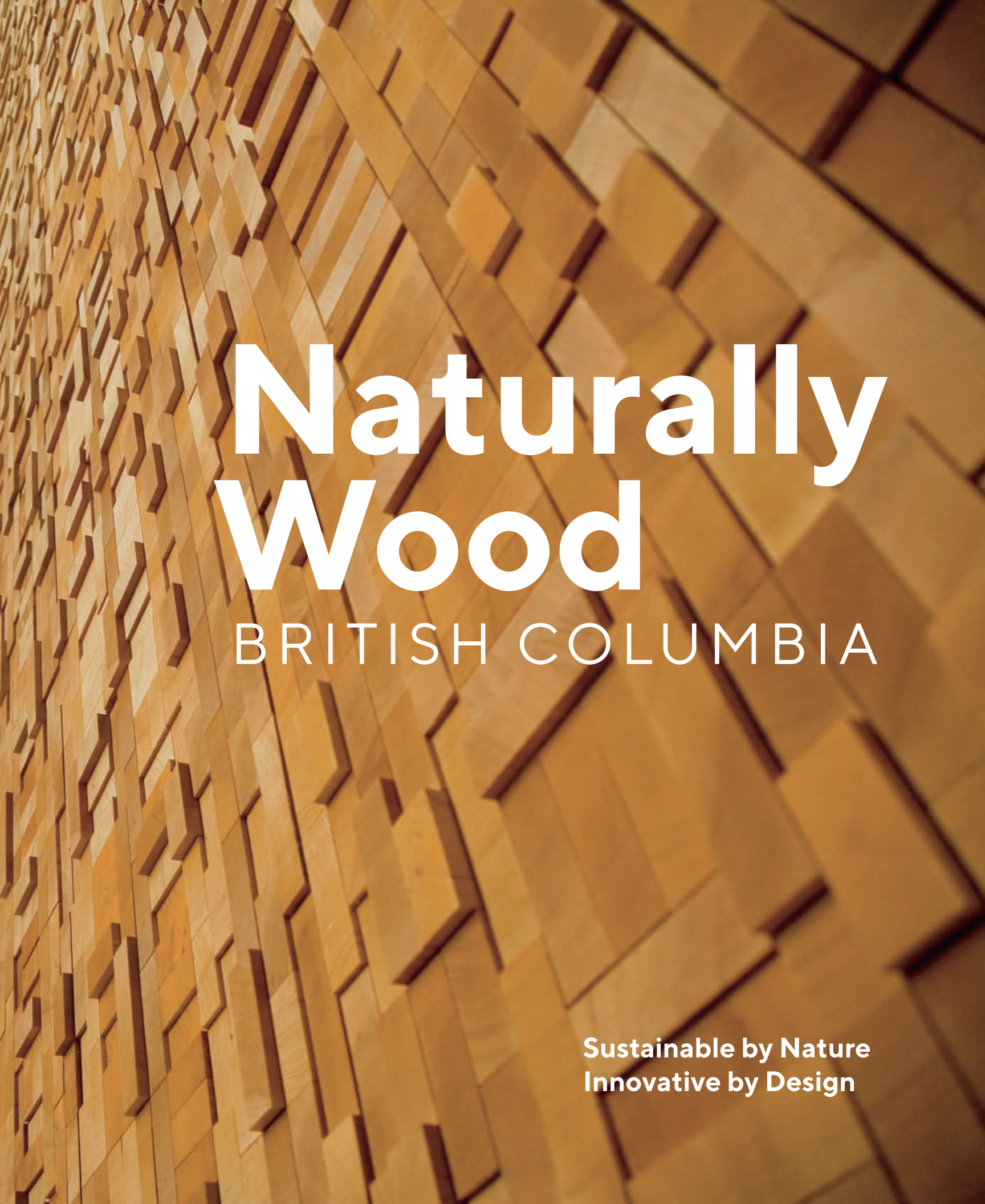


Naturally Wood

BRITISH COLUMBIA

Sustainable by Nature
Innovative by Design

Mass Timber's Mass Appeal

What Is Mass Timber?

The term mass timber can refer to a category of wood products, or a form of construction, that uses large, engineered wood products and systems to form the primary structure of a building. Mass-timber products complement light- and heavy-timber framing options and are commonly fabricated as panels, columns, and beams.

What Are the Benefits of Mass Timber?

Because it comes from forests that are sustainable and renewable, mass timber is an environmentally friendly building material. With its high strength and dimensional stability, it has a growing appeal to building professionals as an alternative to concrete, masonry, or steel in many building types. Hybrid construction pairs the high strength-to-weight ratio of mass timber with concrete and/or steel to create a cost-effective and sustainable building system.

What Are the Different Types of Mass-Timber Products?

Cross-laminated timber (CLT)

CLT is an engineered product consisting of layers of dimension lumber (usually three, five, or seven) oriented at right angles to one another and then glued to form structural panels.

Dowel-laminated timber (DLT)

DLT is a mass-timber panel product created by stacking dimension lumber together on its edge, friction-fit together with hardwood dowels. DLT is the only all-wood mass-timber product with no metal fasteners, nails, or adhesives.

Glue-laminated timber (glulam)

Glulam is composed of dimension lumber pieces bonded together with durable, moisture-resistant adhesives. The grain of all laminations runs parallel with the length of the member.

Laminated strand lumber (LSL)

To make LSL, thin strands of wood are aligned parallel to the length of the member, glued under pressure, and then machined to consistent finished sizes.

Laminated veneer lumber (LVL)

LVL is made of dried softwood veneers, glued together so that the grain of each veneer is parallel to the length.

