Trail Blazing
One of the first public spaces to use dowel-laminated timber panels

The Fair-Haired Dumbbell
Where art, architecture and unique wood structures meet

Skyline House
Open spaces that capture perfect views
“The complex geometry of the Rocky Ridge Recreation Centre was developed with significant industry input. Structurlam proposed an ingenious solution that resulted in significant cost savings and a partnership with the design and construction management team to achieve successful project outcomes.”

Dave Edmonds
ARCHITECT, GEC ARCHITECTURE
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Glulam beams and bright mural embody what’s new and exciting in Portland architecture.

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Protecting CLT and other mass timber structures from lightening threats.
Thank You

It was quite an introduction I had to the world of wood when I took over this magazine as Executive Editor seven years ago.

My third day on the job marked Canada’s inaugural National Tree Day, which was created through a Private Member’s Bill to celebrate the great benefits trees provide – clean air, wildlife habitat, reduced energy demand, and a connection with nature. This year’s event was the first that Royal Galipeau, the Member of Parliament who founded the day, was not present. He passed away earlier this year, having planted more than 75,000 trees, by his own estimation.

Two weeks into the job, Toronto played host to Greenbuild, an event that still welcomes delegates from around the world and showcases the latest in green building products, technologies and innovations. The U.S. Green Building Council (USGBC) said it had selected Toronto for several reasons, including its growth in the movement with nearly 300 projects registered and seeking LEED certification, and 44 projects LEED certified in the Toronto area.

Flash forward to today where the latest numbers show last year there were 483 new projects LEED certified in Canada, bringing the total projects certified in Canada to 3,470. Of those, 1,332 or more than 35 per cent, are in Ontario.

Indeed, the world of wood continues to change and grow with each day. Seven years ago, most of the projects we saw were residences, places of worship, schools, or community centers. The number of commercial, mid-rise and tall timber buildings, and one-of-a-kind installations have astounded me as times have changed and ushered in new materials, updated codes and new ways of looking at things. As you will see in our forthcoming Wood Design Award Winners book due out later this Fall, the winning projects might be our most varied and progressive to date. There are no one-trick ponies. The projects are beautiful inside and out, sustainable and use wood in an innovative or unique way.

Witnessing a greater acceptance of the fact that wood can produce such a range of architecture is probably one of the most important things I’ve seen. As I move on to new endeavours, I want to thank all of you for sharing your stories and your love of wood with me. I hope we’ve captured them with the same passion you’ve shared.

Theresa Rogers
Executive Editor

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 Jana Manolakos jmanolakos@dvtail.com.
 inspiration BOARD

WHAT I’VE FALLEN FOR THIS MONTH...

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TALL TIMBER

There’s a new vision taking shape for Toronto’s Eastern Waterfront that combines urban design with digital technology to address some of the biggest challenges facing cities, including energy use, housing affordability and transportation. Sidewalk Toronto, the urban innovation subsidiary of Google’s parent company, Alphabet, aims to make this area the global hub of a new industry focused on urban innovation to improve the quality of city life. To start, Alphabet plans to move Google’s Canadian headquarters to the Eastern Waterfront. More good news: it also plans to use mass timber for most of the buildings of tall timber.

PHOTO CREDIT: MIT Mass Timber Design

MIT RESEARCHING SUSTAINABLE CONSTRUCTION

Researchers around the world have been seeking ways to make buildings more efficient and less dependent on emissions-intensive materials. A project developed through an MIT class has come up with a highly energy-efficient design for a large community building using wood. For this structure, called “the Longhouse,” massive timbers made of conventional lumber would be laminated together like supersized plywood. The design will be presented this October at the Maine Mass Timber Conference, which is dedicated to exploring new uses of wood. John Klein, a research scientist in MIT’s architecture department taught a workshop called Mass Timber Design where the new design was developed.

PHOTO CREDIT: MIT Mass Timber Design

SMALL PROJECTS, BIG IDEAS

The Small Project Practitioners, an AIA Knowledge Community, recently presented the 2018 Small Project Awards, to recognize 11 small project practitioners for the high quality of their work and to promote excellence in small project design. The program strives to raise public awareness of the value and design excellence that architects bring to projects, no matter the limits of size and scope. This year’s theme, “Renewal,” recognized projects that engage the idea, and incorporate concepts and elements relating to the theme. Many of the winners incorporate wood. Read more: www.aia.org/resources

Five Fields Play Structure.
FRISCH Projects in collaboration with Matter Design

Five Fields Play Structure.
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www.wooddesignandbuilding.com
www.WoodDesignAwards.com
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Publication Mail Agreement #40063877
Printed on recycled paper
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Wood Columns

Jana Manolakos

Internal columns are essential to dispersing building loads, but that doesn’t mean they have to be intrusive and plain, obscuring the splendor of visual design. Whether supportive or decorative, as essential elements in architecture they contribute to aesthetics and can make or break a space. As such, the use of timber for interior columns has grown in parallel with eco design trends, contributing to a sustainable footprint and upholding environmental consciousness.

The East Village Urban Marketplace in Sydney, Australia, is a showpiece for enhanced spatial ambience with its spectacular tree-like columns which provide a canopy over shoppers. Interior architects at Koichi Takada introduced a different and natural setting to promote a unique shopping experience. This environmental design draws its influence from parks and landscapes through the use of timber as the main component, and applies texture that draws the eye to the tree-like columns that grow and fan out to merge with the ceiling.

Japanese architect Kenaike Watanabe acknowledges the consumer preference for airier interior spaces and natural elements with spruce columns that resemble tree trunks and act to open living spaces. Clusters of columns splay out like tree branches inside the two-story Y-House Residence, a home in the seaside city of Kamakura. The columns also integrate furniture and function as informal partitions, with bookshelves between their branches. The space is finished with plywood sheets applied to sloping ceilings that match the Japanese cedar floorboards.

DTACC Architecture, TESS and Agence Jouin Manku joined forces to breathe new life into an original 1930s factory in Boulogne, France, that now houses the Société Foncière Lyonnaise’s In/Out Campus, by adding a new wing designed around the idea of movement and flow using glass and wood. Here, the columns evoke production, action and dynamism and do not interfere with the space. Their design reflects an ambience where employees experience a healthy balance between formal and informal, as well as between work and play, an idea at the heart of the In/Out Campus.

