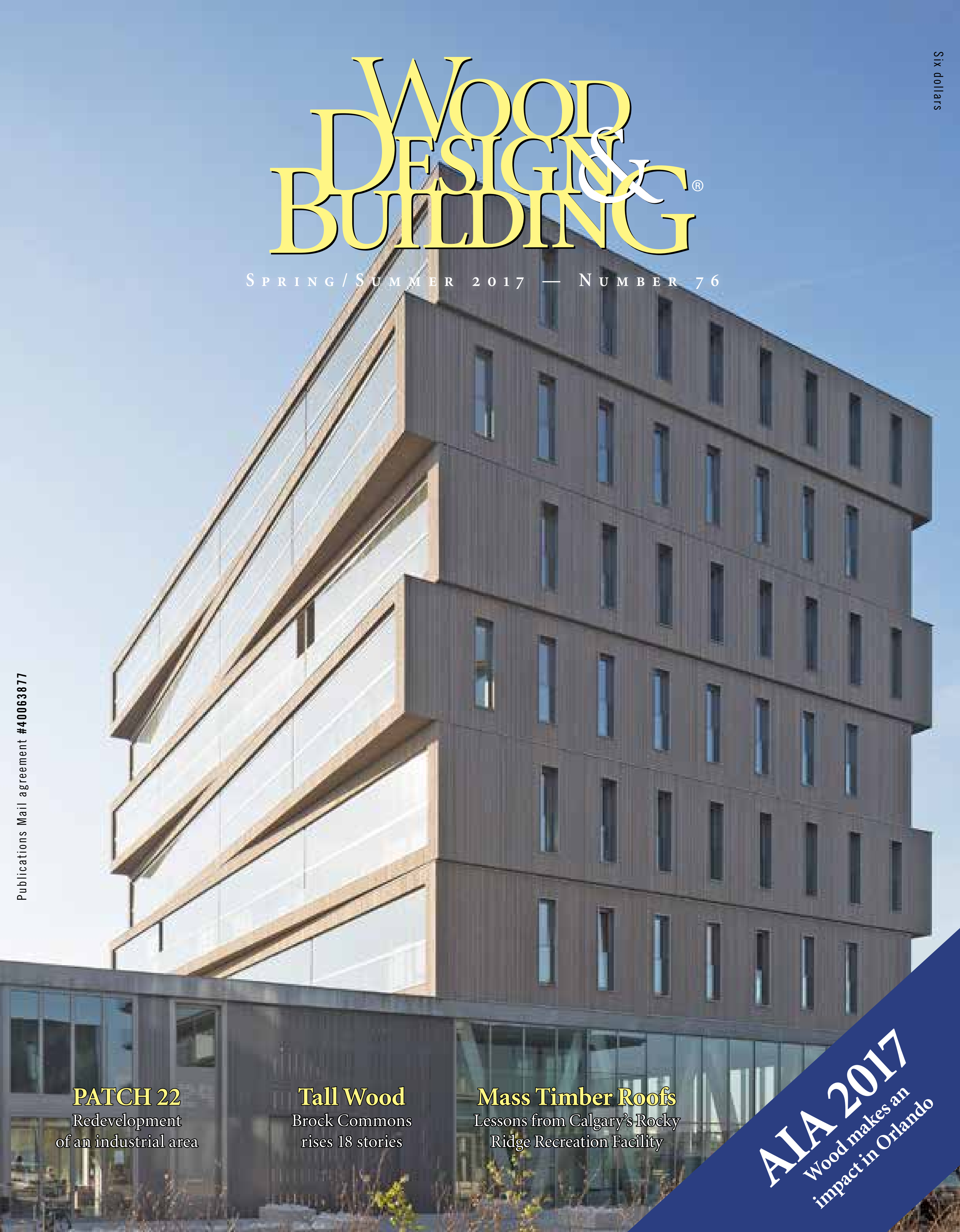
Wood Design & Building®

Spring/Summer 2017 — Number 76



PATCH 22
Redevelopment of an industrial area

Tall Wood
Brock Commons rises 18 stories

Mass Timber Roofs
Lessons from Calgary's Rocky Ridge Recreation Facility

AIA 2017
Wood makes an impact in Orlando

Six dollars

Publications Mail agreement #40063877

CANADA'S REPUTATION TAKES TOP SPOT

Looking up: Tall Wood Buildings Around the World

Holz8	Cenni di Cambiamento	Forté	Brock Commons	Treet Building	Bridport House
GERMANY	ITALY	AUSTRALIA	CANADA	NORWAY	ENGLAND

Tall wood building supplied by Structurlam.

Structurlam is a leader when it comes to redefining what is possible in tall wood structures. We strive to provide the most advanced and efficient mass timber solutions and are proud to be the preferred supplier for the 18 stories Brock Commons building. Canada is tall wood.

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contents

Above and **on the cover:** PATCH22, AMSTERDAM, THE NETHERLANDS
PHOTO CREDIT: Luuk Kramer Photography & Film

PHOTO CREDIT: KK Law, Courtesy of naturallywood.com

Transparency

This issue, I am truly inspired by the projects on these pages. They artfully play with the notion of transparency, a central theme in two new books sent to me for review (see opposite).

The idea of using minimal materials to maximum effect is simple strategy that is incredibly well suited to wood.

Each of the projects featured in this issue utilizes the strengths of wood to their full potential. Wood's renewability, versatility, and nearly unlimited design possibilities are advantages, naturally inherent to the material itself, that are enhanced by innovative manufacturing and engineering. The design intent of each building is honest and transparent.

CLT panels and other engineered wood products are being used in interesting ways to provide both form and function. For Christian Huot, Director of Branding Initiatives at ReThink Wood, "this means not just using it as a structural component" but also showcasing the material aesthetics within the structural application. Turn to p. 33 to read more about wood's impact at this year's show.

In Amsterdam's PATCH22, the wood has largely been left exposed, making this a key contributor to the ambience of the apartments and the exterior.

Similarly, the Rocky Mountain Institute Innovation Center's beautifully exposed wood structure eliminates the need for finishing materials. The building takes design inspiration from its surroundings and maintains unobstructed views, building layers of meaning around the idea of transparency.

At Brock Commons, a brand new 18-story hybrid wood structure on the UBC campus, another facet of transparency is explored. Brock Commons was selected for construction through the competitive process of the Tall Wood Building Demonstration Initiative. The initiative's overall objective is to link scientific advancements with technical expertise to showcase the application, practicality, and environmental benefits of structural building solutions that are innovative and wood-based. To achieve this outcome, a monitoring system will be installed to collect data on the performance of the engineered wood products and hybrid structural systems in this high-rise building. The data, and the research that will be conducted with it, are expected to contribute to performance and building safety standards for future tall wood buildings.

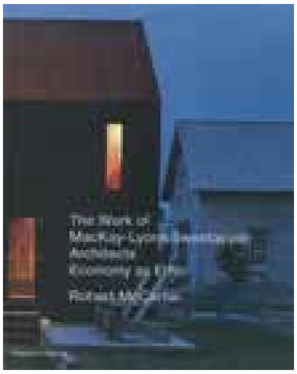
I'd love to hear your thoughts on transparency and welcome your emails. Better yet, drop by our booth, #1483, at this year's AIA show in Orlando. I look forward to meeting you!

Theresa Rogers
Executive Editor
trogers@dvtail.com

Wood Design & Building magazine invites you to submit your project for consideration and possible publication. We welcome contributed projects, bylined articles and letters to the editor, as well as comments or suggestions for improving our magazine. Please send your submissions to Theresa Rogers at trogers@dvtail.com.

inspiration BOARD

WHAT I'VE FALLEN FOR THIS MONTH...



THE WORK OF MACKAY-LYONS SWEETAPPLE ARCHITECTS

Economy as Ethic
ROBERT MCCARTER
Hardcover, 416 pages
Thames & Hudson, $70

The work of MacKay-Lyons Sweetapple Architects – winners of more than 100 awards – is characterized by an ethically driven desire to use minimal materials to maximum effect, and by its deep engagement with the landscape and climate of maritime Nova Scotia.