Mass plywood panel (MPP)

MPP, sometimes dubbed "super plywood," consists of several layers of wood veneer glued and pressed together in alternating directions of grain.

Nail-laminated timber (NLT)

NLT is created by stacking dimension lumber together on its edge and fastening it together with nails or screws. It can be site built or fabricated in panels off-site.

Parallel strand lumber (PSL)

PSL is manufactured from veneers that are clipped into long strands, laid in a parallel formation, and then bonded together with an adhesive to form the finished structural member.

Adapted from Perkins+Will's *Wood 101 and Mass Timber Pocket Guide*

DIMENSIONS MAY VARY BY MANUFACTURER

CROSS-LAMINATED TIMBER

LAMINATED VENEER LUMBER

DOWEL-LAMINATED TIMBER

MASS PLYWOOD PANEL

GLUE-LAMINATED TIMBER

NAIL-LAMINATED TIMBER

LAMINATED STRAND LUMBER

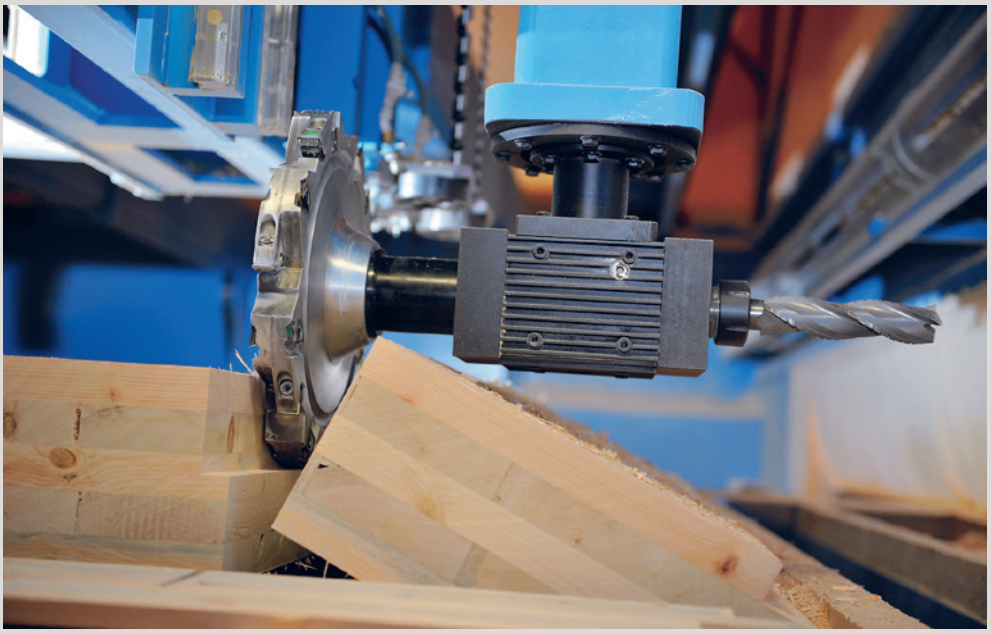
PARALLEL STRAND LUMBER

ESSAY

Timber Tech

Chronicling the technological advances in British Columbia's wood industry

BY JIM TAGGART



CLT fabricated using CNC technology.

The Wood Innovation Research Lab at the University of Northern British Columbia gives much-needed space to test and research state-of-the-art building systems.

In many countries, wood was the first building material, chosen for its strength, versatility, and workability. In B.C., archaeologists have dated the remains of an Indigenous pit dwelling at X̱á:ytem (Hatzic Rock) to at least 5000 BC. The site, eighty kilometres east of Vancouver, was designated in 1992 as a national historic site of Canada for its spiritual value to the Stó:lō Peoples. Pit dwellings employed simple log construction, but over the centuries, more sophisticated forms of wood building were developed and refined. Impressive handcrafted post, beam, and plank longhouses were much in evidence when the first Europeans arrived in the late eighteenth century.

European settlers introduced other hand-building techniques, including the squared-log construction popularized by the Hudson's Bay Company. Then, in the late 1800s, things began to change with the mechanization of sawmills and the introduction of mass-produced nails. Light-wood-frame construction became the norm for smaller buildings, while post-and-beam construction, using nail-laminated decking and simple iron- or steel-plate connections, became the standard for larger ones. Historic examples of the latter—precursors to the recent mass-timber movement—can still be found in Vancouver's Gastown.

The industry grew over the next century, driven by an increasing population and rail and road connections to new markets, but little changed technologically. Notable exceptions were the introduction of plywood, first manufactured in B.C. in 1913; and glue-laminated timber (glulam) beams, first manufactured in North America in 1934 but not widely used in B.C. until after World War II. These were the first engineered wood products (EWPs). EWPs offer certain advantages over solid-sawn lumber, eliminating considerations such as shrinkage due to changes in moisture content, size limitations, and variable strength due to knots and splits.

In the 1970s and '80s, new EWPs were developed, beginning a new era in timber engineering and generating an expanded understanding of the potential of wood structures. EWPs are created using veneers, strands or smaller sections of wood glued together and formed into panels or beams—with dimensions limited only by the size of the press and the constraints of road transportation.

The manufacturing process eliminates defects, improves dimensional stability, and enables larger spans.

Most notable of these EWPs is parallel strand lumber, a beam product developed in B.C. that has been used in many large buildings including the University of British Columbia's (UBC) Forest Sciences Centre and Surrey's Central City. Another new EWP was laminated strand lumber, a large-scale panel product used in projects such as Gilmore SkyTrain Station and North Vancouver City Hall.