In Romania, architect Tudor Radulescu, BEE Architects, led a team that included a priest, in delivering a modern interpretation of an age-old architectural style in the refurbishment of The Church of the Order of Discalced Carmelites. The austerity of the order and simplicity of traditional Romanian architecture inspired the new design which gives way to the beauty of the wooden structure that was always hidden in ancient times. The arch in the church’s nave rests on 12 pillars, wooden lamellar ribs, which cling to the walls and stride heavily on solid concrete consoles.

   Architect: Koichi Takada Architects
   Location: Sydney, Australia
   PHOTO CREDIT: Koichi Takada Architects Pty Ltd

   Architect: Kwas/Kensuke Watanabe Architecture Studio
   Location: Kamakura City, Japan
   PHOTO CREDIT: Koichi Torimura

3. Société Foncière Lyonnaise
   In/Out Campus (2013)
   Architect: DTACC
   Location: Boulogne, France
   PHOTO CREDIT: Thierry Lewenberg Sturm

   Architect: Tudor Radulescu
   Location: Snagov, Romania
   PHOTO CREDIT: Viorel Plesca
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A new report by independent public policy think tank Montreal Economic Institute (MEI) says forest harvesting does not threaten the sustainability of our forests. In fact, due to innovation, the forestry industry is more and more productive and our forests are actually under-harvested.

Canada’s forest cover has remained relatively stable since 1990 and innovation accounts for much of that. The volume of softwood roundwood needed to produce a given quantity of boards for example, fell nearly a quarter between 1990 and 2017.

“A lot more is produced while cutting down fewer trees,” says Alexandre Moreau, Public Policy Analyst at the MEI and author of the publication. “Whether in sawmills or in pulp and paper mills, efficiency gains have allowed more to be done with less. The value added to sawmilling sub-products, with the help of new technologies, has also boosted productivity, with the wealth derived from each tree continuing to rise.”

The forestry sector employs nearly 60,000 workers and generates $6.5 billion in economic activity in Quebec, alone.

“Today’s technology and methods allow the forest to be harvested in a way that respects the environment, meeting both social expectations with regard to respecting biodiversity and the economic needs of the workers and communities that depend on the forest,” says Moreau.

www.iedm.org/e

American Wood Council (AWC) President and CEO Robert Glowinski issued the following statement on Aug. 31, in response to James (Jim) Hubbard’s confirmation as Under Secretary of Agriculture for Natural Resources and Environment at the U.S. Department of Agriculture (USDA). Hubbard worked for the Colorado Forest Service for 35 years and served as the state’s chief forester for the last 20 years.

“AWC congratulates Under Secretary Hubbard on his confirmation. His background makes him distinctly qualified to lead USDA efforts in its role supporting robust forests, which includes advancing markets for wood products.

“For example, moving the construction of tall wood buildings forward would introduce carbon-neutral building materials to our urban areas, as well as create jobs in rural areas. Supporting tall wood construction is a win-win for the Administration, the environment, and the American people.”

www.awc.org

The National Institute of Building Sciences recently announced the jury for its 2018 Beyond Green High-Performance Building and Community Awards. The 2018 jury members include Nancy McNabb, AIA; Jason Hartke, PhD; and Arpan Bakshi.

The awards recognize those buildings, initiatives and innovations that are influencing, informing and inspiring the high-performance planning, design, construction and operations processes. The jury is responsible for selecting those projects and activities that best exemplify the eight design objectives of high performance from all of the entries submitted to the Institute by the October 31, 2018 deadline.

The 2018 award categories include: High-Performance Buildings; High-Performance Attributes and Systems; High-Performance Initiatives; and Innovations for High-Performance Buildings and Communities. Winners will be recognized on January 9, 2019, during the National Institute of Building Sciences’ Annual Awards Banquet. As part of the awards presentation, the Beyond Green High-Performance Building and Community Award winners will have the opportunity to present their projects and highlight the challenges and opportunities they faced while delivering high-performance buildings.

The Awards Banquet is one of a number of events taking place during Building Innovation 2019 – The National Institute of Building Sciences Seventh Annual Conference and Expo, January 7-10, at the Mandarin Oriental, Washington, D.C.

www.nibs.org

The American Hardwood Information Center, a resource for consumers and professionals seeking information about American hardwoods, has launched an app for Apple mobile device users. The American Hardwoods Species Guide Mobile App helps users choose which hardwood species will work best for their next project.

The free Reference Guide application not only includes information about the most abundant American hardwood species – availability, physical and working characteristics, strength and mechanical properties, and typical applications of each – it also allows users the ability to compare species being considered for a project.

A stain simulator displays the species in clear, light, medium, and dark finishes to help visualize stain combinations of flooring, cabinetry, moulding, and furniture co-existing in a single design space. Species profiles include images featuring the wood in finished applications.

www.HardwoodInfo.com
BC Local Governments Recognized for Leadership in Wood Design and Building

Leadership in structural and architectural wood use by local governments was recognized in September at the Union of BC Municipalities (UBCM) Convention in Whistler, BC. Five local governments were presented with 2018 Community Recognition Awards for use of wood in their community projects by Wood WORKS! BC. The province-wide awards are presented annually to communities that have been exemplary advocates for wood. This may be demonstrated through the specification of wood in a community project and/or through visionary initiatives that work toward building a community culture of wood.

The 2018 recipients are:

LMLGA – Lower Mainland Local Government Association: City of Surrey for the South Surrey Operations Centre | Township of Langley for the Aldergrove Credit Union Community Centre. MERIT: City of Coquitlam for Rochester Park.

AKBLG – Association of Kootenay Boundary Local Governments: Village of Radium Hot Springs for the Radium Hot Springs Community Centre and Library. MERIT: City of Kimberley for the Civic Centre North Wall Replacement.

NCLGA – North Central Local Government Association: Village of Hazelton for the Upper Skeena Recreation Centre | Town of Smithers for the Smithers Airport. MERIT: City of Quesnel for South Quesnel Park.