"The work of MacKay-Lyons Sweetapple Architects is predicated on the belief that what really matters in architecture is not fashion and form, but the material culture of building and making places," writes author Robert McCarter. "Understood this way, architecture has everything to do with how its spaces are ordered to house the activities that take place within and between them; with how a building engages with its context and the history of human occupation that has taken place there; with how a building is constructed, how it is structured, and of what materials it is made; and with how all these characteristics affect the experience of those who inhabit it."

TRANSPARENT ARCHITECTURE

GORDON GILBERT
Softcover, 110 pages
ORO Editions, $19.95

Transparent Architecture points to an architecture that seemingly suggests a multiplicity of qualities. Paradoxically, it also illustrates an architecture that reveals itself and its own singular nature clearly. The structures themselves display their own material and organizational logic, yet are also able to function as containers for thought, moods, and memories, allowing an inhabitant to move through and interact in a changing world. This is an architecture of natural processes in the revealed landscape.

The experimental drawings, texts and built projects are visual and spatial explorations aiming toward architecture that provokes thought, refines one's ability to see, and embraces the confluence of things.

the BIG 95 tABBIES 2015 Award Winner

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PUBLISHER ETIENNE LALONDE
elalonde@cwc.ca

PUBLISHING MANAGER SARAH HICKS
shicks@wood-works.ca

COMMUNICATION MANAGER NATALIE TARINI
ntarini@cwc.ca

SPECIAL PROJECTS MANAGER IOANA LAZEA
ilazea@cwc.ca

EXECUTIVE EDITOR THERESA ROGERS
trogers@dvtail.com

STAFF WRITERS HERMIONE WILSON
hwilson@dvtail.com

KELLY TOWNSEND
ktownsend@dvtail.com

CONTRIBUTORS FORESTRY INNOVATION INVESTMENT
NICHOLAS SILLS

ART DIRECTOR SHARON MACINTOSH
smacintosh@dvtail.com

ADVERTISING SALES

SALES MANAGER BETH KUKKONEN
bkukkonen@dvtail.com
905-886-6641 ext. 306

SENIOR ACCOUNT EXECUTIVE GILLIAN THOMAS
gthomas@dvtail.com
905-886-6641 ext. 308

V.P. PRODUCTION SERVICES ROBERTA DICK
robertad@dvtail.com

PRODUCTION MANAGER CRYSTAL HIMES
chimes@dvtail.com

DOVETAIL COMMUNICATIONS PRESIDENT SUSAN A. BROWNE
sbrowne@dvtail.com

CIRCULATION

PUBLICATION PARTNERS wdesign@publicationpartners.com

SUBSCRIPTIONS

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905-886-6640 Toll-free 1-888-232-2881 www.dvtail.com
For:
CANADIAN WOOD COUNCIL
99 Bank St., Suite 400, Ottawa, ON Canada K1P 6B9
1-800-463-5091 www.cwc.ca
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Spas

Kelly Townsend

Spas are peaceful, thoughtfully crafted refuges where guests unwind from the stresses of everyday life. Every aspect of the spa experience is designed to instill feelings of serenity and tranquility. Many spas use wood in their architecture because an affinity for this warm, natural material fosters relaxation while promoting environmentally friendly practices.

Gilpin Spa, located in Windermere, UK, was designed to blend in with its woodland setting, according to Principal Architect Ben Cunliffe. Its prefabricated, lightweight timber frame resulted in minimal waste in the construction process. The marriage of serene atmosphere and environmentally conscious design achieved the architect's vision for an old-world aesthetic for the spa.

"Many spas are very hard surfaced with endless walls of tiles, anthracite or granite. We wanted a softer, more comfortable relaxed Nordic feel to contrast with the modern cubic exterior and the wood is endemic to this aesthetic," says Cunliffe.

The therapeutic atmosphere at **Hepburn Bathhouse and Spa** in Hepburn Springs, Australia, is the result of the thoughtful reuse of existing heritage structures artfully combined with modern extensions. **Spa Balnea**'s wooden siding gives the building a natural profile and helps it blend into the surrounding forest setting. The **Jordanbad Biberach Sauna Village** was carefully designed with spa guests in mind; the Robinia wood slats that make up the structure of the saunas were strategically placed in vertical and horizontal patterns, with consideration of lighting and space, and with each structure offering a unique view of the serene greenery outside. The pine wood panels of **Löyly** act as venetian blinds for guests, allowing privacy from the outside, while still providing an uninhibited view of the Baltic Sea.

When it comes to spas, the benefits of wood building materials go far beyond their practicality. They are an integral part of creating the luxuriating space guests look for when they need a moment of relaxation.


1


2


3


4


5

1. Gilpin Spa (2013)
Architect: Ben Cunliffe Architects
Location: Windermere, United Kingdom
PHOTO CREDIT: Rachel Cunliffe

2. Hepburn Bathhouse & Spa (2007)
Architect: Cox Architecture
Location: Hepburn Springs, Victoria, Australia
PHOTO CREDIT: Derek Swalwell

3. Spa Balnea (2014)
Architect: Blouin Tardif Architecture Environnement
Location: Bromont, Quebec, Canada
PHOTO CREDIT: Steve Montpetit

4. Jordanbad Biberach Sauna Village (2015)
Architect: Jeschke Architektur & Planung
Location: Biberach, Germany
PHOTO CREDIT: Sandra Wolf, Christina Jeschke

5. Löyly (2016)
Architect: Avanto Architects
Location: Helsinki, Finland
PHOTO CREDIT: kuvio.com

The National Research Council and Infrastructure Canada look to upgrade codes due to climate change.

Examining Consequences of Climate Change on Buildings and Infrastructure

Buildings and infrastructure are being more and more challenged by the impacts of climate change and an increase in extreme weather events such as damaging floods and devastating high winds. In response to this new reality, the National Research Council (NRC) and Infrastructure Canada are upgrading codes, specifications, guidelines, and assessment tools to keep people safe. Over the next five years, the NRC will conduct research, evaluations, as well as risk analyses to develop new solutions to factor climate resilience into the design of future buildings and infrastructure.

"With climate change, the total annual precipitation is increasing, as well as the frequency and severity of extreme events, such as heat waves, high winds, floods, and droughts, all of which is resulting in increased stress on built structures," says Richard Tremblay, General Manager of Construction at the National Research Council of Canada. "In 2017, it is a necessity to start planning to adapt our buildings and infrastructure to withstand the new loads."

The federal government is investing $40 million into these efforts. The NRC will make full use of its leading experts as work gets underway in its world-class research facilities in Ottawa. Several government departments and industry leaders will be involved.

"I see this initiative on climate change adaptation as having the potential to have a profound impact on the Canadian construction industry and on the future of buildings in Canada," says Doug Crawford, Chair of the Canadian Commission on Building and Fire Codes.

The new measures are expected to reduce the costs of rehabilitation and replacement of buildings and infrastructures affected by extreme weather events. New specifications and guidelines will be ready and released as soon as 2020. **www.nrc-cnrc.gc.ca/eng**

U.S. Senate and House Introduce Timber Innovation Act

In March, the U.S. Senate and House introduced the "Timber Innovation Act" to the support of the American Wood Council (AWC), American Forest Foundation (AFF), Binational Softwood Lumber Council (BSLC), National Alliance of Forest Owners (NAFO) and Southeastern Lumber Manufacturers Association (SLMA). The legislation recognizes the potential environmental and economic benefits of increasing wood use in tall building applications. The bills would:

- Establish a performance-driven research and development program for advancing tall wood building construction in the United States;
- Authorize the Tall Wood Building Prize Competition through the U.S. Department of Agriculture (USDA) annually for the next five years;
- Create federal grants to support state, local, university and private sector education, outreach, research and development, including education and assistance for architects and builders, that will accelerate the use of wood in tall buildings;
- Authorize technical assistance from USDA to implement a program of education and technical assistance for mass timber applications; and
- Incentivize the retrofitting of existing facilities located in areas with high unemployment rates to spur job creation.