B.C.'s architects, engineers, and fabricators are keeping pace with international innovations, importing new, highly efficient connectors from Europe. These connectors provide engineers with alternatives to the simple steel plates that were the default solution for decades. European connectors offer a variety of solutions applicable to different load conditions. The advantage is superior performance, which is achieved through more careful attention to the unique properties of wood, including its different strengths parallel and perpendicular to grain and the greater strength achieved by spreading the load across the fibrous structure, rather than concentrating it at a single point. Some of these connectors are variations on bolts, pins, and screws, while others require complex yet highly precise machining of joints.

These latter types are best accommodated using a computer numerical control (CNC) machining process. The introduction of sophisticated CNC machinery, and the 3-D digital models used to instruct them, constitutes a significant technological advancement in contemporary wood building technology. CNC machines can also be used to cut, rout, and drill wood members of all shapes and sizes with unprecedented speed and accuracy.

In 2001, B.C.'s first CNC machine fabricated structural wood products for the Saulteau Community Centre and then the Prince George Airport, both of which feature glulams machined to an elliptical cross-section. Digital fabrication is now used by at least four timber fabricators in British Columbia. All four companies have worked extensively in international markets, designing and prefabricating structures of all types, from custom houses to large commercial projects.

The speed and precision of CNC fabrication can save a great deal of time and expense on site by bringing multiple operations into the factory. This can include pre-drilling all holes for mechanical and electrical systems, and pre-installing connections. More and more buildings are being created as an entire "kit of parts" so that site assembly becomes similar to children's building blocks—but on a grand scale.

This analogy has become more appropriate since the arrival of cross-laminated timber (CLT) in British Columbia. Constructed much like plywood, with alternating layers of small dimension lumber laid up in panels up to eight feet wide, forty feet long, and twelve inches thick, CLT has the capacity to displace other materials for large-scale commercial projects, given its smaller carbon footprint and environmental advantages. B.C. companies began manufacturing CLT in 2011, initiating a new phase of the revolution in wood building technology.

To maximize the time and cost advantages of building large structures in engineered wood, design and construction professionals engage in an integrated process in which entire buildings are constructed as virtual 3-D models, providing the opportunity to optimize building systems, identify and eliminate conflicts that might otherwise arise in the field, and even follow the construction process in the virtual world before breaking ground on site. This process was employed to great effect in the eighteen-storey Brock Commons Tallwood House at the University of British Columbia.

Prefabrication can be applied to structural members such as posts and beams; to building elements such as roofs and walls; or even to volumetric modules. Some of them, like the roof for the visitor centre of the VanDusen Botanical Garden, are extraordinarily complex. Increasingly, roof and wall panels are being designed to meet the rigorous Passive House energy conservation standard, such as at the Audain Art Museum in Whistler, or the Bella Bella Staff Housing project, which takes advantage of volumetric prefabrication, including fully finished modules. Prefabrication by B.C. companies is increasingly being used to construct highly repeatable buildings, such as residential dormitories and hotels.

Over the past twenty-five years, British Columbia's industry has embraced the emerging technologies of mass-wood design and construction and created a remarkable series of demonstration projects, including high-rise buildings and long-span structures. The Richmond Olympic Oval has a wood roof that covers a vast area with no interior support, while the Wood Innovation and Design Centre in Prince George is a thirty-metre-high academic and office tower that contains no concrete between the ground-floor slab and the mechanical penthouse.

Over this same time, old technologies like nail-laminated timber have been updated and revived in projects such as public transit stations and modern office buildings, and new products have been introduced, such as dowel-laminated timber, a panel product that uses dowels to join laminations, making it easier and safer to cut and shape. We are seeing a growing list of precedent-setting innovations in the province, such as the world's longest-spanning timber catenary roof crowning Grandview Heights Aquatic Centre, or the first-of-its-kind CLT cantilevered staircase in UBC's Earth Sciences Building.

Not far from UBC's gravity-defying CLT staircase is the Centre for Advanced Wood Processing at UBC, a national centre for education, training, and technical assistance for the wood-products manufacturing industry. Home to cutting-edge training and robotic technology, the centre is helping fuel the next generation of professionals and entrepreneurs who will come up with further innovations and breakthroughs. This includes training in product development and wood finishing, as well as company-specific in-plant training. Similarly, the non-profit firm FPInnovations supports innovators through practical research in a variety of areas ranging from forest operations and wood products manufacturing to the performance of advanced wood building systems. This includes real-life seismic testing and validation of products and systems for projects such as the Earth Sciences Building, the Wood Innovation Design Centre, and Brock Commons Tallwood House.

With a combination of enterprise and technology, the B.C. wood industry has developed a depth and breadth of expertise in modern mass-wood construction that firmly positions it as a world leader.

MULTI-FAMILY RESIDENTIAL & ACCOMMODATION

Wood's Home Advantage

Through advancements in construction technology, modernized building codes, and a demand for sustainable design, wood is proving to be a viable and effective material for a growing range of residential buildings. Podium wood-frame designs and hybrid mass-timber construction have enabled B.C. industry to take wood buildings to new levels—eighteen levels, in fact, with the construction of Tallwood House at the University of British Columbia's Brock Commons, the tallest hybrid wood structure in the world when it was completed in 2017.

As in many parts of North America, the demand for affordable housing in B.C. is increasing, and wood is the material of choice to add value to homes. Whether light-frame wood, hybrid, or mass-timber construction, all can deliver safe, comfortable, quality buildings. Wood is well suited for economical and timely construction in hard-to-reach remote locations, such as Vancouver Coastal Health's staff housing in Bella Bella and tight urban sites in Metro Vancouver. And modular prefabricated wood technologies can speed up construction schedules and reduce overall construction costs, as was the case when Trinity Western University in B.C.'s Fraser Valley built a wood-frame five-storey student residence in just nine months.