Recipients of awards for Southern Interior Local Government Association and Vancouver Island Local Government Association will be announced when presented at their respective area association conventions in the spring.

“We congratulate these five local governments for their leadership and vision by choosing wood for their new community structures,” says Lynn Embury-Williams, Executive Director of Wood WORKS! BC, which has worked extensively with municipalities on all aspects of project planning from RFP wording to specification of structural and architectural wood products.

“Through their new wood projects, these communities have realized wood’s many benefits including cost-effectiveness, a reduced carbon footprint and enhancement of their streetscapes through beautiful and expressive new buildings. They have also demonstrated that traditional and new technologically advanced wood products and building systems can be used effectively and distinctly in many types and sizes of civic buildings.”

Embury-Williams applauds the communities for further advancing wood use in design and building, leading us to a more sustainable future.

http://wood-works.ca/bc

Wood Industry Resource Collaborative to Spark Workforce Growth

In August, 11 wood industry associations announced the formation of a coalition aimed primarily at perpetuating the long-term growth of the industry by sustaining an engaged workforce. Since its formative two-day brainstorming meeting in November 2017, the group has chosen to organize under the name Wood Industry Resource Collaborative (WIRC).

The collaborative group is a consortium of trade associations, all related to the woodworking or the wood products manufacturing industry. The group’s purpose is to provide a collection of tools and solutions for the wood industry to attract and retain employees, while improving the perception of the industry. The group will connect industry associations with one another and support and strengthen the woodworking industry and their associations’ members by sharing information and resources.

The charter members agreed to the following goals and identified those influencers who can effectively drive interest in the wood industry as a career path (e.g. parents, teachers, social media, and financial resources):

- Attract Employees: Increase student awareness of wood industry careers; increase parent awareness of wood industry careers; increase student engagement; and increase High School counselor awareness of wood industry careers.
- Retain Employees: Increase association memberships; improve association member engagement and satisfaction; and improve work culture at member companies.
- Improve the Perception of the Industry: Develop and communicate the stories of the industry; increase positive media coverage; increase engagement with legislative and educator communities; and involve more associations in WIRC initiatives.

The primary target for the group’s efforts is Generation Z – those born between 1995 and 2014 – who are the most diverse and multicultural of any generation in the U.S. In addition to the youngest generation, the group will also target Millennials and Gen Xers (parents).

Forum organizers and charter members include executive-level representatives from the following associations: AWFS (Association of Woodworking & Furnishings Suppliers); AWI (Architectural Woodwork Institute); CMA (Cabinet Makers Association); HMA (Hardwood Manufacturers Association); NBMDA (North American Building Material Distribution Association); NWFA (National Wood Flooring Association); WCMA (Wood Component Manufacturers Association); WMIA (Woodworking Machinery Industry Association); WMMA (Wood Machinery Manufacturers of America); WPMA (Wood Product Manufacturers Association); and WMMPA (Moulding & Millwork Producers Association).

www.woodindustryed.org/wirc
Skyline House

Open plan home embraces the views

Oakland, CA
Situated high on top of a mountain range overlooking the city of Oakland, CA, the site for this rebuild of an existing house has unobstructed views toward the southwest bay and Golden Gate. Skyline House was designed for a young family that wanted an open plan home embracing the views of the bay and creating a connection to the existing garden.

Because of its location, the site is confronted with extreme weather and wide temperature swings. The San Francisco Bay has a unique micro-climate with the bay reaching far inland and bringing a very temperate climate. The omnipresent fog and afternoon breezes are big influences on the weather and ambient temperature. On the days where it gets hot, the fog and breezes can start to roll inland to cool the interior in the evening. The fluid, rolling form of the ceiling was derived from the function of the air flow and ventilation. Once the cooler air is captured and funneled inward, the rise of the ceiling increases the volume, thereby slowing the laminar air flow, and keeping the interior from feeling too drafty.

Use of deep overhangs and wood trellising at the rear protect the space against excessive sun and heat gain. The insulation in the roof is maximized, thereby decreasing the need for heating, and improving the occupant comfort in the summer (without A/C). The main living space becomes the connector of the two contrasting outdoor spaces.
Working with the existing floor plan, the 2,700-sq. ft. design transformed the kitchen area to open out and connect to the front yard garden, forming an outdoor dining area. A concrete planter/bench was placed to further define the outdoor garden space. Opposite of the remodeled kitchen, the interior dining space seamlessly opens out to the viewing deck, creating one large open space and extending the roof structure as a trellis to shelter the space from the direct sun. A new stair connects the main floor with the lower ground floor continuing the wood tube down through a crevasse to a media/projection room, bedroom and office area.

ARCHITECT
Terry & Terry Architecture
Berkeley, CA

STRUCTURAL ENGINEER
Santos & Urrutia Structural Engineers Inc.
San Francisco, CA

GENERAL CONTRACTOR
Lynden Construction
Piedmont, CA

PHOTOGRAPHY
Bruce Damonte Photography
San Francisco, CA
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The Fair-Haired Dumbbell

Glulam beams and bright mural embody what’s new and exciting in Portland architecture

Portland, OR
The Fair-Haired Dumbbell is a collaboration between the architect and developer. Structurally supported by mass timber sourced in the Pacific Northwest, this 56,389-sq.ft. office building with ground-floor retail is located in the heart of the Burnside Bridgehead developments. At the east side of the intersection of Burnside Street and the Willamette River, the Bridgehead is home to some of Portland’s most exciting and interesting new architecture.

Completed in 2017, the Dumbbell’s starting point was a small, challenging “island” site, bound by busy streets on all sides. In order to maximize useful space in the area, which measures just over a quarter-acre, the design team incorporated small interconnected public plazas that flow into the ground-floor retail. These provide refuge and facilitate pedestrian movement and visibility through the site. The Fair-Haired Dumbbell building sits squarely in the center of the action and doesn’t shy away from attention.

The project consists of two canted six-story towers clad on all eight sides in hand-painted original artwork by LA-based artist, James Jean. The building was initially conceived of as two “presents” to the city of Portland: it is “presented” on a podium, while the artwork represents the giftwrap.