"The United States has an opportunity to bring new, sustainable mass timber technology to our construction industry, and the Timber Innovation Act directs technical assistance and research components already in place," says AWC President and CEO Robert Glowinski. **www.awc.org**

Maryland Senate Bills Would Create Unfair Advantage

In March, American Wood Council (AWC) Northeast Regional Manager Matt Hunter, BCO, along with numerous representatives including building owners, architects, developers and engineers, all testified in opposition of Maryland House Bill 1311. The bill would prohibit a multifamily dwelling from being constructed using wood-frame construction in jurisdictions exceeding a specified population density. The legislation is a companion to Senate Bill 722. AWC Vice President of Codes and Regulations, Kenneth Bland, says, "These bills would circumvent the extensive effort architects, engineers, and building code officials put into the process to regularly update the national model building codes. The construction requirements of the model codes are developed by the International Code Council and approved by building and fire officials from all over the country in a consensus process... S.B. 722 and H.B. 1311 are not promoting proven safety measures; they are promoting the interests of specific building materials." **www.awc.org**

Supply Management vs. Softwood Lumber

With the United States on the verge of reopening NAFTA, Canada should seize the opportunity to open its agricultural markets, and in return ask for full access to American markets for its softwood lumber, argues an Economic Note entitled, "Trading Supply Management for Softwood Lumber?" published recently by the Montreal Economic Institute.

"With trade between Canada and the United States having stagnated since the early 2000s, eliminating supply management and softwood lumber tariffs would be a good way of breathing new life into the economic partnership," points out Alexandre Moreau, Public Policy Analyst at the MEI and author of the publication.

Canada is the second-largest trading partner of the United States, with trade totalling nearly $882 billion a year, or almost $2.5 billion a day. To preserve and even expand economic relations between the two countries, it is imperative that politicians on both sides of the border resist the influence of lobby groups and come to the defence of the millions of consumers who pay the price for protectionism, concludes Michel Kelly-Gagnon, President and CEO of the MEI. **www.iedm.org/e**

City of Saint John Adopts Code Changes Enabling Wood Mid-Rise Construction

The City of Saint John, NB, recently adopted the 2015 National Building Code provisions to allow wood mid-rise (five- and six-story) construction. Joining the list of other jurisdictions such as Quebec, Ontario, Alberta and British Columbia, Saint John is the first Atlantic Canadian city to make the decision to provide builders with a new construction choice for taller mid-rise buildings that should also increase affordability.

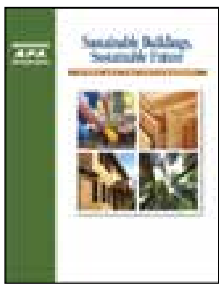
"Mid-rise code changes are the result of a lengthy, carefully considered code process that included participation from expert stakeholders and consultants," says Michael Giroux, President of the Canadian Wood Council (CWC).

The National Building Code requires all buildings to achieve the same level of structural performance and safety, regardless of the materials used in construction. "It's encouraging to see that wood-use in mid-rise adoption is being replicated throughout jurisdictions in Canada who are recognizing its sustainable, economic, and safety benefits," says Etienne Lalonde, VP Market Development for the CWC and Wood *WORKS!* National Director. "To date, 80 wood mid-rise projects have been completed, and another 75 are under construction in Canada – a testament to the success of this construction option being recognized by the individuals who specify building materials for projects." **www.woodfacts.cwc.ca**

The Wood Innovation and Design Centre was designed by Michael Green, MGA, a speaker at Wood *WORKS!* Ontario's Tall Wood Symposium.

Tall Wood Symposium

A Tall Wood Symposium was held recently in Woodbridge, ON. Speakers included architect Michael Green, a world leader in tall wood design. Another speaker, Karla Fraser, was the Senior Project Manager for the construction of UBC's Brock Commons project, the tallest wood building in the world. Fraser gave a comprehensive overview of the construction of the 18-story residence built with CLT. In addition, Ron McDougall, Mass Timber Specialist with Structurlam, presented, "The Evolution of Building Systems" with an emphasis on the lessons learned from six years of supplying fabricated mass timber components. The high-profile event was dedicated exclusively to tall wood construction, allowing Ontario's design and construction professionals to learn about building taller wood buildings. **http://wood-works.ca/ontario**



APA releases New Publication

APA, The Engineered Wood Association's publication Sustainable Buildings, Sustainable Future, presents the environmental benefits of wood products and an in-depth view of how sustained demand for wood products fosters a cycle of grown in North American forests. Additionally, it includes a detailed case study examining how timber volume has increased during the last 50 years thanks to forest management and replanting efforts. The guide also compares energy consumption in the manufacture of wood, steel and concrete products, and provides a comparison of the net carbon impact. **www.apawood.org**

Courtyard House on a River

Compact footprint minimizes site disturbance and emphasizes design over size

Greenwater, WA

This two-bedroom residence is located in a wooded area, just outside Seattle, in the shadow of Mt. Rainier. Clad in a custom-run Western red cedar rainscreen siding system, the 1,900-sq.ft. home on the banks of the White River quietly blends into the surrounding forest. An entry courtyard creates a smooth transition from the outdoors while forming a gentle periphery to keep the ubiquitous elk herds at bay.

Designed to provide a zen-like retreat from the bustle of the city, the open living area uses large glass walls to create a sense of space and light even on the Northwest's darkest, rainy days. The exposed architectural-grade glulam beams unify the various rooms under a single roof system, while drawing the eye up through the roof monitor to the trees beyond. Black-stained Douglas fir No. 1 columns help support of the roof system and

define a circulation zone between the entry courtyard and living/dining spaces. The wood wall studs are of hemlock fir and the exposed wood columns are 6 x 6 Douglas fir. The clear cedar exterior siding is installed in both horizontal and vertical configurations.

A steel-clad fireplace is the central architectural feature, complementing the natural wood interiors while separating the living room from the covered outdoor patio.

By working diligently with the client, who was also the home's general contractor, the building footprint was kept as compact as possible, minimizing site disturbance out of respect for the lush evergreen landscape. The residence places emphasis on design over size while offering an open feel in every room.

ARCHITECT
Robert Hutchison Architecture
Seattle, WA

STRUCTURAL ENGINEER
Swenson Say Faget
Seattle, WA

GENERAL CONTRACTOR
Withheld – Same as Client
Greenwater, WA

PHOTOGRAPHY
Mark Woods
Seattle, WA

Lakeside Market

Commercial development offers flexibility with wood-framed buildings

Victoria, BC

Located in a small suburb of Victoria, BC, this commercial project is one part of a comprehensive master plan that includes two, three-story wood-framed apartment buildings. The 16,500-sq.ft. Lakeside Market is composed of four, two-story commercial buildings. Their locations were restricted by several large underground utilities corridors. The complex steps down a hill bounded by a park in the east and a busy arterial road in the west.

The buildings are separated by a terraced and richly landscaped courtyard. This publicly accessible space connects the surrounding sidewalks with the nearby Galloping Goose Trail and the network of pedestrian pathways in the park. The courtyard was a response to a 40-ft. right-of-way for a water main that cuts through the site. The courtyard landscaping and a constructed wetland across the street from the building at the bottom of the hill form part of the project's stormwater management strategy.

The forms, materials, colors, and textures of the architecture are a reflection of an adjacent Garry oak meadow and the natural surroundings of nearby Thetis Lake Regional Park. The material palette is deliberately restrained. The soft texture and warmth of the wood siding and soffits contrast with the hard surfaces of the unit pavers and metal roofing. The siding continues the tradition of cedar in this semi-rural context.

The exterior of the buildings is a ventilated, insulated, rainscreen assembly clad in vertically oriented tongue and groove siding made of Western red cedar. The siding was milled for a tight-joint detail with square edges; its combed surface creates a smooth, refined facade. Both the siding and soffits are lightly pigmented and clear-coated to allow the natural texture and color variations of the wood to show through and harmonize with the dark brown window frames. The engineered wood joists of the insulated roof are clad with pre-finished steel.