Along with affordability, wood provides several other benefits for multi-family residential and hotel construction: wood-frame and timber buildings can flex, absorbing and dissipating energy when subjected to earthquakes. When equipped with firewalls, automatic sprinklers, and fire detectors, wood-frame is proven to be as fire safe as other forms of construction. At the same time, wood structural systems have a high building-volume-to-surface-area ratio, allowing for generous interiors even with space constraints that require tall, compact designs. As a natural insulator, wood offers thermal advantages over concrete or steel. And finally, of course, there's wood's unique aesthetic beauty and visual warmth that British Columbians are so at home with.

Brock Commons Tallwood House

King Edward Villa

Vancouver

This six-storey mixed-use residential project is located on a major commercial thoroughfare in East Vancouver and offers seventy-seven rental units with easy access to transit and nearby shopping. The building's structure is composed of one level of underground parking, one storey of retail space in concrete construction, and five storeys of rental apartments, prefabricated in light-wood-frame construction.

The site was exceptionally tight, with minimal setbacks on the front and sides, and a small rear yard for storage and staging. Access for construction vehicles was restricted to a single twelve-metre-wide laneway overhung by a large tree. In response to these constraints, wood-frame components, including floor, wall, and roof panels, were prefabricated off-site. Using a 3-D model, each element was given a unique code corresponding to a specific location in the building. Components were delivered on a just-in-time basis, minimizing site storage and road closures. The accuracy of the model meant that wall elements had their stud spacing precisely aligned from one floor to the next. This facilitated the rapid installation of electrical, mechanical, and plumbing services, resulting in a cleaner site and shorter construction time at a competitive cost.

OWNER Richard Wong
ARCHITECT GBL Architects
STRUCTURAL ENGINEER Bryson Markulin Zickmantel
COMPLETION 2017 **SIZE** 5,405 m^2

The Heights

Vancouver

As Canada's largest building to earn Passive House certification—a rigorous, ultra-high standard for energy efficiency—The Heights will incur heating and cooling costs that are 80 to 90 percent less than those of a standard building, an attractive benefit for owners who have to cover operating costs over the facility's lifetime. This mixed-use project, with five storeys of light wood-frame on one storey of concrete, was built under the City of Vancouver's Rental 100 Program, an initiative that offers developers increased density in exchange for operating the building as rental apartments for a period of sixty years.

Located in the Hastings–Sunrise neighbourhood of East Vancouver, the building features a highly insulated and airtight envelope, triple-glazed windows, heat-recovery ventilation, and a highly efficient air exchange for a healthy indoor environment. Over the long term, the increased capital costs of providing additional insulation, high-performance windows and doors, as well as other measures, can be offset by the reduced size and cost of mechanical equipment and the savings in operating energy.

In addition to being the most economical construction material for this size and type of building, wood is ideal for Passive House construction. Being a natural insulator, it minimizes thermal bridging and contributes positively to the overall performance of the building envelope. The Heights sets a new standard in occupant comfort and energy efficiency for rental buildings in B.C.

OWNER 8th Avenue Development Group
ARCHITECT Cornerstone Architecture
STRUCTURAL ENGINEER Weiler Smith Bowers
COMPLETION 2017 **SIZE** 5,600 m^2

Winning with Wood

How wood is boosting affordability, value, and innovation

BY KERRY GOLD

The Heights
Wood is the most economical construction for this size and type of building. The Heights sets a standard in occupant comfort and energy efficiency for rental buildings in B.C.

Library Square
OWNER Thompson-Nicola Regional District and TriCity Contracting (BC) Ltd.
ARCHITECT JM Architecture Inc.
STRUCTURAL ENGINEER Siefken Engineering Ltd.
LOCATION Kamloops

Project manager Paul Warwick is proud of King Edward Villa, a seventy-seven-unit rental project in East Vancouver that Performance Construction built—it's six storeys high and was built entirely using prefabricated wood-frame construction. It was a pioneering project, launched not long after city building code amendments increased the allowable height of wood-frame residential construction to six storeys. Prior to the 2009 change, only four-storey wood-frame buildings were allowed in B.C.

More multi-family developers are discovering that the innovative use of wood and mass-timber construction doesn't just save money, it can be an advantage that sets you apart in a sea of condos that begin to all look the same. Increasingly, both buyers and renters are placing importance on organic materials, sustainability, and warm, inviting interiors—all areas where wood construction excels. Wood can offer performance and thermal benefits, adding to energy efficiency and occupant comfort, while at the same time offering aesthetic warmth and a visual selling feature.

In the case of King Edward Villa, Warwick and his team introduced double-insulated prefabricated walls and floor trusses to the project. Those techniques boosted energy efficiency significantly and helped the project target LEED Platinum certification, all the while keeping costs down. "We made the case to the owner that if we built a more efficient building with a really efficient envelope, they would have very low operating costs, because a person renting out almost eighty apartments is definitely looking to cut back as much as they can on their energy use," says Warwick. "We now have a year and a half of performance data, and the numbers are really good," he adds. "A small, six-hundred-square-foot apartment

King Edward Villa
Off-site wood prefabrication reduced completion to just two months for these mixed-use rental apartments, resulting in a double-digit cost savings and a tight, more precise structural fit.

costs less than one hundred dollars a year to heat. So it's very impressive." His clients are increasing looking for sustainability and energy efficiency. "These buildings use about 50 to 60 percent less energy than is mandated currently by energy codes."