The artwork counteracts the gray of the city, the streets, and the skies, and causes passersby to take notice of the building. A partnership was struck with the Regional Arts and Culture Council (RACC), to commission the work, which showcases cross sections of a thundereggs (Oregon’s state rock) and geodes.

The structure is composed of glulam beams and columns, made from wood procured in Vancouver, WA. The heavy timber post-and-beam perimeter has a two-hour fire rating for the walls and provides increased ductility in the event of an earthquake.

At each level, sky bridges connect the mirrored 4,000-sq.ft. office spaces, giving the creative companies who work there the flexibility to build out their own floor plan to meet their specific needs. Since no two elevations are the same, tenants and visitors alike take in impressive views of Portland’s many angles through windows of varying sizes. At the ground floor, the project complements the neighborhood with unique retail offerings and creative landscaping.

OWNER/DEVELOPER
Guerrilla Development Co.
Portland, OR

ARCHITECT
FFA Architecture + Interiors
Portland, OR

GENERAL CONTRACTOR
Andersen Construction
Portland, OR

PHOTOGRAPHY
Guerrilla Development Co.
Portland, OR
Radium Hot Springs Community Hall and Library

DLT, glulam create a special community hub

Radium Hot Springs, BC
The new Community Hall and Library in the village of Radium Hot Springs, located next to Kootenay National Park in BC, opened in August. It is one of the first public buildings in Canada to be constructed with dowel-laminated timber (DLT) panels.

The 8,000-sq.ft. facility containing a hall, meeting room, servery and library, is the community’s home, and is located in the center of the village overlooking Legends Park. All village events can be held within the hall, such as weddings, leisure classes, children’s day camps, movie nights, and reunions.

The project was conceived in a unique stakeholder engagement process, designed to fulfill the province’s “Wood First” policy. The project goal was to create a “100-mile building”, maximizing the use of local resources, particularly wood. At the outset of the project, the design team met with local wood industry representatives to assess the material, skills, talent, and labor available locally.

As the design was developed, the tender documents were structured to accommodate a variety of local solutions from glulam to LVL to DLT. The DLT panels were prefabricated off-site in Golden, BC – 37 miles north of Radium and transported to Radium in a choreographed sequence to maximize installation efficiency.

The team designed a modular DLT system that integrates lighting, acoustics and services with the DLT panels. The panels span the glulam beams and are bridged by the plywood deck. The prefabricated DLT panels were constructed from 2 x 4 and 2 x 6 dimensional lumber and fastened with beech dowels. Alternating 2 x 4 and 2 x 6 timber creates a variegated texture. No adhesives were used in the fabrication and the panels are sealed with a clear protective coating.

The exterior of the building is clad in charred wood siding, manufactured five miles from the site. An auger system was custom-built to allow for a controlled charring of the timber.

Inspiration was drawn from the intriguing site, which is perched on the edge of a natural kettle hole lined with pine trees, a microcosm of the surrounding valley. The low, sloped forms frame the views of mountains to the east and highlight the silhouettes of pine trees. An entry plaza lined with wood benches was inspired by the paint pots in nearby Kootenay National Park. The interior spaces are defined by the DLT ceilings. Wood screens filter the views from the ramped corridor into the hall enhancing the height of the space and referencing the pine forests beyond.

The building has already become a centerpiece for the municipality, rebuilding pride in the community space. “The Community Hall and Library will help create a vibrant community gathering place that is an
emblem of the Village of Radium Hot Spring’s culture, showcases wood, and is a model of economic, social and environmental sustainability,” says Clara Reinhardt, Mayor. “The community consultation was well attended and the new building truly reflects the personality of our community.”

OWNER
Village of Radium Hot Springs
Radium Hot Springs, BC

ARCHITECT
Urban Arts Architecture
Vancouver, BC

STRUCTURAL ENGINEER
Equilibrium Consulting Inc.
Vancouver, BC

GENERAL CONTRACTOR
Ken Willimont
Radium Hot Springs, BC

TIMBER SUPPLIERS
Glulam – Western Archrib
Edmonton, AB
DLT – International Timberframes Inc.
Golden, BC

PHOTOGRAPHY
Best Impressions Photography
Golden, BC
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Unterdorf Elementary School, Höchst

Radical approach to building design aims to set a new standard for Austrian schools

Höchst, Austria
A fixture in Scandinavian countries, cluster schools are gaining ground in Austria. The pedagogical approach behind these types of schools involves teaching in small groups, flexible spaces and diversified, preferably outdoor, open areas. There are no classrooms along the access corridors; instead, open layouts allow for different forms of teaching and learning. In recent years, schools in the region have been architecturally implementing these requirements in different manners. The architects have delivered a radical example of this approach in the recently completed Unterdorf Elementary School.
In a plain, elongated, ground-level wooden building, four identical clusters are placed on the east side; the special education classes and the administrative area are located on the west side. A spacious hall connects the special education area with the gymnasium. The clusters comprise two central classrooms, an open group area and a quiet room, as well as washrooms and wardrobes around a central lounge. Each lounge is topped by an elevated, truncated pyramid through which daylight flows.

A direct exit into a private garden and the outdoor classroom area provides outdoor space and enables short access routes. Large-area glazing provides the necessary transparency so that the teachers can always see their students when they are learning or playing in small groups in different rooms. These visual axes also act as a constant invitation to use the space in the middle, strengthening the sense of community within the cluster. The breaktime area in front of the hall is connected by several paths to Unterdorf’s wider network of roads. Parts of the outdoor areas are available to locals as a freely accessible play and leisure area.

The entire school is of pure timber construction. The multi-layer, glued-together solid wood panel surfaces are unclad and the timber framework is visible in every room. Students benefit from the better learning environment and a pleasant, warm atmosphere within the building, which also saves on heating costs. The materials used are based on the fundamental principles of
sustainability and ecological efficiency. The renewable, regional building material used dramatically reduced the gray energy factor.

A working group of teachers, community representatives and consultants was involved from the outset in the competition’s bidding stage as well as the planning, and also regularly participated in the building meetings. This close cooperation was a key factor in the successful implementation of this forward-looking pilot project, which sets a new standard for schools in Austria and, hopefully, will stimulate further timber construction in Austria.