Generous overhangs and an arcade along the courtyard side of the lower buildings protect the wood cladding. This, along with a miniature bronze louver system and fabric canopies over the west windows, help meet code-mandated energy efficiency standards. Structurally, load bearing dimensional wood columns, glulam beams, TJI joists and 2 x 6 platform framing, were used. To address exposure issues in the stairway between buildings, smooth-formed and board-formed poured-in-place concrete was used. From an urban design perspective, the structures were located close to the road to help scale and humanize them. The lower floor is at sidewalk level and provides commercial shops within walking distance of the surrounding neighborhood and regional park

CLIENT
XW Sunrise Developments Ltd.
Victoria, BC

ARCHITECT
D'Ambrosio architecture + urbanism (DAU)
Victoria, BC

STRUCTURAL ENGINEER
Hoel Engineering
Victoria, BC

GENERAL CONTRACTOR
Eagleye Restoration & Construction
Victoria, BC

PHOTOGRAPHY
Silent Sama Architectural Photography
Burnaby, BC

1. residential building A
2. residential building B
3. courtyard
4. commercial building
5. courtyard

SITE PLAN

Rocky Mountain Institute Innovation Center

CLT, glulam and SIPS help achieve project's high performance goals

Basalt, CO

Rocky Mountain Institute's new Innovation Center is a physical manifestation of the organization's mission and values; it optimizes resources for a high level of energy efficiency in a structure that complements the local community and serves as a demonstration site for the industry. The net-zero energy office and convening building provides space for RMI research and conferences. The building accommodates 40 workspaces, conference areas for up to 80 people, a reception/demonstration atrium, library, kitchen and dining areas.

Located on the edge of the Roaring Fork River in Basalt, CO, the 15,610-sq.ft. building has unobstructed views, ample daylight and a natural material palette that reflects the surrounding landscape. The site gently slopes down into the Roaring Fork Valley with mountains rising in the distance. The building overlooks the river to the south, a watershed conservation area to the west, and Basalt Mountain to the north. Defined by its Aspen groves, pine forests, mountain meadows, deep valleys, stunning red cliffs and free-flowing river, the 38,000-sq.ft. site is an ideal location for this building that takes its design inspiration from its surroundings.

As if growing from its location, the building's exterior palette features the durable materials of the area. Rough-hewn Colorado red and buff sandstone walls rise from the earth, zinc shingles and metal panels reflect the snow-capped mountains, and western juniper wood rainscreens contribute to the Rocky Mountain palette. The selection of these regional materials reduces carbon and environmental impacts and enables the building to nestle within the landscape and blend into its native environment.

The goal was to create the highest-performing building possible, while also creating a replicable process. Designed to be a 100-year building, the design team incorporated a variety of tools and materials that helped the building become a LEED Platinum and Passive House certified structure targeting Living Building Challenge "petals" including net-zero energy.

The building's structural system uses a combination of prefabricated CLT, glulam, and structural insulated panels (SIPs) with oriented strand board (OSB) facing to help achieve the project's high performance goals. These systems were energy-efficient and easy for trades to work with, allowing the structure and envelope to be constructed quickly which, in this cold climate, was necessary because of the short construction window.

The use of flat CLT panels in the building's floor structure allows for future flexibility and maximum daylight penetration resulting in generous light-filled spaces. The overlapping CLT panel floor system created mechanical chases with room for the addition of future systems. This low-profile structural system also afforded ceiling heights of 10 feet 6 inches while maintaining a 12-ft. floor to floor height, thereby increasing daylight penetration without increasing the building height, which was limited by code. The CLT panels, sourced from Penticton, BC, utilize beetle kill timber for inner layers as a way to make productive use out of forests decimated by the mountain pine beetle.

The use of wood is key to the Innovation Center's goal to achieve a high-performance workplace that promotes the best in human performance. The exposed CLT and glulam structure responds to the biophilic design goals of the project by showcasing natural materials that reinforce occupants' connection to nature – a strategy that has been proven to reduce stress and increase productivity. The exposed structure is complemented by wood slat ceilings and white birch casework, creating a balanced neutral palette selected to maximize light reflection and minimize eye strain. The exposed wood structure also eliminates the need for finishing materials.

Engineered, 12-in. thick SIPs with OSB facing and wood splines provide a super-insulated, low-infiltration envelope with minimal thermal bridging, a key strategy in creating this passive building that has no mechanical cooling and minimal distributed heating used only on cold days in the extreme mountain climate.

On the exterior, western juniper – a native "waste" wood considered invasive in some areas – spans the transition of exterior facade elements and denotes building entries. The product's extreme durability is a benefit in the harsh climate. Left untreated, the juniper will weather to a silver patina, making the building seem as if it grew from its site. The natural rot resistance of the juniper eliminates the need for chemical treatments or coatings and reduces the long-term maintenance of the exterior wood

CLIENT
Rocky Mountain Institute
Snowmass, CO

ARCHITECT
ZGF Architects
Portland, OR

STRUCTURAL ENGINEER
KPFF Consulting Engineers
Portland, OR

GENERAL CONTRACTOR
JE Dunn Construction
Denver, CO

TIMBER SUPPLIER
Structurlam
Penticton, BC

PHOTOGRAPHY
Tim Griffith Photography
San Francisco, CA

PATCH22

Super-flexible wood high-rise brings redevelopment to an industrial area

Amsterdam, The Netherlands

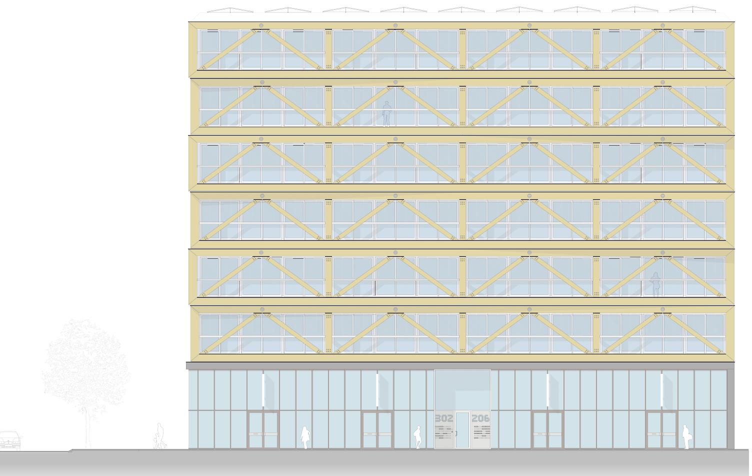
PATCH22, a 98-ft. tall wood high-rise, is the result of a collaboration between an architect and a building manager who decided to achieve together what they had not yet had an opportunity to achieve when working for previous clients: a striking, outsized wooden building with a great degree of flexibility and a high level of sustainability.

The project was developed during a period of financial crisis from 2009-2014, so innovative financing solutions were conceived and implemented to meet this challenge. The project incorporates numerous technological innovations including hollow floors and a removable top floor. A lack of service shafts in the apartments was achieved by having the piping and cabling taken horizontally to central shafts in the core but the standout feature is the use of a wood as the main structure. The wood has largely been left exposed, making this a key contributor to the ambience of the apartments and the exterior.

PATCH22 employs wood as the principal material for both the structure and facade. The structural wood on the outside of the building is redwood while the facade is Douglas fir. On the interior, the architects used glulam for the columns and beams and CLT for load-bearing walls. The fire resistance requirement of 120 minutes for the main load-bearing structure was satisfied by adding three inches of additional wood to the structure on the fire-load sides. This allowed the wood to remain exposed.

The architects aimed to create a structure that would enable buyers to build their own spaces. The firm didn't want to create an anonymous structure because the renewal of the post-industrial area where PATCH22 is located needed an innovative, landmark building to show the city of Amsterdam that transformation had begun. It turned out that the expressive exterior and the completely open layout of the interior were the perfect combination to attract buyers to this part of the city, even during the credit crunch of 2009-2014.

The high-rise section of the 58,125-sq.ft. building can be converted from commercial space into residential space and vice versa without any changes to the structure. Each of the levels, which shift in and out in a playful manner, can be configured into large loft apartments of up to 5,812-sq.ft. with huge balconies, or divided up into as many as eight smaller apartments. The floors can also accommodate open plan office space that covers the entire floor thanks to the lack of structural dividing walls, and a generous story height of 13 ft. Apartments can be subdivided or merged, and the division into apartments is flexible and able to be changed in the future. The apartments themselves offer complete layout flexibility because the occupants are able to install the pipework and wiring to suit their own needs.



