensure the building comes together as designed and meets envelope expectations, following construction and prior to occupancy, builders must conduct an on-site airtightness test and meet minimum airtightness targets. The details will matter a great deal.

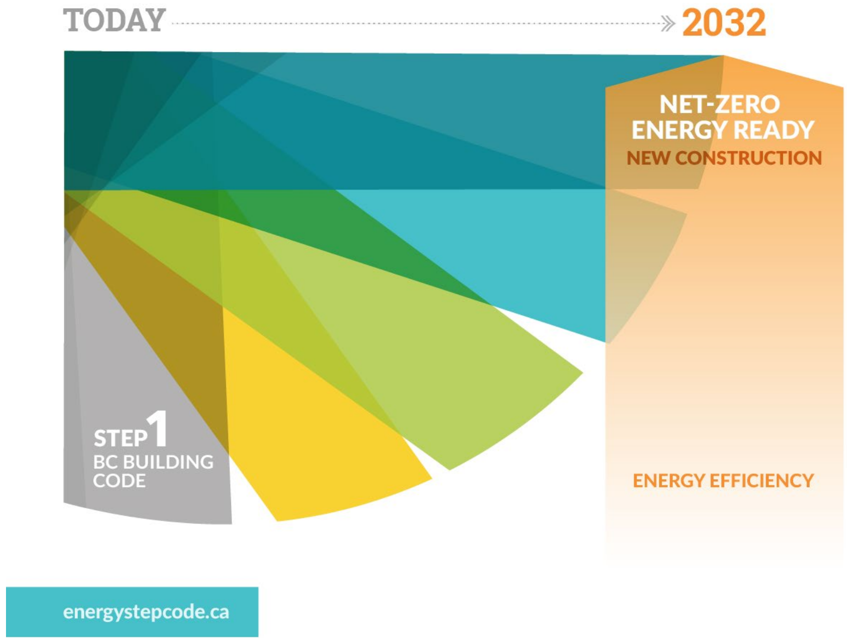
The BC Energy Step Code is notable for its performance-based approach. While the regulation requires whole-building energy modelling and on-site testing, it stops short of prescribing requirements for materials or construction methods. Instead, it establishes an outcome, and leaves it up to the design and building team to decide how to accomplish it.

To achieve Step 1, builders need to use a whole-building energy model to calculate the proposed building's energy use and conduct an airtightness test, but the actual energy performance only needs to be as good as that required in the base BC Building Code. Step 1 aims to familiarize builders with a new way of measuring energy efficiency, although the actual construction techniques remain conventional.

To achieve the **Lower Steps,** building and design professionals and trades can rely on conventional building designs with careful air-sealing practices, and incrementally incorporate some key new elements in the design, envelope, mechanical equipment and systems. Builders and designers will want to collaborate closely with their energy modeller to choose the most cost-effective strategies and materials to meet the requirements. These Lower Steps give builders new flexibility in how to achieve modest gains in efficiency through improved envelopes and/or upgraded systems.

To achieve the **Upper Steps,** builders and designers will need to adopt a more integrated approach. They will likely need to embrace more substantial changes in building design, layout, framing techniques, system selection and materials. Without additional training and experience, these techniques and materials will incur higher costs – though the province is developing resources to help address those gaps.

The BC Energy Step Code firstly focuses on envelope performance, to reduce the building's space conditioning loads, before looking to efficient mechanical systems to satisfy those conditioning loads. Under this "envelope first" approach, designers will need to carefully specify window and wall systems to minimize thermal bridging and air leakage.



SAMPLE PART 9 COMPLIANCE STRATEGIES

For Part 9 buildings, windows will remain the weak link in most wood-frame wall systems; glazing will remain an important element in the overall envelope performance. With the help of modelling software, designers will work to balance glazing surface area with the windows' capacity to reduce heating and cooling loads. While double-glazed windows are standard today, as communities move to the Upper Steps of the BC Energy Step Code tomorrow, triple-glazing will eventually become commonplace.

For wall systems, Part 9 designers will consider such options as:

- **Exterior insulation.** Design practitioners already know that they can improve an envelope's thermal performance by adding additional exterior insulation layers. Common materials include extruded polystyrene, expanded polystyrene, and mineral wool. While each material has its own advantages and disadvantages, designers considering overall wall performance must pay special attention to the material's vapour-transmittance and air-sealing characteristics.
- **Insulated concrete forms (ICF).** In an ICF approach, builders use expanded polystyrene foam board with reinforcing steel to assemble foundations and walls in a Lego-like manner. The concrete and steel offer structural integrity while the insulation delivers thermal performance. ICFs can provide a very effective air barrier.
- **Double-wall construction.** Often called a "prairie wall," in a nod to its geographic origins, designers and builders employing this approach use a 2"x10" sill and top plate for a double-stud wall. Builders then offset double two-by-four studs; the space between provides a thermal break in the wall and allows space for up to R48 insulation.