CLIENT
Municipality of Höchst
Höchst, Austria

ARCHITECT
Dietrich | Untertrifaller
Munich, Germany

STRUCTURAL ENGINEERS
Merz Kley Partner (timber)
Dornbirn, Austria

Gehrer (concrete)
Höchst, Austria

PHOTOGRAPHY
Bruno Klomfar
Vienna, Austria
These are exciting times for wood design. New products and systems, advancements in manufacturing, more progressive building codes, computer-aided design, integrated project delivery, and the design community’s focus on sustainability and renewed appreciation of timber construction have given rise to an incredible new generation of wood buildings.

Design professionals around the world are using wood products and systems in an ever increasing array of building types and applications and the media is awash with stories of bigger, better and taller wood buildings.

Amidst the rapid succession of timber buildings making global headlines, over the next year we are going to present a series of short articles that will offer a closer look at a single building during the course of its construction.

Though this serial profile will offer insight into just one building, it is symbolic of the many projects being built in wood that are accelerating innovation, changing attitudes about wood construction and improving the way we build our communities.

80 Atlantic is a five-story commercial building in Toronto, ON. It is four stories of heavy timber construction above a one-story concrete podium. The exposed wood structure is comprised of glulam columns and beams with nail-laminated timber (NLT) panels. NLT was selected for its simplicity, aesthetics and economics. The wide range of products available today makes it much easier to select a wood solution tailored to meet specific project requirements.

80 Atlantic is a modern take on the iconic, century-old brick and beam warehouse buildings that are being adapted for reuse as offices, condos and studio lofts in major cities everywhere. These renovated old buildings are highly valued for their character and versatility, and they command a premium in the marketplace but, although the structures are as robust as ever, they require extensive upgrades to overcome building envelope performance issues (they were built without insulation) and other challenges. Once completed, 80 Atlantic will deliver all the desirable attributes of these old buildings – an exposed timber structure, tall ceilings, heaps of...
character, and versatile spaces – with none of the problems.

80 Atlantic completely reinvents the construction method by employing the newest materials, latest sustainable design strategies and innovative construction processes to deliver a modern, high-performance building that is built to last. For example, the project will have raised access floors and engineered plenums to house mechanical, electrical and telecommunications services. This design enables workspaces to be easily reconfigured as required and housing these services in the floor results in an exposed wood ceiling uncluttered by services. The HVAC ducts, also in the engineered plenum, will provide an effective, locally customizable and healthier distribution of air.

Interestingly, the floor plate construction hearkens back to the original warehouse flooring method - where solid sawn lumber was ganged up on edge and nailed together on-site - but with a significant upgrade. Instead of being built on-site, the nail-laminated timber in this project has been panelized and machine fabricated off-site in an indoor facility, a process that minimizes waste, improves both quality and efficiency, and shortens the construction schedule.

Although the province of Ontario’s building code was amended in 2015 to permit wood construction as tall as six stories (up from four), the planning and approvals process for a new building of this size can be lengthy, so when it comes to mid-rise buildings in wood, the city is still in the early adoption phase of mid-rise wood construction. 80 Atlantic is one of the first commercial buildings of this height to go to construction in Toronto since the code update, though there are now many mid-rise wood buildings in the design and development phase.

The coming surge in wood projects like 80 Atlantic is encouraging because the benefits of wood construction are so significant. Design solutions that incorporate wood products from responsibly managed sources can significantly lower the carbon footprint of any building, reduce our dependence on non-renewable materials, and provide warm, beautiful, human-centered environments people love and which last for generations.

**PROJECT FACTS**

**Location**
80 Atlantic Avenue (Liberty Village), Toronto, ON

**Type**
Office/Retail

**Office Space**
79,758 sq.ft.

**Retail Space**
7,719 sq.ft.

**ARCHITECT**
Quadrangle Architects Ltd.

**DEVELOPER**
Hullmark Developments Ltd.

**ENGINEER**
RJC Engineers

**CONSTRUCTION MANAGER**
Eastern Construction Co. Ltd.

**NLT FABRICATOR**
Timmerman Timberworks Inc.

**GLULAM FABRICATOR**
Nordic Structures

**PHOTO CREDITS:** Steven Street

Left: Nail-laminated timber (NLT) panel being manufactured in the shop. The NLT laminating machine lines up the dimensional lumber on its edge and nails the laminations into place at a rate of 12 nails/second. An entire panel can be fabricated in as little as 45 minutes. Right: NLT panel being moved to storage location prior to site delivery. The NLT machine, seen at the right of the frame, can manufacture up to 8 NLT panels per day in dimensions of up to 10’ X 50’. There will be approximately 220 NLT panels installed at 80 Atlantic once the project is complete.
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Continuous Load Path for Wind

Brent Bunting

Whether the load is downward by gravity or lateral and vertical by wind and seismic, the load path has to be continuous or the building will not remain in place and undamaged when exposed to natural hazard loads. Although gravity dead and live loads usually are the primary design concerns, wind and seismic hazard loadings must also be considered and, unlike gravity loads, they are not necessarily downward. Seismic and wind loads are usually lateral and frequently upward. “Continuous Load Path” is a term used to describe how the loads applied to the structure make their way to the foundation. Whether the direction of load is vertical or horizontal, the load path ends with the ground below the structure and, like a chain, weak links are places where failure can occur.

This article is only a primer for the continuous load paths needed to resist wind loads. In Figure 1, the basic forces imposed on a wood frame structure are illustrated. Wind pressures create download, uplift, sliding and overturning forces. For wood frame buildings, the horizontal wind force applied to the wall is transferred from the cladding, to the sheathing and into the studs. The studs transfer the load to the floor or roof diaphragms, which transfer the loads to the side walls and down to the foundation. This horizontal load transfer from walls to diaphragms is typically accomplished through the use of mechanical fasteners and foundation anchors.

I have been providing details and connection solutions to contractors, designers and building officials for more than 20 years and one of the most common questions I answer is, “Can I use four hurricane ties to connect the truss to the wall for 3,000 lbs of uplift?” My answer is always, “Yes but no.” If you connect the trusses to the double top plate of the wall but do not connect the double top plates to the studs, what is stopping the double top plates from lifting away? Similarly, what will stop the wall from lifting off the floor platform and the floor platform of the upper story from the wall below?