SOUTH FACADE

Sustainability was achieved through energy efficiency, the use of renewable materials and great flexibility in the floor plan layout options that makes the building infinitely adaptable to future uses. The roof is entirely covered with PV panels, making the building energy-neutral. Rainwater is collected and reused in a greywater system. Heat is generated using carbon dioxide-neutral pellet stoves that use compressed waste wood from the timber industry as fuel.

With a light wooden building, wind forces on the facades were the biggest structural challenge. The architects embraced this idea and shaped the building as if the wind had already done its work and shaken all the floors. A post-sales survey revealed that the iconic look of the exterior in combination with the neutral interiors were very appealing to customers and the main reason they risked a move to the undeveloped industrial area on the north side of Amsterdam in the middle of a financial crisis.

CLIENT
Lemniskade BV
Amsterdam, The Netherlands

ARCHITECT
Frantzen et al architecten
Amsterdam, The Netherlands

STRUCTURAL ENGINEER
Pieters Bouwtechniek
Amsterdam, The Netherlands

GENERAL CONTRACTOR
Hillen & Roosen
Amsterdam, The Netherlands

PHOTOGRAPHY
Luuk Kramer Photography & Film
Amsterdam, The Netherlands

AIA 2017

WOOD TAKES ON AIA 2017

Hermione Wilson

This year's AIA Conference on Architecture features more than 17 exhibitors gathered together in the "Wood Pavilion" and multiple sessions on wood-related topics. It's a sign of the times. The wood construction industry has a strong presence at the trade show and in the world of architecture right now as the rise of mass timber products and new innovations pushes the boundaries of what is possible in wood construction. We spoke to some of the people who are representing wood at the show about where they see the industry going.

Christian Huot, Director, Branding Initiatives, reThink Wood

What is reThink Wood doing at AIA 2017?
We are one of a bunch of different exhibitors in the wood pavilion. Our booth is probably one of the largest in that wood pavilion, representing softwood lumber and wood use in construction. We partner with other organizations to present at the AIA tradeshow, namely WoodWorks and the American Wood Council, as well as a few other organizations like the Western Red Cedar Lumber Association, Northeastern Lumber Manufacturers Association, the Western Wood Products Association, and Southern Pine Council, to provide this showcase of wood at AIA.

What are your goals at this year's show?
Our goal is to raise awareness of using wood in a built environment, focusing mainly on non-residential buildings, but including multi-family residences. We're really looking to communicate to architects, engineers,

AIA 2017

and developers – folks who are attending AIA – just what is going on with wood these days. There are a lot of innovative products and systems that are available to create beautiful projects, but people aren't necessarily aware of mass timber products, the different code allowances, or different ways to design buildings with wood.

How have you seen the presence of the wood construction industry change and evolve at AIA over the years?
I see more of a coming together. There's not a glass pavilion, to my knowledge, there's not a steel pavilion, so we're a little unique in that way. We're a family in a sense. The people who are there represent different associations or different products or different uses of wood ranging from hardwood floor products, to sheathing, to wood furniture. Really what's happened over the last couple of years is a coming together, a realization that promoting the use of wood is of benefit to more than just the single producer or the single manufacturer. It's really an opportunity to let more people know the possibilities of building with wood – renewability, versatility, innovation – those types of things.

Are there any interesting trends you are seeing in architecture at the moment?
For me, the diversity of architects and what they come up with, in terms of the designs for buildings in their regions and their cities, continues to amaze me. We see a more mature use of mass timber products, going beyond glulam beams and trying to push the boundaries to see where other mass timber products can be a design element in the building. Things like CLT panels or NLT panels are being used in interesting ways to provide some form and function, while also benefitting from the product itself. This means not just using it as a structural component but refers to the use of wood aesthetically within that structural component.

The theme of this year's AIA show is "Anticipating Need, Challenge and Change." How would you apply that to wood construction in 2017?
The Architecture 2030 Challenge is all about transforming... We're proceeding toward this moment in our world where the built environment needs to respond to the challenges of our impact on the world, be that climate, or space and density, affordability, urban spread, etc. The built environment is responsible for creating these living spaces and work spaces that are sustainable yet innovative enough that we are learning and creating better cities and better places to live for the next generation. Really, it comes down to making decisions based on what's best for the sustainability of us, and I think that's a really big challenge where wood can play a role. I think we see that in the innovation of wood products like mass timber where now we can start to build taller, we can have longer spans, so we're no longer limited to smaller buildings, no longer limited to dimensional lumber. Mass timber can now play a role in safe construction of buildings and offices and dwellings.

Scott Breneman, Senior Technical Director, WoodWorks

Presenting "Evolution of Mid-Rise: Wood Raises More Opportunity for Increased Value" at AIA 2017

Tell me about the presentation you are giving at AIA 2017.
It is primarily about mid-rise construction and related trends.

One trend is the increase in mid-rise wood construction in parts of the country where it isn't yet entrenched. In certain regions, five-story wood construction has been common for a long time; in others, it's relatively new. As these areas trend away from single-family housing, developers and designers are looking for opportunities to economically build denser multi-family projects – that of course meet all the requirements for safety and performance. The result is that there are jurisdictions and designers becoming familiar with four-story and five-story wood construction that don't necessarily understand how to achieve these buildings under current building codes or what those systems look like. Through presentations like the one I'm giving, WoodWorks provides a necessary education component – i.e., teaching people how to present those projects in the context of building codes and design them effectively.

The second theme is the evolution of building codes over time. For example, there was a significant change recently that relates to podium construction – which is an economical way to increase the density of mid-rise projects. Under the 2012 IBC, you can have five stories of residential wood-frame construction over a one-story podium. In the 2015 IBC, you can have the same five stories of residential wood over a two-story podium. This change offers a pretty significant increase in density at relatively low cost.

This is the kind of information we're giving architects and engineers, to make sure they understand the changes and can leverage the flexibility and options available in the building code.

What are some of the new trends you're seeing in wood construction?

Another trend is the growing use of wood for what I call open or exposed timber offices. There's been a lot of revitalization and reuse of old wooden warehouses in downtown districts, and a lot of these repurposed buildings were turned into offices. People like them, and they like working in them, and now we're seeing a proliferation of new timber offices. Wood office buildings are allowed to be up to six stories under the IBC; that's not something new in the building codes, but people are rediscovering that building type. The trend toward timber offices is closely aligned with the growing interest in mass timber. Newer buildings aren't always mass timber – they could be tongue and groove floor decking over glulam beams, over glulam columns, none of which is new – but there's a definite link.

This trend is seeing a lot of movement on the west coast, but also elsewhere. The six-story Bullitt Center in Seattle (completed in 2013) was a real eye-opener in that it was the newest heavy timber building in Seattle in decades, but it was also a very green building that met Living Building Challenge standards. It was a high-profile building and I think it inspired a lot of people to build exposed wood offices. But when you look at the trajectory of the trend, it started with a pathfinder, a high-end building developed and paid for by an occupant who wanted to set an example, and evolved to what we have now, a variety of completed, market rate office projects where the central design feature is exposed timber. It's exciting to hear developers talk about how they built one of these open timber offices to be competitive with traditional offices down the street, except now they're getting more rent for the space because it's so attractive.

What about tall wood?

Tall wood is exciting and inspiring – and gets a lot of attention – but it takes a while for those projects to move forward. Tall wood, to me, refers to something that's not currently allowed by the prescriptive limits of the code. There are projects, like Carbon12 in Portland, which are beyond the code limits and use a mostly timber system. Also in Portland is the Framework project, which will be 12 stories; that's under plan check now. Those are inspiring projects that show what wood can do and we hope there will be many more. The ICC (International Code Council) is working on potential changes to future versions of the code which may allow taller wood construction. From WoodWorks' perspective, we're as fascinated as everyone else by developments in tall wood, and we're keeping a close eye on the design of these buildings so we can help educate other interested designers. At the same time, we're very much focused on what can be built under the code today; the trends in mid-rise and offices, and also education, are just as fascinating.