SAMPLE PART 3 COMPLIANCE STRATEGIES

To comply with the BC Energy Step Code, Part 3 designers will optimize the energy conservation measures available to them through modelling, while adhering to specific guidelines intended to ensure consistency and fairness. Modelling will help ensure that envelope heat loss is accounted for more holistically, to include thermal bridging that occurs outside of the wall assembly.

Strategies to meet the BC Energy Step Code Part 3 include:

- **Lower steps:** In the B.C. Lower Mainland, envelope systems may continue to use higher-performing double-glazed windows, but walls will need to approach values of R10 compared to today's industry-typical R4 to R5 performance. To achieve an R10 effective wall, energy conservation measures may include fewer balconies (or thermally broken balconies), exterior insulated assemblies, precast sandwich panels, and improved window-wall systems. In colder climate zones, designers will likely need to specify triple-pane windows.
- **Window area:** The BC Energy Step Code does not specify a fixed requirement for window coverage. That said, builders who wish to use more extensive glazing will need to specify higher performance glass, or improved overall wall performance. In the Lower Mainland, builders and designers can still reach net-zero-energy-ready performance levels with 40 per cent glazing.
- **Heat recovery:** Heat recovery on ventilation air is likely a requirement for all steps in all climate zones, with higher-efficiency units more likely for Upper Steps.

RESOURCES COMING ONLINE

As local governments begin referencing the BC Energy Step Code in policy, designers, builders, building officials, suppliers and contractors will need to change how they design and build. To assist with that transition, BC Housing is preparing a series of illustrated guides. For designers, these will explain what targets need to be met to comply with each step in each climate zone. The resources will spotlight common strategies, including those outlined above, that builders can use to achieve a given performance level. A separate BC Housing resource will help consumers better understand the comfort, health, durability, and energy savings benefits of high-performance homes. It will help them ask the right questions of their realtor or builder.

These guides, and other technical resources, will be made available in the coming months at energystepcode.ca. The BC Energy Step Code is arguably the most significant and direct tool that British Columbia local governments have been provided to date to meet climate commitments. With teamwork and collaboration, it will get us where we need to go, while delivering maximum benefits to industry and homeowners along the way. ■

STAYING ON COURSE: THE ENERGY STEP CODE COUNCIL

The Province of British Columbia established the Energy Step Code Council (ESCC) to support the successful implementation of the BC Energy Step Code and the market transition to net-zero-energy-ready buildings. The ESCC serves as a “bridge” between governments, utilities, and the design, building, development and construction sectors, to ensure local governments adopt steps of the BC Energy Step Code in a responsible manner. It offers a venue for stakeholders to gather and share information, and work collaboratively to resolve issues as they arise. The ESCC also affords the province an opportunity to monitor and track implementation, which could inform future changes to the energy-efficiency requirements in the BC Building Code. For more on the ESCC, visit energystepcode.ca

Bob Deeks is the president and owner of RDC Fine Homes, which builds and renovates single-family and multi-family residences with a focus on sustainable, healthy, high-performance construction. Bob is active with the Canadian Home Builders’ Association (CHBA), serving as chair of the Net Zero Energy Housing Council and as vice chair of the Technical Research Committee.

Christian Cianfrone is a Principal and Building Energy Practice Lead with the Building Performance Analysis group in the Vancouver office of Morrison Hershfield. Christian serves as the company’s Building Energy Practice Lead, responsible for technical development, project delivery, and business development for building-energy-related projects.

Gary Hamer is a Residential Specialist Engineer in BC Hydro’s Advanced DSM Strategy group. As part of his conservation and energy-management duties, he helps advance codes and standards in the province’s residential sector. Gary serves as chair for the Technical Committee of the CHBA’s Net Zero Energy Housing Council and chair for the Canadian Standards Association’s Residential Equipment Technical Committee.

BCBEC FOUNDATION AWARDS PROFILE:

Sepideh Daneshpanah

By Matthew Bradford

The BCBEC Foundation honours students and apprentices in British Columbia who have demonstrated excellence in their studies within the field of building envelope design, construction, and technology. Created in 2006, it has provided thousands of dollars to future industry leaders in support of their education and career development.

In 2015, BCIT student Sepideh Daneshpanah joined BCBEC's portfolio of winners, receiving $1,000 from the Foundation's Tom Morstead Memorial Award. Prior to starting her studies at BCIT, Sepideh acquired a Bachelor of Architectural Engineering. In 2010, she decided to join BCIT to obtain a Diploma of Architectural and Building Engineering Technology. After completing her diploma, Sepideh decided to pursue her higher education by joining BCIT's Master of Building Science. Moreover, Sepideh has parlayed her education into roles within the architecture and interior design fields and currently works at a Building Science Firm, LDR Engineering Group.