You might recall the article “Hurricane Ties Keep the Roof on – Right?” by Stephen MacDougall in the Spring/Summer 2018 issue of Wood Design & Building. The article outlined an incident where a three-year-old agricultural building failed under low wind loads. The roof truss connections to the top plates of the exterior walls were made using
hurricane ties that could resist the factored uplift load, but the wall top plates were only connected to the wall studs through the use of end nails. The weak link was not the connection of the truss to the wall top plates but the connection of the wall top plates to the studs. The resulting failure of the building under low wind loads could easily have been predicted. Nails embedded in the end-grain, such as those used to fasten the wall top plate to the studs or vertical framing members are not intended to provide withdrawal resistance. The Engineering design standard in wood (CSA O86), clause 12.9.3.4, directs that nails and spikes in end grain shall not be considered to carry load in withdrawal.

For uplift on the roof, the continuous load path starts with fastening the roof sheathing to the rafters or trusses, then the connection between the rafters or trusses and the wall, and finally anchoring the wall to the foundation. Each of these can have multiple connections that need to be reviewed in order for the continuous load path to be complete.

When the roof is subjected to uplift forces, the trusses or rafters need to be restrained at the top of the wall. For Part 9 buildings, Table 9.23.3.4 of the National Building Code of Canada (NBC 2015) requires that trusses or rafters be toe-nailed to the double top plates of the wall with three, 3 ¼-inch common wire nails. This prescriptive connection provides the uplift resistance to the roof primarily through the withdrawal resistance of the nails and can develop 0.70 kN of resistance (CWC, 2014). For buildings located in areas of high wind or for buildings with longer roof spans, this toe-nailed connection is typically supplemented with metal straps, commercially known as hurricane ties.

Two different methods are used to transfer the uplift load from the roof rafter or truss to the wall system below: 1) directly connect the member to the wall plates or 2) directly connecting the roof member to the wall studs bypassing the wall plates.

For lighter loads, Method 1 is the connection of choice. Standard hurricane ties or framing clips can provide the required resistance. As an alternate, innovative proprietary wood screws installed through the double top plates into the bottom of the trusses or rafters are becoming popular, due to the ease of installation and resistances similar to that of hurricane ties (Fig. 2). With the direct-connect method, as previously indicated, connection of the wall plates to the studs must be addressed. Do not assume the end nailing of the wall plates to the studs can be used to complete this connection, as CSA O86 does not provide a factored withdrawal resistance for nails installed in end grain. The wall plate-to-stud connection can be made through the use of sheathing nailing with proper detailing, proprietary wood screws in withdrawal or with metal connectors known as “stud plate ties.” Regardless of how the connection is detailed, the load needs to transfer into the wall studs to keep the load path continuous.

When bypassing the wall plates using the Method 2 load-path strategy, direct connection of the roof member to the wall stud must be attained. For trusses with raised heels (also known as “energy heels”) the geometry may permit the wall sheathing to be raised above the top plates of the wall, such that it can be nailed directly to the truss members, which can transfer loads to the wall studs below. Larger hurricane ties, girder tie-downs and metal straps are commercially available, where individual or a combination of components can be used to complete this connection.

Once the load gets into the studs, the job becomes a little easier. Load transfer from one story to another can be done by installing the sheathing so that the individual panels are fastened to the studs above and below. An alternate load path mechanism is the use of straight metal straps in the same fashion (typically installed over the sheathing) or long screws that connect through the floor cavity. Do not rely on the prescriptive nailed connection of the sole plate to the rim joist (3 ¼” common wire nails at 16” on center) to provide the uplift resistance. For applications where structural
panel sheathing is not being used, do not rely on the end nailed, or toe-nailed connections of the studs to the sole plate, as these do not provide sufficient resistance to uplift.

Complete the continuous load path by transferring the load to the foundation. If this is done by extending the sheathing over the sole or sill plate, then proper detailing needs to outline the fastener requirements to get the load from the sheathing into the sole plate. Anchorage of the sole plate to the foundation can be done with cast-in-place anchor bolts, but be aware that the prescriptive anchoring requirements in article 9.23.6.1 of the NBC 2015 (1/2-inch diameter anchor bolts at 2.4m on center) will most likely be inadequate for the uplift load. Where the uplift force is greater than the prescriptive solution capacity, embedded strap anchors or post-installed tension ties can be used to anchor the studs directly to the foundation.

In addition to the standard wind uplift load path discussed, additional load paths around window and door openings need to be addressed. Larger forces will occur at these connection locations and lintels or headers will need to be anchored to the studs or posts to carry the forces into the surrounding wall framing.

Whether it is uplift due to wind or horizontal forces due to earthquake, detailing must be done to ensure the load can get from the starting point to the end, without any weak links along the way. For the continuous load path to work, each connection along the path needs to be evaluated to ensure there is adequate resistance to the applied load. Designing and building a continuous load path is essential to ensuring a strong, resilient structure.

REFERENCES


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The Role of Coatings in Mass Timber Performance

Sjoerd Bos

As mass timber construction continues to grow, architects are faced with a multitude of coating decisions based on each building’s unique needs. Too often, a one-size-fits-all approach is taken when it comes to coatings for mass timber construction, an approach that comes with some risks. While budget and timing are factors, it is important to understand the outcomes of various coating-related decisions such as the trade-offs of applying one coat versus two coats, the value of applying an undercoat or primer, and the pros and cons of machine versus hand application of the coating.

Videotron Centre This 689,000-sq.ft. multi-use indoor arena was completed in 2015. The $400-million, seven-story building fit the city’s strategy for supporting sustainable projects. The coating was fully applied in the factory for fast and easy installation. (Manufacturer/Application: Nordic).
Cross-laminated timber (CLT) has been used in Europe extensively and is growing in popularity in North America. In fact, the global CLT market is expected to exceed $2 billion by the year 2025, according to Grand View Research, Inc. Increasingly, five- and six-story wood buildings are gaining ground against traditional concrete and steel shells as designers and developers embrace timber’s potential for lower costs, faster installation and a significantly lighter carbon footprint.