King Edward Villa was part of the City of Vancouver's Rental 100 program, an initiative to increase the stock of affordable housing in the city. Cost savings and energy efficiency can benefit renters, and are a boon for developers who must keep starting rents below certain thresholds to participate in the program.

Warwick is at work on another mid-rise that follows the exact same wood-frame template, at West 35th Avenue and Quebec Street in Vancouver. It is a five-storey condo building with eighteen units, and their anticipated energy savings is expected to boost their value. "Properly built, wood-frame is a much more efficient building thermally, and also very sound proof," says Warwick.

GBL Architects project manager Greg Ellingson says a significant amount of time was spent up front, planning the template for the manufacturer of the prefabricated components. "It took a bit longer planning wise, but once it went out, it went up fast," he says.

Warwick forecasts that in another decade the majority of buildings will be constructed out of prefabricated wood components, based on cost benefits and efficiency alone. "In six-storey mid-rise construction, I believe a wood-frame structure is the most cost-efficient way to build a building," he says. "Concrete has its merits, but it's very expensive. There is a premium in both cost and time to build a concrete structure as opposed to a podium wood-frame building," says Warwick. A typical forty- or fifty-unit concrete building takes about five thousand metric tons of concrete, and an enormous amount of steel is used to reinforce it, while a five-storey eighteen-unit wood-frame building can take as little as two months to put up. A concrete equivalent would take two or three times as long, says Warwick.

Wood construction has long been a differentiator for Vancouver mid-rise developer Adera Development Corporation, but the company took a bigger leap into mass-timber prefabricated construction with its Virtuoso building at the University of British Columbia's Wesbrook Village. After the success of Virtuoso, in 2018, Adera launched North Vancouver's first mass-timber development, a 179-unit six-storey multi-family project called Crest. Before construction had begun, the developer had already sold 150 units of the mid-market project.

Another way the developer stands out is in their use of cross-laminated timber (CLT) to block sound transference between floors. Adera's patented wood technology—which they call "Quiet Home"—blocks sound that is airborne, such as human voices, as well as sound created by impact, such as furniture dragged across a floor.

Because seeing is believing, their showroom featured a slab of CLT that ten people could jump up and down on, in order to show its strength. Eric Andreasen, vice president of marketing and sales at Adera, says, "we trademarked the Quiet Home system because for the longest while, noise concerns had been top of the list for our customers. We substituted the concrete slab between each floor with a wood slab, and showed it performs better than concrete."

And prefabricated panels mean his company can build far more rapidly than they had with traditional construction. There are greater efficiencies for both the developer, the community, and the consumer. "There are a whole bunch of benefits, to the environment, to the community, and in time savings, that can be captured by building with CLT," says Andreasen. "Those savings make a difference to the consumer at the end of the day."

Another project that saw savings from creative use of mass timber is the Penticton Lakeside Resort, which used glue-laminated timber and CLT to maximum effect in its newly expanded hotel. A major cost-saving measure of mass timber is that it's five to six times lighter than concrete. "So they saved over a million dollars by not having to install piles," says Stephen Tolnai, vice president of sales and marketing at Structurlam Products, whose plant is based in Penticton. "And now they have a better building that is sustainable and beautiful—they exposed all the materials—and not only did they save time, they saved a significant amount of money."

Brannigan Mosses, director of regional sales and marketing at the resort, says the new seventy-room wing is a major draw for guests wanting an "elite experience." The mass-timber design is attracting people who are environmentally conscious and interested in sustainability, including tourists visiting the local wineries, mountain bikers, and even a few dignitaries. "I think it gives us an opportunity to cater to people who are looking for something just a little bit different," says Mosses.

Camas Gardens Supportive Housing

Victoria

This modest, attractively modern, light-wood-frame housing near downtown Victoria proves that publicly funded projects can be cost effective and still deliver on quality and aesthetics.

In partnership with BC Housing to deliver integrated services, Camas Gardens provides a contemporary and comfortable facility along with forty-four modern units for individuals who are homeless or at risk of being homeless.

The project supports an integrated service model and takes full advantage of the benefits of prefabricated wood-frame construction to deliver safe and affordable housing.

The exterior wood-frame walls were assembled off-site to reduce time and construction waste. The well-being of residents was top of mind, with a wood-frame double-wall system providing durable fire protection and improved safety in the event of an earthquake. The palette of natural materials and western red cedar cladding complements the site's landscaping and park-like courtyard, all of which contribute to a calming and supportive environment.

OWNER Pacifica Housing Advisory Association
ARCHITECT Low Hammond Rowe Architects
STRUCTURAL ENGINEER Read Jones Christoffersen
COMPLETION 2011 **SIZE** 3,166 m^2

Bella Bella Staff Housing

Bella Bella

When fire destroyed the existing staff housing for the hospital in Bella Bella, a small, remote community on B.C.'s central coast, the health authority faced a daunting challenge—how to build a replacement facility quickly and economically in a community with a labour shortage, a hard-to-reach site, and a challenging climate.

The answer was to use modular prefabrication. Each module was fitted out and finished to the greatest extent possible before the entire building was shipped to Bella Bella for installation. Site work was limited to overbuilding on the existing foundation, craning the modules, final envelope and weatherproofing, and constructing of the wood decks and stairs. Prefabrication, which took only forty-five days, was carried out by Metric Modular in Agassiz, 125 kilometres east of Vancouver. The modules were trucked to the Fraser River, loaded on a barge, then delivered to the site and lifted into place to create a single building comprising six two-storey, two-bedroom units. Walls and floors were constructed with standard spruce–pine–fir dimension lumber, while structural plywood and oriented strand board were used for the roof, wall sheathing, and subfloor. Cedar was used for the exposed post and beams on the rear decks.