How do architects and designers take the AIA 2017 Anticipate Challenge theme and apply it to wood construction?

I think this is an interesting and relevant challenge in the realm of timber offices because exposed timber is new to many designers and offers opportunities to be innovative and assume a leadership role in their city or region. If you're in Minneapolis, you can be known as a leader in the design of timber offices. It's this spirit of innovation that causes some designers to look at systems and technologies that are new to them, educate themselves, and come up with something truly inspiring. It's easy to do what you've always done and know very well but, if you want to stand apart from the competition, I think you have to accept the challenge of doing something exciting and different.

Tom Chung, Principal Architect, Leers Weinzapfel Associates

Presenting "UMass Design Building: Leading the Way with Mass Timber Solutions" at AIA 2017

Tell me about the presentation you are giving at AIA 2017.

It's a good general case study of our University of Massachusetts Amherst Design Building project, in terms of the design but also all the issues of approval, schedule, and budget. It's a case study of realizing this vision in an area of the country where this hasn't been done before. I'll be going through a brief introduction to what the project is, its background, and what the design idea is. Then I'll go through the structural design of the project, discussing the mass timber elements from the glulam columns, beams, and bracing, to CLT floor systems and shear walls. Essentially, everything above the foundation was wood, with CLT in all aspects of the design. I'll be talking about that in terms of how the architect and the structural engineer worked together to formulate and develop the whole system. I'll also be talking about how, as the architect, I navigated the process of code approvals, cost estimating, budget, schedule, getting the clients on board, getting the code officials on board, and the variance process we had to go through. In the last third of the presentation I will be focusing on the main space, discussing the detailing, procurement, fabrication, and construction of the whole zipper truss element.

Is the UMass Design Building the first mass timber building of its kind in the U.S.?

There are a lot of firsts with this project. It's the largest CLT academic building in the United States. More interestingly, it is probably the most advanced CLT structure in the U.S., meaning that it used CLT for all aspects of the structure, not just the load-bearing vertical structural system, but also the seismic, wind, and shear loads. All the cores are made up of CLT. It's not just CLT, but it's using it in a composite system in conjunction with concrete and then making that system work together. The zipper truss is also fairly unique... the shape of the building is unique in that most timber buildings and CLT buildings have been basically rectangular boxes that have been extruded because of their typology of either being offices or residences. This is an academic building with quite different parameters, spans, and program, so it's a building complex in geometry, irregular form, cantilevers, and a very expressive wood structure in the middle.

So for all of those reasons it's a very unique type of building. It's really the only structure that I can think of in the United States that explores the possibility and the limits of the geometry and the shape of wood in terms of what a building can look like. A lot of people say these days, "If you can design it, you can build it because the technology is there," and I think this is one of the buildings that proves that case.

Have you seen the presence of wood grow at the AIA show over the years?

I think that it's just starting to happen. I've seen it more at specific events like the Mass Timber Conference, and the various conferences that WoodWorks has put together, like the Global Buyers Mission in Vancouver that happened two years ago. It's been more specific to wood industry-led organizations. With the AIA conference, I definitely see that it's become more a part of the conversation.

What are some of the latest trends you're seeing in wood construction, besides tall wood?

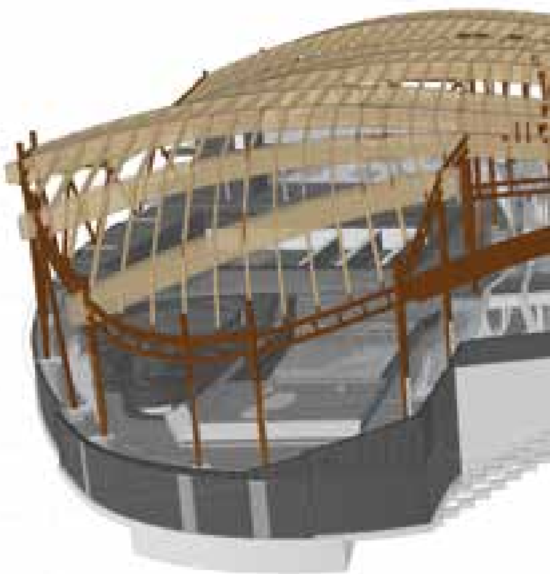
That's probably the one that has garnered the most attention because there has been a concerted effort in that area. In the U.S. we're just starting to get some semblance of momentum, so it's still very new in many places. We're doing a project right now, the first academic student residences out of CLT, in Arkansas, so it's growing. There's definitely more traction in Portland than anywhere else in the country right now because of a fabricator, D.R. Johnson, that's producing CLT. There also seems to be this discussion around using CLT or NLT (nail laminated timber). That's another topic of conversation I hear all the time. We also see potential in academia in terms of sustainability, the care and concern for that, and the research aspect of wood and its technologies being really conducive to creating a market for mass timber.

Rocky Ridge Recreation Facility, Calgary, AB. PHOTO CREDIT: dsTroyer photography/David Troyer

Mass Timber Roofs

Complex projects demand precision, attention to detail and dedicated cooperation of all project partners

Nicholas Sills

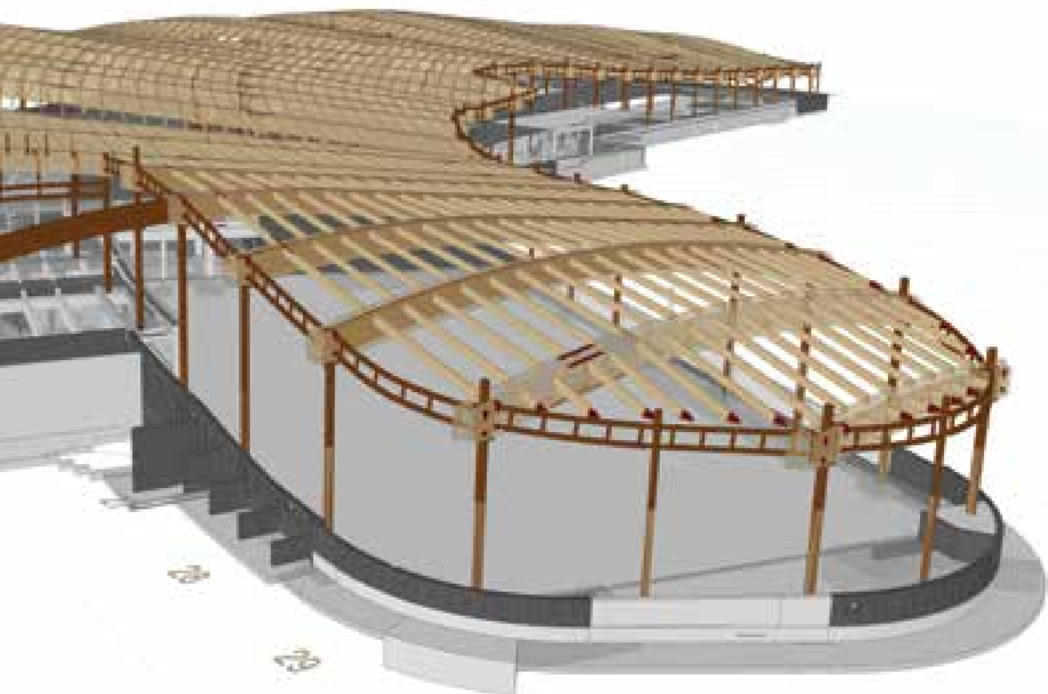


The Rocky Ridge Recreation Facility in Calgary, AB, has one of the largest free-form mass timber hybrid roofs in the world. The recreation center, with more than 284,000-sq.ft. of enclosed space, hosts a suite of recreational amenities including two ice surfaces, a field track loop, gymnastic courts, a library, and an indoor pool. The entirety of this complex is housed under an undulating, glulam double beam and purlin roof with a Q-deck surface infill. The roof structure is composed of massive double glulam arches that span the building's width. Each arch is comprised of four beams spliced together to produce an overall beam length of 295 ft. These individual beams were shipped out in lengths of up to 92 ft. with widths of 12 in. and depths up to 5 ft. The giant beams were then spliced together with precision-engineered moment splice connections. Between these giant arched glulam beams runs a series of nearly 2,000 purlins with spans of up to 46 ft. Each of these purlins fits perfectly between the primary beam gridlines, with minute free form geometry milled into the top surfaces of the purlin and end connection points. The project is an icon, as it blends into the grassy, glacial-tilled fields of the prairies.