Supportive government initiatives
Momentum is growing. The 2021 International Building Code will allow mass timber construction for structures as high as 18 stories in the U.S. After years of study and research, Canada has also made mass timber a more feasible option. Per the 2015 Model National Building Code of Canada, the maximum height for mid-rise wood-frame construction has been lifted from four to six stories. Numerous projects have already been designed and built to these new building code requirements and more are coming.

Benefits of mass timber construction
There are many reasons why taller timber construction is gaining a strong foothold – from economic and aesthetic to environmental. When managed sustainably, wood is a renewable resource and an effective carbon capture system; carbon remains stored throughout the lifecycle of the wood products – even after disposal when wood fiber is recycled.

Tall timber structures also deliver excellent fire and earthquake resistance. Wood structures perform very well when faced with wind and seismic activity due to the lightweight nature of the wood, ductile connections, and redundant load paths. If mass timber is exposed to fire, the outer layer burns and creates a protective charring layer that slows down combustion, offering a natural barrier against flames. The char layer acts as insulation, delaying the transfer of heat to the cold layer of wood below. Because of mass timber’s density, it also means there are no empty spaces through which air and fire can travel.

According to Think Wood, which partners with various industry groups to promote the economic, environmental and societal benefits of using softwood lumber in commercial, community and non-residential building applications, another advantage of mass timber construction is that it offers a shorter construction schedule, which ultimately lowers construction costs. Well-suited to prefabrication, mass timber components can be manufactured off-site and delivered quickly to the job site. This can considerably reduce a worksite footprint and significantly improve construction times.

The aesthetic, health and wellness properties of wood cannot be overstated. Timber buildings, especially those where the wood is featured and left exposed, have a positive impact on occupants. A 2015 study from Planet Ark entitled, Wood – Housing, Health, Humanity, showed that students in classrooms featuring more wood have lower heart rates and stress responses than students in classrooms using primarily plastic and metal.

Why coatings matter
Wood is clearly a strong, versatile, and environmentally friendly building material. Although it also has some natural protective properties, wood is subjected to a range of weathering factors and possible biological/physical degradation during its service life. The impact of these factors can be significantly minimized with protective coatings. Furthermore, for architectural purposes, coatings can enhance and highlight wood’s aesthetic properties in natural or translucent colors or create stunning architectural features with more opaque or weathered tones.

Ultimately, design and construction are just the first steps in a building’s journey. An appropriate coating can help ensure a building will perform well over time, reducing time-consuming maintenance costs for the owner and allowing the mass timber structure to stand as a testament to the beauty and longevity of wood construction.

Factors impacting coating decisions
There are several factors to consider that can impact a coating recommendation and the final outcome.

When determining the appropriate coating and maintenance interval, it’s important to look at the wood species/substrate, its expected exposure, and whether it will be used for an interior or exterior application. Based on this starting point, the impact of
weathering and biological/physical factors such as UV exposure, humidity, exposure to traffic/human touch or pollutants, and temperature range can be evaluated. Nevertheless, the type of wood and the conditions it will be exposed to in situ are only part of the equation. Coatings must also be properly applied.

In factory settings, undercoats and topcoats can be applied under exacting conditions, with temperature and humidity controls and an easier ability to ensure sufficient product is applied to achieve the desired coating thickness. Increasingly, mass timber manufacturers are applying all coats in the factory and delivering the product prefinished for on-site installation.

Sometimes, only the undercoat (or primer) will be applied in the factory, with subsequent topcoats applied on-site. Selecting the right undercoat to apply to all six sides of a CLT or glulam piece is critical to garner all the benefits of protection and ensure the successful, subsequent topcoat application. Absorption of the undercoat enhances the stability of wood components and increases topcoat performance so it is imperative that the undercoat allows subsequent topcoats to sink in and penetrate the wood for optimal performance. An effective undercoat also protects the pieces from moisture intrusion in transit and during construction, especially on the all-important end grain. It also helps control finish clarity, color, and grain definition, while offering deep wood protection against UV damage and moisture.

**Guidelines and best practices for selecting the appropriate coating**

Sometimes the design intent is to keep the wood as natural as possible; other times there is a desire to play with color to make designs come alive. When comparing coatings such as natural, translucent, or opaque, the tint load is an important consideration. With lighter-toned woods, where a natural look is desired, it is often necessary to fine-tune transparency. In general, the stronger the color system, the greater the UV blockage.

Designers should take the following things into consideration when selecting a coating product: environmental performance, ability to penetrate wood, ultra-low VOC profile, ability to customize tone, overall performance, and ease of maintenance. Increasingly, specifications also need to consider regulations surrounding fire retardancy, though this is an evolving area.

Fire retardant coatings are rated as Class A, B, C, D, or E according to a flame spread index outlined in ASTM E84, which is the standard test method for surface burning characteristics of building materials. The classes indicate the degree of flame spread, with A being the best (lowest amount of flame spread) and Classes D and E considered not effective against any fire exposure. Though mostly meant for interior finishes, there are some Class B finishes that can be used on exterior, non-exposed surfaces. Architects should work with coatings manufacturers on a custom specification when desiring Class A or B rating since some fire retardant coatings can be top coated and still achieve a Class A rating, while others cannot.

**Most often overlooked areas related to coating performance**

Moisture management is another key consideration when a wood building is designed and constructed. Ground clearance, overhangs, and exposed ends are just some of the design factors that can inhibit – or promote – moisture retention and subsequent damage.

Moisture is a major factor in wood structure failure when water gets trapped at the connection points of the wood. The ends of wood pieces absorb water longitudinally up to 20 times faster than across the grain. To help protect wood, undercoats should be applied in the factory to all six sides of an engineered wood piece, with particular attention to the end grain. There are many coating options to be applied at the factory or on-site to protect the end grain to combat delamination and other moisture intrusion issues.

For all of the reasons detailed above, the most valuable advice is: don’t compromise on the coating. It can ensure the building’s beauty and performance is enduring with manageable maintenance.