For the first time in Canada, a modular building was constructed to the ultra-low-energy Passive House standard, reducing the energy required for heating and cooling by approximately 90 percent compared to conventional construction. The workers at Metric Modular were trained in the required construction techniques and testing was carried out in the factory before delivery. Local workers were trained in the assembly of the modular structure.

OWNER Vancouver Coastal Health
ARCHITECT Mobius Architecture Inc.
STRUCTURAL ENGINEER Canstruct Engineering Group
COMPLETION 2015 **SIZE** 500 m^2

The Merits of Modular

Cutting-edge construction, limited assembly required

BY DAVID WYLIE

Jacobson Hall, Trinity Western University, under construction.

Metric Modular built the two-storey Burns Lake–based Key-oh Lodge on a compressed timeline by constructing 30 prefabricated wood-framed modules and using wood harvested from the community's own forest.

Key-oh Lodge
OWNER Burns Lake Band
ARCHITECT Boni-Maddison Architects
STRUCTURAL ENGINEER Canstruct Engineering Group
LOCATION Burns Lake

Modular construction is gaining a reputation as an affordable and efficient way to build multi-storey residential and commercial projects. While the type of construction is not entirely new, technological advances are making it a game changer for affordable housing. "Modular construction is at the forefront of innovative off-site construction techniques," says Craig Mitchell, director of innovative solutions at Metric Modular. "Repetition in the projects lends itself well to what we do."

The head office for Metric Modular, in Agassiz, B.C., a short drive east of Vancouver, is itself an example of what can be done with modular construction. The high-quality finishes and oblique roof offer a modern perspective on the formerly underused construction method. The company has a second manufacturing facility in Penticton. The pair of 8,350-square-metre facilities employ about one hundred people each—though when business is on a significant uptick, there can be up to 160 people in each factory.

"We're a wood-first company. We use more wood in our buildings than conventional construction," says Mitchell, explaining that the company "doubles up" on wood. "We're putting box upon box upon box. The floor, the walls, the roof, they all have to be transported down the road. With conventional construction, the roof of the suite is the floor of the suite above. With our method, this leads to a more rigid building and a higher sound attenuation between rooms."

The facilities operate like an assembly line, piecing each module together in about twenty days, from the first wood cut to the final fixtures. The repetitive floor plans of buildings like hotels, condos, and dormitories are a perfect fit for off-site modular construction. The climate-controlled environment in the facilities means consistent quality at all times, explains Mitchell. "We are building at ground level in a well-lit, beautiful working environment," he says. "We're not working five storeys in the air on the side of scaffolding in the pouring rain at four o'clock on December 15th while the wind and rain is driving sideways and you're trying to install a window."

With Metric's manufacturing techniques, most employees don't need specific certifications. Metric president Stephen Branch

says a strong presence in the local community—and local market—is key to the business' success. "You can't go to the world if you don't have a local foundation. If our core is not strong, the export market is irrelevant," he says.

That approach is having a positive impact on communities, both by providing more affordable housing options and through local, stable employment. Metric's workforce is diverse, including about 10 percent First Nations workers. "It's more reflective of being active members of the communities in which we work," says Mitchell, adding the company has had successful training programs with local First Nations communities.

Branch says the company is now focused on finding the right customers, those who understand the benefits and the business reasons to go with wood-frame modular. "It fits great in the right area," he says. "It's all about reducing the pain points. The more you can do here [in the manufacturing facility], the easier it is on-site. The idea is to assemble as much as possible, not construct."

Modular construction does have some convincing to do in the marketplace. Part of the challenge is showing people the quality, says Tim Epp, director of manufacturing at Metric. "It's a very big misconception when people think of modular as cheap or flimsy," says Epp. "Typically, these are engineered heavier than any site-building. We have to meet the same building codes that everybody else has to meet, and we have to be engineering these modules for site transport and craning."

The company has produced numerous examples of cutting-edge design. Metric partnered with BC Housing and the Vancouver Organizing Committee for the 2010 Olympic and Paralympic Winter Games to design and build 320 temporary accommodations used by about six hundred officials in the Whistler Athletes' Village. Those facilities were repurposed into housing as a legacy project. After the Games, Metric stacked and connected the units. "It takes a lot of planning," says Epp. "All of the plumbing and electrical required for this use had to be incorporated and hidden in the walls. Structurally, we had to build for both purposes and meet all of the codes."

Canada's first ever multi-unit modular Passive House, in Bella Bella, is an example of the energy efficient, innovative work that Metric specializes in. The staff housing project had to be built in seven months—the kind of accelerated timeline with which Metric shines. The company managed to complete the project on time, no small feat in a remote location like Bella Bella, where there is only boat and air access. The modules were built in Agassiz and trucked to a barge that transported them to a specially built beachhead.

Planning ahead is one of the main ways Metric creates cost and time efficiencies. All of the drawings are done ahead of time and all of the material is purchased before construction begins. "A lot of time and energy is put into planning how we're going to build it before we even start. That means the timeline is shorter, the amount of trucks, material, and people working on site is a lot less. There is a lot less impact to the area. Especially if you're building in a densely populated area—instead of being there for a year, you're there for five months," says Epp. "The second the site foundation is done, we can start craning finished modules on to the site, and then it's just a matter of interconnections, some of the exterior, and you're away to the races. You can literally take half the time out of the process."

Half an hour from their manufacturing plant in Agassiz, a forty-six-unit modular supportive housing residence is underway in their neighbouring city of Chilliwack. With homelessness rising in urban centres and smaller communities, the speed and efficiency of modular building has proven imperative, helping B.C. cities such as Chilliwack to find effective, long-term solutions for their community residents in need.