We caught up with Sepideh to reflect on her career to date and her experiences with BCBEC.

BCBEC Elements: What have you been up to since winning BCBEC Foundation's award?

Sepideh Daneshpanah: Since I received the award, I have been working on my master's research thesis field experiment on the effect of interior living walls on indoor environmental quality. I have also been working at LDR Engineering Group as a Building Science Consultant.

BE: How did you first find out about BCBEC?

SD: In 2011, when I was at my second year of ABET (Architectural and Building Engineering Technology) at BCIT, my Building Science instructor recommended attending the BCBEC Annual General Meeting (AGM). The student fee was very reasonable, so I attended. I have been attending the AGMs and some of the other events since.

At first, as I did not know much about building science, so I did not fully understand what was discussed at the BCBEC technical seminars. However, I realized that BCBEC can be a great resource for acquiring knowledge about the field of building science and making connections with industry professionals.

BE: How has the BCBEC Foundation award supported your career?

SD: First of all, it was a big accomplishment for me, and a reward for my hard work. It gave me the emotional support I needed to start my career, and encouragement for working towards a good quality research thesis, which is expected to be completed soon. On the other hand, winning this award helped me build my connections. I made a connection with LDR at the award ceremony which resulted in me working for the firm.

Being part of the BCBEC community has helped me get access to education sessions, acquire new information, and be up-to-date. On the other hand, it has given me an opportunity to meet professionals in the building science industry and make connections with them. Meeting people and knowing about them has helped me define a career path that works for me.

BE: Do you keep in touch with those people?

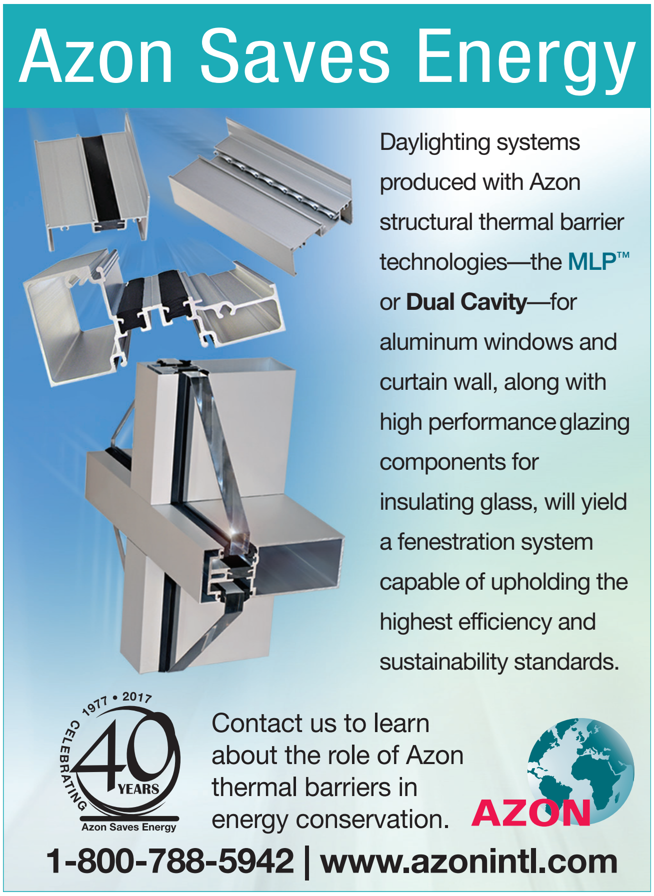
SD: I do. I think it feels great to see people I know, and get an update on where they are at. This way, I will never lose previous connections, and get a chance to build new relationships at the same time.

BE: What challenges do you see for your industry moving forward?

SD: Since I have just started working in the industry, it's hard for me to comment on this. However, I think there should be more emphasis on connecting academic institutions and the industry. I think BCIT and BCBEC have been really successful in narrowing the gap between academia and industry yet there is still room to make and strengthen those connections perhaps between BCBEC and other post-secondary institutions.

BE: What advice would you give to students who are starting to get involved with BCBEC?