Sjoerd Bos is Managing Director, Sansin.
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Lightning Threats

Protecting CLT and other mass timber structures

Jennifer Morgan and Michael Chusid

Figure 1: Top: The Wood Innovation Design Centre at the University of Northern British Columbia in Prince George, BC, is one of the tallest modern CLT office buildings. The slender air terminals (lightning rods) on the roof are inconspicuous from the ground making it necessary to retouch the photo to make the lightning protection system visible. Design: Michael Green Architecture. PHOTO CREDIT: Ema Peters
For cross-laminated timber (CLT) and other mass timber buildings to reach ever greater heights and gain public acceptance, the safety of the building systems have to be assured with regard to all types of threats, including lightning. To be sure, buildings of all types are susceptible to lightning damage but load-bearing timber structures have unique vulnerabilities.

Fortunately, lightning protection systems (LPS) based on recognized standards are time tested and compatible with contemporary timber construction systems. Indeed, when Ben Franklin demonstrated the effectiveness of lightning protection systems in the 18th century, he was not concerned with steel or concrete structures. The buildings of his time were primarily constructed of wood, including heavy timbers for roof trusses, barns, and mill construction.

In the two-and-a-half centuries since then, his concepts have been proven, refined, and incorporated into building codes and standards and can now be applied to innovative timber buildings. (FIG 1)

THUNDERING TIMBER
In simplest terms, lightning is a discharge of electrical energy that can spark between the atmosphere and ground. The energy, seeking the path of least resistance, will travel through buildings, including wood components. The current can be as intense as several millions volts and tens of thousands amps. It can heat air to 50,000 degrees Fahrenheit – five times hotter than the surface of the sun.

Ordinary fires originate in the space surrounding a timber member and attack wood’s perimeter where combustion can be retarded by fire-resistant applied finishes or by charring that slows burning. Lightning, on the other hand, can ignite the wood directly, diminishing the effectiveness of gypsum board or other fire-resistant materials. More, moisture in the wood can vaporize and expand explosively to shatter a timber. The consequences of a lightning strike can be seen in trees that are struck by lightning and either burn from the inside out or are shattered. (FIG. 2).

Another consequence, not unique to wood construction, is that lightning traveling through a building can flash (arc) from structural members to electrical, mechanical, and other building components that offer less resistance to ground. The resulting surge can fry electronic devices, cause structural damage or injure building occupants.

LPS BASICS
An LPS consists of a network of interconnected, adequately sized, metal components that create a low-resistance path that allows lightning to flow safely between the top of a building and ground without damaging the structure or its occupants and contents.

Major components of an LPS include rooftop air terminals (lightning rods) or strike termination devices, through-structure penetrations, braided conductor cables to interconnect components, ground electrodes, bonding connections, and fittings. Surge protective devices are also required on all utilities.
entering the building. (FIG. 3)

Current flows through an LPS in milliseconds without encountering enough resistance to generate significant heat; components can be placed in direct contact with wood without igniting fire. Cables, for example, can be fastened to the surface of timbers, pulled through holes drilled in beam and panels, or run through channels routed or fabricated into CLT members. (FIG 4)

LPS components are typically aluminum and copper. Copper components can also be plated to meet aesthetic and corrosion resistance concerns.

RISK ASSESSMENT

Lightning protection is required for certain occupancies by some local and state building codes, regulatory authorities, and insurance organizations. On most projects, however, building owners depend on their architects to consider lightning protection as part of the professionals’ obligation to protect public health, safety, and welfare.

This obligation can be fulfilled by using the methodology in NFPA 780, Annex L to assess whether a structure’s vulnerability to lightning is greater than its tolerable risk:

- Vulnerability is determined by lightning density (frequency/area/year, based on weather maps), as well as a structure’s area and height, topography and proximity to taller structures or trees.
- Risk is affected by conductivity and combustibility of the roof; value and combustibility of contents; ease of evacuation; owner’s attitude toward operational continuity; and environmental hazards.
- Risk is also affected by the combustibility of the structural system, so timber buildings have slightly increased risk compared to non-combustible structures.

Regardless of calculations, NFPA recommends an LPS if any of the following are present: large crowds, need for continuity of critical services, high lightning flash frequency, tall isolated structures, explosive or flammable content, irre-
placeable cultural heritage, or regulatory or insurance requirements.

**HOW TO SPECIFY**

An LPS system should be designed, fabricated, and installed in accordance with:

- National Fire Protection Association (NFPA) 780 – *Installation of Lightning Protection Systems*
- UL 96A – *Installation Requirements for Lightning Protection Systems.*

It is important to reference these North American standards to avoid non-conforming systems with names like “early streamer emissions” or “charge dissipation arrays” and claims that a single air terminal can protect an entire building.

The claims have been vetted and rejected by government agencies including NASA and US Departments of Defense, Commerce, and Transportation; standards writing organizations; and almost the entire scientific community. Even the US Courts have issued injunctions against some of the most egregious claims.

Generally, it is not necessary for the architect to detail the LPS unless special aesthetic or project conditions apply. Instead, the specifier should cite the above standards and delegate design to an individual certified by the Lightning Protection Institute (LPI) as a Master Installer or Master Installer/Designer (or a firm employing one). As an added assurance, the LPS can be commissioned with an inspection by the LPI-Inspection Program (LPI-IP).

With a lightning protection system, a CLT or other heavy timber building could well be safer than a steel or concrete building without lightning protection. Getting this message across to designers and builders will help build confidence in timber construction and inspire greater use of innovative building techniques.

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The story begins with a group of friends – all former baseball players – who would often hang out, enjoy some brews and talk baseball. One day, an idea popped up: what if you could take the beauty of a baseball bat and turn it into a mug? This idea was the seed for the invention of the Bat Mug and, soon after, the five friends founded Lumberlend Co. The sports-inspired mugs are crafted by hand from birch. The wood is carefully sanded and checked for imperfections, coated with paint for a customized touch, or sent to a laser engraver. The mug can hold 12 oz and is coated with an eco-friendly epoxy which means it can hold any beverage of any temperature. The mugs have been hitting it out of the park, selling more than 15,000 over the course of 22 months to major leaguers and armchair athletes alike. 

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