Although this project was complex, going far beyond typical construction processes and design requirements, the timber installation portion of the project went smoothly. The success from this process demonstrates the potential of future construction services and the power of in-depth, high-level Building Information Modeling (BIM).

Complex Organic Geometry

During initial design phases, The City of Calgary developed the project scope through public engagement; subsequently, Structurlam developed the design direction, a process that included designing a freeform flowing roof to echo the glacial flows of hillsides around the project. The first concept to bring this to fruition included using a single common glulam arch radius, slightly adjusting the position of this same curve. The adjustments of this same arch radius were made in a freeform context, producing a roof that double curved in the other direction along a unique set of points. This resulted in a completely freeform set of organic roofing geometry, loosely defined by boundary conditions such as required height at certain intervals and end points. Project partners worked to bring basic sets of rhyme and reason to the freeform shape and wrangle it into a set of geometric rules that could eventually be produced with a combination of CNC machines and precision set glulam jigs. The top surfaces of these large glulam arches were five-axis swarf, milled with a complex surface to exactly match the freeform roof geometry. The infill glulam purlins were similarly milled and cut to exact precision to allow the installation of pre-engineered, drop in place connections.



RENDERING: GEC Architecture

Fully Coordinated BIM Model

A BIM model, fully coordinated between all trades, was used with Autodesk's BIM 360 Glue. Each trade was required to regularly upload their 3D model in a format compatible with the software. This information was then used for coordination and clash detection between all trades. Online markup reviews were held weekly to ensure issues were resolved in a timely manner. This BIM system is a great example of how advanced construction systems and 3D modeling procedures, when implemented into design and construction, result in high-level performance across all parties. The use of these fully integrated models allowed the coordination of the timber with other material suppliers. For the detailing team, this meant online coordination of nearly 4,000 connection points where every single element was required to match in both the steel and glulam supplier's model. Enhanced BIM modeling matches perfectly with modern mass timber construction as the integration to CNC machines is relatively seamless and this level of design detail is needed for the mass timber supplier to produce these high-quality and tight-tolerance projects.

Design with Tolerances/Practicality

Roofs larger than football stadiums don't snap together overnight. However, in this case, the precision of the mass timber package allowed for exceptional instal-

Telus Gardens, Vancouver, BC. PHOTO CREDIT: R. Stefanowicz Photography

lation speed. There were almost no site interference issues as a result. The success of this design resulted from in-depth analysis to work in appropriate tolerances on purlin to main beam connections and potential shim locations between primary beams. The use of BIM models to coordinate between trades allowed the project team to work on a universal set of specified tolerances. The steel supplier knew where their steel needed to be and the tolerances that were acceptable to fit with the mass timber system.

Coordination/ Timelines/Shipping

Production coordination initially called for just-in-time delivery of glulam components with a small buffer zone. The mass timber supplier worked diligently to ensure the schedule could be met and that the majority of glulam elements could be stored on-site prior to installation if needed. The requirement was contractually set to maintain a minimum of three beam lines and purlin bays available on-site at all times so the installation crew would not be held up waiting for materials.

QA/QC

Quality assurance and quality control are key to this workflow. With a single glulam beam having up to 529 ft^3 of wood, there was no room to make mistakes. Quality control starts with a comprehensive quality assurance plan. This means that parts and production orders are checked before, during, and after processing to ensure that total quality is achieved throughout the fabrication of all elements. CNC machines must be calibrated consistently throughout the entire project requiring continual quality assurance processes to be in place. The high level of attention to detail that must be maintained on projects of this scale is easy to underestimate. However, detailed procedures and checking processes allow complex teams to pair with modern technology and produce these outstanding results.

One-of-a-kind Facility

Structures like the Rocky Ridge Recreation facility are becoming more common in Europe, however, this project is first of its kind in terms of size and complexity in North America. Other projects that showcase impressive mass timber roofs in North America include the Kin Arena in Prince George, BC; the Banff Recreation Centre in Banff, AB; the Armstrong Arena in Armstrong, BC; and the well-recognized VanDusen Gardens and Richmond Oval in Greater Vancouver.

Conclusion

The Rocky Ridge Recreation Facility is a stunning new addition to Calgary's recreational facility offerings. The large, sweeping curves flow into the natural landscape while housing an impressive assortment of recreation facilities. The project, funded by The City of Calgary, was made possible through the collaboration and detailed project development of extraordinary team members. These unique mass timber roofs provide inspiration to the world by demonstrating what is possible with natural, strong and beautiful engineered wood products. Projects like this present mass timber as a leader in performance construction for unique projects completed on time and on budget.

Nicholas Sills is the Detailing Department Supervisor at Structurlam Products LP. He can be reached at (250) 492-8912.

DESIGN AND CONSTRUCTION OF A TALL WOOD BUILDING
BROCK COMMONS

PHOTO CREDIT: KK Law, Courtesy of naturallywood.com

The University of British Columbia, one of Canada's premier universities, is located on a forested peninsula on the west side of Vancouver. It is a community of academic, residential, commercial, and agricultural functions and facilities, with a strong focus on sustainability and the integration of research, teaching, and operations.

The student population is growing. In order to provide more housing, reduce commuting, and nurture a more sustainable and vibrant community, the university is developing campus hubs. These mixed-use high-rise hubs consist of student housing, academic facilities, and other social and service amenities for the whole community.

The university's most recent hub development features the Brock Commons Phase 1 Building, an innovative hybrid high-rise that, at 174 ft. high (18 stories), will stand as the tallest mass-timber building in the world when completed in 2017. Brock Commons will provide 404 beds for students, in studios and quad units, with public amenity spaces on the ground floor and a lounge on the top floor.

Brock Commons' hybrid structural design ensures the building's performance and safety. The foundation, ground floor, and stair/elevator cores are reinforced concrete, while the superstructure is composed of cross-laminated timber (CLT) floor panels supported on parallel strand lumber (PSL) and glue-laminated timber (GLT) columns with steel connections. The building envelope is comprised of prefabricated, steelstud frame panels with wood-fibre laminate cladding, and a traditional SBS (styrene-butadiene-styrene) roof assembly on metal decking.

The University of British Columbia is already at the forefront of the global movement to revitalize mass-timber construction and be innovative in the use of new wood products in its academic and operational buildings, but the construction of a residential high-rise is a first for the university. Brock Commons is pioneering recent advances in engineered timber products and building techniques, demonstrating that wood is a viable option for high-rise applications while creating unique research and learning opportunities related to the design, construction, operation, and inhabitation of a tall wood building in North America.

In 2013, Natural Resources Canada collaborated with the Canadian Wood Council to launch the Tall Wood Building Demonstration Initiative. It provides financial and technical support for encouraging the design and construction of tall wood buildings in Canada. The initiative's overall objective is to link scientific advances with technical expertise to showcase the application, practicality, and environmental benefits of structural building solutions that are innovative and wood-based.

Brock Commons is one of the tall wood building designs selected for construction through the competitive process of the Tall Wood Building Demonstration Initiative.

Building Elements

CLT panels
Quantity: 464 panels
Weight: 954 tonnes

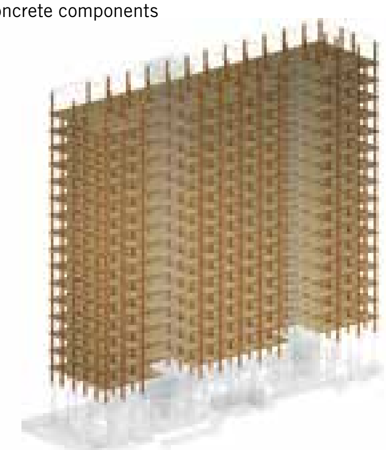
Glulam/PSL columns
Quantity: 1,298 columns
Volume of concrete saved: 2,650 m3
(Reduction in CO_2 emissions compared to a concrete building of similar size)

Final design

Brock Commons' structural system is designed as a hybrid configuration. The foundations, ground floor, and building cores are reinforced, cast-in-place concrete. The concrete second-floor slab acts as a transfer slab between the concrete and the wood structures and allows the ground-floor structural grid to be independent of the wood structural grid. The structural gravity load system of floors three to 18 consists of GLT columns and CLT floor panels, with PSL columns replacing the GLT in high-load areas on floors two to five. Point connections between columns and slabs consist of hollow structural section steel assemblies.