SD: I suggest that students use their BCBEC membership. BCBEC offers great events at discounted fees for students at which they can learn and meet people in the industry. ■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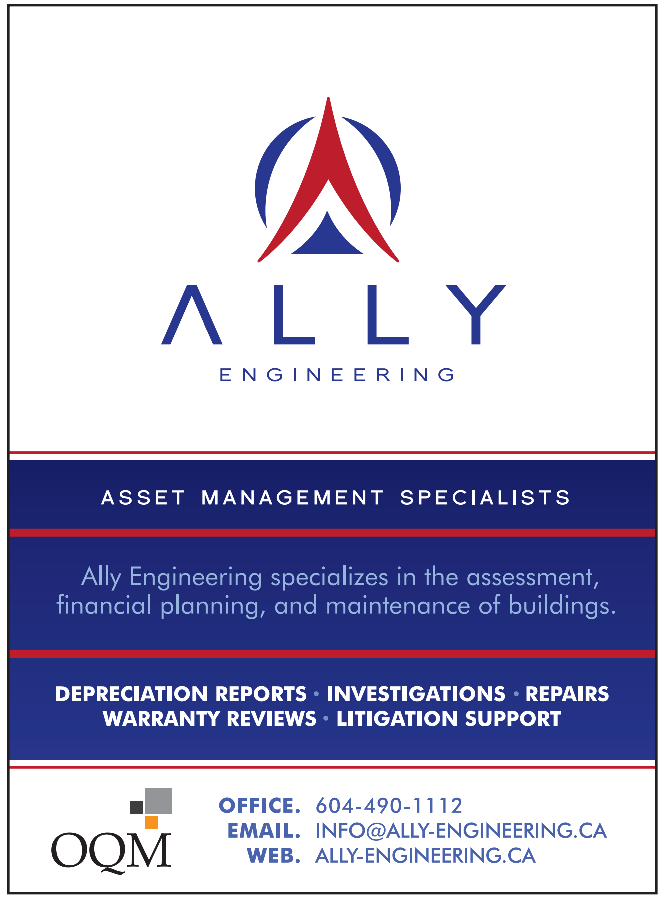
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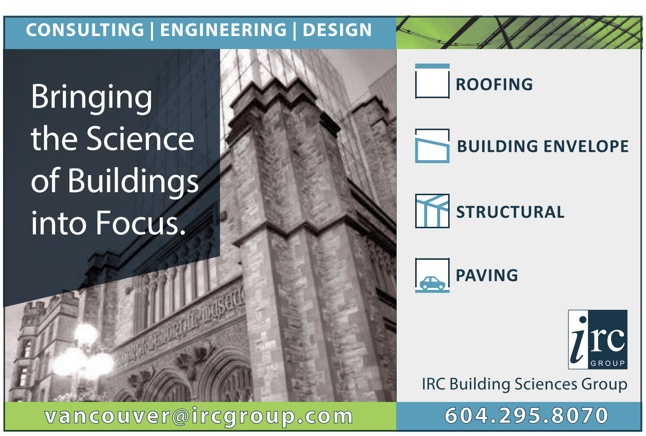
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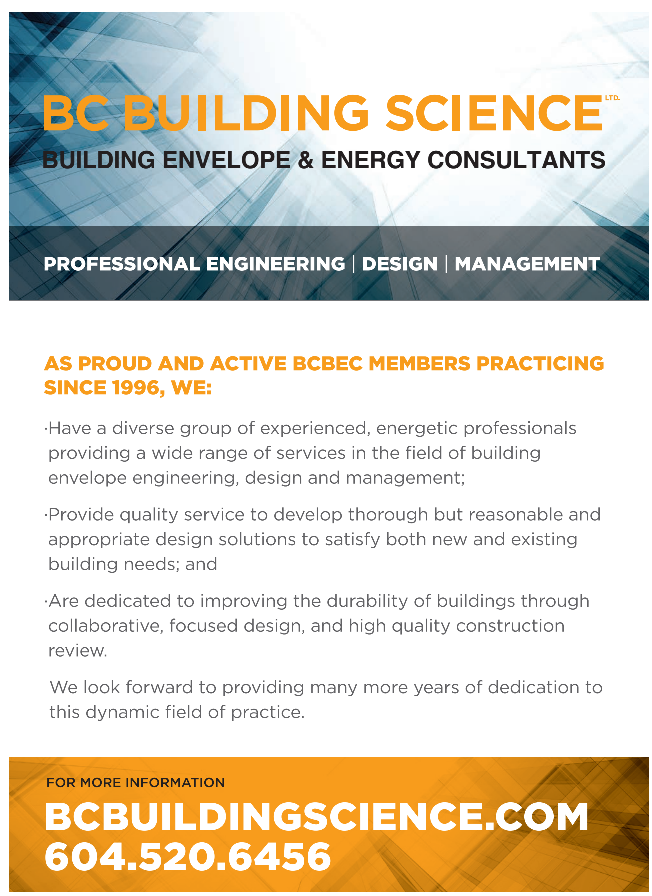
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