Metric Modular has become one of the largest manufacturers of modular wood-frame structures in North America. With over twenty modular housing projects under their belt in B.C., they are proving the case for modular wood buildings as affordable, fast, and high-quality solutions for the future.

Metric Modular assembled 90 prefabricated wood-framed modules, providing Trinity Western University with a five-storey student residence 50% faster than conventional construction.

Jacobson Hall
OWNER Trinity Western University
ARCHITECT BR2 Engineering
STRUCTURAL ENGINEER Canstruct Engineering Group
LOCATION Langley

Brock Commons Tallwood House

Vancouver

This eighteen-storey residential tower became the world's tallest mass-timber hybrid building when it was completed in 2017, and is now home to over four hundred students. While the wood structure makes the building extraordinary, in all other respects the design is deliberately straightforward, demonstrating that timber construction can be a highly efficient, safe, repeatable, and reliable approach to high-rise construction.

The fifty-four-metre-high structure comprises an innovative and efficient system of Douglas-fir glue-laminated timber (glulam) posts that directly support cross-laminated timber floor panels without the need for downstand beams. The entire mass-timber superstructure, including the prefabricated exterior wall panels, with wood-fibre-and-resin cladding, was erected in just over two months.

The seventeen storeys of mass timber sit on a single-storey concrete podium. The mass timber components are encapsulated in drywall for added fire resistance, this being the most expedient approach to ensure quick approvals and address tight schedule constraints. Inside the building, warm wood finishes are used on the ground floor and in the social and study spaces. Glulam columns are left exposed in the upper level amenity lounge, hallways feature wood doors, and elevator lobbies are finished in the same wood-fibre cladding panels used on the exterior.

OWNER University of British Columbia
ARCHITECT Acton Ostry Architects, Inc.
STRUCTURAL ENGINEER Fast + Epp
COMPLETION 2017 **SIZE** 15,120 m²

HOW'D THEY DO THAT?

Brock Commons Tallwood House

A closer look at how to build an 18-storey timber high-rise

Towering above the University of British Columbia's (UBC) Point Grey campus, Brock Commons Tallwood House is one of the tallest contemporary mass-timber hybrid structures of its kind in the world. Standing at 18 storeys, the innovative wood-hybrid building is home to more than 400 university students. Brock Commons showcases mass timber as a practical building material for high-rise construction.

Building Innovation

Tallwood House is one of over 20 UBC buildings and structures with mass-timber elements. It has a hybrid structure composed of mass timber, concrete, and steel.

Safety First

Structural components of Tallwood House are encapsulated with 3 or 4 layers of fire-rated drywall. Encapsulation enhances mass timber's natural fire performance, as it chars on the outside without impacting strength for a prolonged period of time. Concrete and mass timber work together to resist seismic forces.

Mass Timber

Large, engineered wood elements manufactured off-site for quick on-site installation

CLT

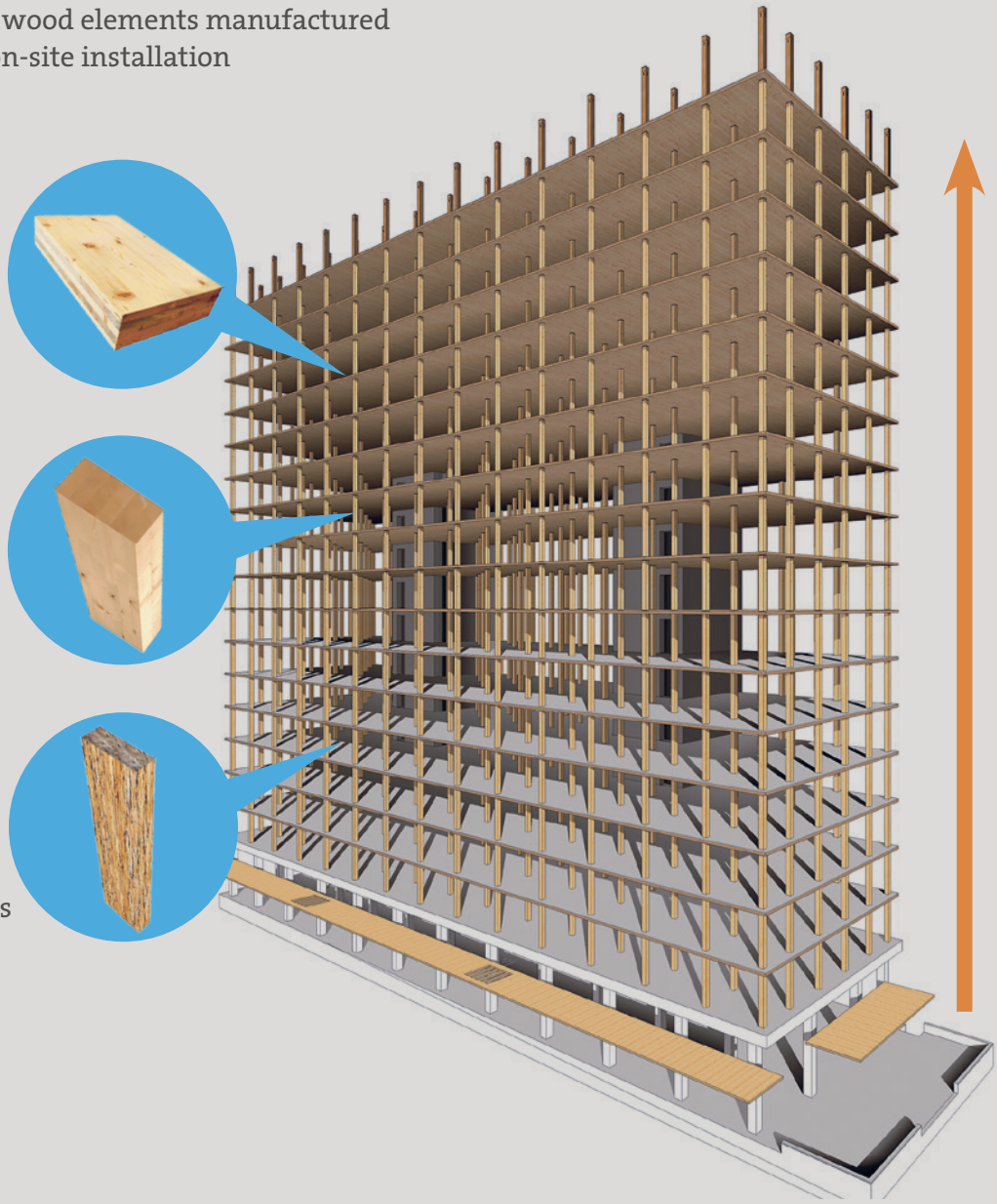
Cross-laminated timber used for levels 3–18 floor slabs