The decision to adopt a hybrid structure was driven by the design requirements and tight approval deadlines. The complexity of providing the necessary support for the lateral forces associated with a tall wood structure made it unfeasible to pursue mass timber solutions for the building cores due to the amount of time that would be needed to create the innovative designs and secure approvals for them. Also, on the ground floor, the use of a concrete structure allowed for high clearances and large spans in Brock Commons' public spaces and provided non-combustible spaces to house large mechanical and electrical services.

Concrete components



Wood components

RENDERINGS: CadMakersInc.

Foundation and superstructure

The building foundation is composed of reinforced spread footings and a strip footing at the perimeter of the building. Below each core is a raft slab that includes soil anchors with 1,250-kN tension force capacity.

The choice of a mass-timber superstructure will result in a building significantly lighter than a comparably sized concrete building, thus Brock Commons requires smaller and less costly footings. However, the lower mass also results in less inertia and less resistance to overturning, which are key considerations in a seismic zone such as coastal British Columbia. The structure is therefore designed to ensure that all lateral forces are adequately transferred first to the building cores and then to the raft slabs.

Brock Commons' superstructure is comprised of reinforced concrete columns on the ground floor and a concrete transfer slab on the second floor, two reinforced concrete cores, mass-timber slabs and columns on the upper floors, and a steel perimeter beam at each floor. The beam stiffens the edge of the perimeter CLT panels and supports the building envelope.

The CLT panels are made of five layers of dimension lumber. The 29 CLT panels per floor are joined together by a plywood spline nailed or screwed to each panel. A concrete topping increases the acoustic insulation properties and provides fire protection during construction. Most of the columns are GLT. Some PSL columns are used on floors two through five at the center of the building, for additional compression strength.

Building envelope

The ground floor of Brock Commons is enclosed by a glass curtain wall system. A three-layered CLT panel canopy with a double-folded, standing-seam, metal roof provides coverage for pedestrians.

On the upper floors, the building envelope is a prefabricated panel system with an R-16 minimum thermal resistance. Each panel is composed of a structural steel stud system; fibreglass batt insulation; a wood-fibre, laminate-panel, rainscreen cladding system; and pre-installed window assemblies.

This prefabricated envelope system allows the building to be rapidly enclosed as the structure is erected, in order to protect the wood components from the weather. The prefabricated portion is composed of the rainscreen cladding system up to the steel studs. The vapor barrier, batt insulation, and the interior layer of drywall will be applied on-site.

Building systems in wood construction

As a general strategy, building systems are consolidated in centralized locations and have highly coordinated distribution pathways to reduce penetrations in the CLT panels. For example, horizontal distribution for both supply and exhaust air ducts occurs immediately below the roof; these ducts then branch to vertical shafts located between units and service the suites on all floors. The kitchen exhaust ducts use charcoal filters to clean and recirculate the air, thus eliminating any horizontal duct runs to the exterior of the building as well as penetrations through the building envelope.

All horizontal distribution of systems, such as conduits and pipes, must be surface mounted to the underside of the CLT panels and require coordination of routes and headroom clearances. Distribution pathways were planned during the design phase in order to facilitate the design of the penetrations and cutouts into the digital fabrication of the CLT panels. These aspects of the design were captured in the virtual design and construction model, and were tested during the construction of the full-size mock-up.

The building systems are also designed to be flexible in order to accommodate settlement and variation in structural movements, given that the wood structural elements will settle and shrink at different rates than the concrete cores. The domestic hot water system is designed with cross-linked polyethylene piping instead of the traditional copper. Polyethylene piping is regarded as a more durable material than copper; it is flexible and thus does not require as many fittings and connections, which decreases the risk of leaks. Other flexible design strategies include the use of braided stainless steel connections, expansion compensators, expansion joints, flexible ducts and pipe connectors, and suspended sanitary and storm stacks at every fourth floor.

In the case of a leak, the ability to prevent and mitigate water accumulation within units or interior assemblies was also considered. Each unit has a floor drain in the bathroom – which is not standard practice in North American residential construction – and a highly visible water-shutoff panel.

Interior layouts and construction

The interiors of Brock Commons are of similar programming and layout as other precedent residence projects on campus. The ground floor includes administration; food services; amenity functions such as social and study spaces for students; and mechanical, electrical, and other service rooms. The upper floors house sixteen single and two quad residential units per floor, and a lounge area is on the eighteenth floor. Standard suite layouts that had been developed for a previous residence were tweaked to allow for the wood structure. For example, the mechanical, electrical, and plumbing systems are consolidated through shafts, and services closets are stacked to minimize the number of penetrations through the prefabricated CLT panels.

The design of interior elements is driven by the need to provide adequate fire resistance and acoustic separation. Encapsulation of the wood structural columns and floor panels achieves a two-hour fire resistance rating. Internal demising walls are designed to provide a two-hour fire resistance rating between suites and a one-hour fire resistance rating between the units and the corridor.

Building monitoring

Because this hybrid type of construction is new, there are few actual performance data on which to base design decisions and code regulations. As part of the demonstration nature of Brock Commons,

a monitoring system will be installed to collect data on the performance of engineered wood products and hybrid structural systems in a high-rise building. The data from Brock Commons, and the research that will be conducted with it, are expected to contribute to the creation of performance and building safety standards for future tall wood buildings.

Facts

- Height: 174 ft. (18 stories)
- Site area: 24,918-sq.ft.
- Gross area: 162,750-sq.ft.
- Typical floor-to-floor height is 9 ft. for the mass timber structure on the upper floors and 16 ft. on the ground floor

Three aspects of building performance that pose specific challenges to tall wood buildings will be monitored.

- Moisture content of the CLT panels – Sensors installed within the CLT panels will measure the variation of moisture content in the panels throughout their entire lifecycle, including during fabrication and installation, as well as during use in the building.
- Vertical settlement, including elastic shortening, moisture-related shrinkage, and creep – Sensors installed along key structural elements on all floors will monitor differential movement between individual components and total vertical settlement of the building.
- Horizontal vibrations due to wind (and, potentially, earthquakes) – Accelerometers located at the top, bottom, and midpoint of the building will monitor acceleration rates, lateral vibrations, and other displacements.

Lessons learned

As a demonstration of a novel type of building, the planning of the Brock Commons Phase 1 Building has required high levels of commitment from the design team, and the ability to respond to some new and unpredictable challenges and considerations.

The building design, and especially the hybrid structural solution, was developed for code approvals and constructability as well as performance. This meant that the design phase had to integrate the traditional building design with detailed planning for the construction phase.

The overall simplicity of the design of the Brock Commons Phase 1 Building is broadly recognized as being key to the project's success. The design approach emphasized the project as a whole rather than viewing it as a set of separate building components, systems, or applications.

Excerpt printed with permission from Forestry Innovation Investment. Read the complete case study online at www.naturallywood.com.

Wood WARE

LUGGAGE

Wood has long been used to make statement pieces in furniture and architecture, and now it can for luggage, too. Combining passions for wood carving and Italian design, EMBAWO's Norbert Öttl designs carry-on luggage and purses that feature wood. Versatile plywoods are used, making it possible to create elaborate curves and shapes. A scratch-resistant coating protects the handmade pieces from humidity and unintentional dings. The material's durability allows carriers to transport it easily and the light weight is a benefit for tight restrictions airlines pose on cabin baggage. Several wood varieties are used including olive, ebony, oak, and various nut trees. The luggage is a step toward sustainability in travel cases and one the company hopes will become a trend in the future.

www.embawo.com

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