Glulam

Glue-laminated timber used for majority of levels 2–18 structural columns

PSL

Parallel strand lumber used for levels 2–5 central structural columns



Reaching Tall Heights Faster

MASS-TIMBER HYBRID STRUCTURE: 17 STOREYS PLUS CONCRETE PODIUM

CREW: ~9

TIME: 2 MONTHS FASTER THAN A COMPARABLE CONCRETE PROJECT

REDUCED: NOISE AND WASTE ON-SITE

Environmental Impact of Wood Use

Mitigated greenhouse gas emissions are equivalent to:

- 511 CARS OFF THE ROAD FOR A YEAR
- ENERGY TO OPERATE A HOME FOR 222 YEARS
- CANADIAN FORESTS GROW VOLUME OF WOOD USED IN 18 MINUTES

The Shore

North Vancouver

These five- and six-storey 359-unit residential condominiums, located on the north shore of Burrard Inlet, are all constructed in light wood-frame over a single-storey concrete parking garage. Many units have large balconies or terraces with views to the Burrard Inlet or North Shore Mountains.

The four buildings, which also include shared amenities such as a fitness room, hot tub, and yoga studio, are arranged around a generous courtyard that includes a fountain, a central plaza with table seating, and four sculptures by local artists.

Adera, the developer and construction manager for the project, took advantage of the multi-phase format to explore different methods of wood construction, optimizing the efficiency and performance of its residential buildings. The test-and-trial approach to the project advances wood-frame and mass-timber construction technologies for the region and demonstrates wood's advantages when it comes to prefabrication, moisture control, nail-laminated timber elevator shafts, and acoustic performance.

OWNER Adera Development Corporation
ARCHITECT Integra Architecture
STRUCTURAL ENGINEER London Mah & Associates Ltd.
COMPLETION 2017 **SIZE** 28,000 m^2

MONAD

Vancouver

Designed to increase the appeal of compact urban living, this innovative, systematized approach to infill development results in dwellings that are more like “sky houses” than traditional condominiums. Low-carbon construction, a high-performance building envelope, and on-site renewable energy enhance the sustainability of the project.

The four-storey mixed-use building, located in the Kitsilano neighbourhood, includes a ground-floor commercial unit of concrete construction below three floors of residential accommodation in factory–prefabricated wood-frame construction. The residential units are arranged around a vertical courtyard, giving each direct access from the outside. The courtyard also gives the units a double orientation, with exterior balconies, daylight, natural ventilation, and views in two directions. A compact car elevator frees up storage space on the basement level.

Off-site prefabrication of the building modules helped to control costs, accelerated on-site assembly, and minimized noise and disruption to neighbours during construction. The MONAD system uses open-sided modules that, with the addition of bridging panels of different lengths, can be adapted to infill lots of varying width. This also permits owners to configure their interior space to suit their individual needs, and offers the option of open-plan layouts.

OWNER Intelligent City
ARCHITECT Lang Wilson Practice in Architecture Culture
STRUCTURAL ENGINEER Fast + Epp
COMPLETION 2011 **SIZE** 1,171 m²

Penticton Lakeside Resort | West Wing

Penticton

Speed of construction, reduced building weight, and the cachet of a timber design convinced the owners of Penticton Lakeside Resort to use wood instead of concrete when expanding their waterfront resort. Situated on the south end of Okanagan Lake, an area popular with tourists and locals alike for its recreational activities, wineries, and fruit orchards; this six-storey, seventy-unit hotel sets a new standard for the use of mass timber in commercial and hospitality projects. The compromised soil conditions of the floodplain site meant that the reduced weight of mass timber compared to concrete lowered the construction costs significantly. Each floor consists of seventy locally produced cross-laminated timber (CLT) panels, making this the largest mass-timber project in the region.

The exposed timber structure—made of a Douglas-fir glue-laminated timber (glulam) post-and-beam frame with CLT floors, roof, shear walls, stairwells, and stairs—envelops visitors with a sense of warmth and modern rusticity. Glulam was also used to build a dramatic nine-metre-high wall using a double lattice of beams to frame the windows. The floor panels were loaded on the truck at the factory not far from the site and lifted by crane and lowered into place in a single movement. Each floor took an average of one week to install and the entire building was completed in just under a year, in time for the resort's busy summer season.

OWNER RPB Hotels & Resorts
ARCHITECT HDR | CEI Architecture Associates, Inc.
STRUCTURAL ENGINEER Read Jones Christoffersen
COMPLETION 2017 **SIZE** 4,665 m²