Wood Design & Building®

Fall 2016 — Number 74

Six dollars

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Unitarian Universalist Fellowship of Central Oregon Church
Cedar interior enhances acoustics

Tedd Benson
Love of timber framing shapes a revival

NLT and DLT
Dowel laminated timber: next-gen NLT

CANADA'S REPUTATION TAKES TOP SPOT

Looking up: Tall Wood Buildings Around the World

Holz8	Cenni di Cambiamento	Forté	Brock Commons	Treet Building	Bridport House
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Above and **on the cover:** UNITARIAN UNIVERSALIST FELLOWSHIP OF CENTRAL OREGON CHURCH, BEND, OR. PHOTO CREDIT: Lara Swimmer Photography

On the Cover

Departments

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A 70-ft. NLT roof panel
PHOTO CREDIT: StructureCraft

Housing Strategies

I want to talk about affordable housing this issue, or rather the lack of it. It's a weighty, difficult topic to tackle in a mere 400 words but I'll try.

A new report from The School of Public Policy at the University of Calgary, examines how to create an effective housing strategy in Canada. A considerable momentum has developed around the need for a national affordable housing strategy. The focus, however, is almost always on how average families are increasingly unable to afford a detached home. But for those families with incomes well below average, it means the danger that they may not be able to afford any housing at all; that they could become homeless.

The report examines affordability of housing in each of Canada's nine largest urban centers using data collected over 24 years, between 1990-2014. The data shows that the affordability of housing for the very poor is not, and has not always been, uniformly bad in all cities and for all family compositions. For example, in 2014, a couple with two children living on low income in Montreal, QC, could devote just 28% of income to renting a two-bedroom apartment while the same family, if living in oil-rich Calgary, AB, would have needed to spend just over twice that amount, 57%, of income on rent.

Any attempt to create a national housing strategy must not only account for a wide range of family types, income levels, and regional variables, but also be affordable for governments. Wood can play a role in this. Many of the wood projects I come across demonstrate the value wood can bring to a wide range of projects, from disaster relief shelters and reconstruction to housing for everyday living.

Japanese architect Shigeru Ban has been constructing high-quality, low-cost shelters for victims of disaster across the world for years.

In China, three award-winning but simple projects, The Pinch, The Sweep and The Warp, are earthquake reconstruction projects located in Yunnan Province. Built by students of architecture from The University of Hong Kong, the projects focus on how a single small structure can address several community needs at once. You can read more about The Pinch, The Sweep and The Warp in our forthcoming book *Celebrating Excellence in Wood Architecture: 2015-16 Wood Design Award Winners.*

And then there is Tedd Benson, whose mission is to make high-performance, high-quality, (detached) homes accessible and affordable. "If we can do that, it will be the achievement of my life," he says. "It might take longer than the years I have, but I'm okay with that."

The world is full of need. These are just three examples of the ways people are helping to meet those needs. There are some great multi-family housing solutions coming online, but if they're only able to meet the affordable housing needs of one segment of society, we've haven't yet succeeded in creating a successful housing strategy. Affordable housing for everyone is one of the greatest challenges before us, but it is also a great opportunity. My hope is that affordable, sustainable wood solutions will be part of the strategy to address the issue of affordable housing.

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

inspiration BOARD

WHAT I LEARNED THIS MONTH...

Lots of acronyms

Are you just learning about nail laminated timber (NLT)? Dowel laminated timber (DLT) is its next generation cousin. Both products support the prefabrication construction trend.

PHOTO CREDIT: Bensonwood

The tools may have changed but timber framing is alive and well

Tedd Benson says this is a pretty great time in timber framing. Following a North American hiatus in timber framing, there has been a relearning and reinvention as we adapt it to the realities of contemporary building and modern technology. And we can easily learn from anywhere in the world, any time in history.

PHOTO CREDIT: Andrew Interisano

We enjoy receiving awards as much as we enjoy giving awards

We're really proud of our recent EXCEL Award from Association Media & Publishing. Our *Celebrating Excellence in Wood Architecture: 2014/15 North American Wood Design Award Winners* book took gold in the General Audience Book category. Make sure you enter this year's awards! If you win, you're in the book!

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TABBIES 2015 Award Winner

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Kiosks

Kelly Townsend

Forget the little kiosk selling newspapers on the streets of any big city, its simple metal stand bowing under the weight of the merchandise. The following kiosks defy that convention, using innovative wood design to create engaging community spaces that are a feast for the eyes.

Chicago Horizon Pavilion's mass timber structure was designed to provide a wide area for community socialization. The structure includes a 56-sq.ft. flat mass timber roof.

London's Flower Kiosk has a creative external form, its undulating surfaces acting as a flower motif, a reference to microscopic 3D ridge patterns found across a flower petal's surface. A fitting title for a kiosk destined to sell flowers.

Story Pod, in Newmarket, ON, is a compact library made of plywood, coated with a dark finish to attract the attention of passersby. Its inviting open concept draws visitors in and encourages them to take or leave a book. Story Pod is a meeting place where community members can read and spend time together.

The East Village Kiosk is a travelling pod built of birch plywood ribs and Plexiglas. The Calgary Municipal Land Corporation uses it for public events and as a fun marketing/sales center for developers.

Ravelijn Kiosk is an information point and rest stop for visitors exploring the fort city of Bergen op Zoom in the Netherlands. Built of Accoya and set into the land, the kiosk sits on a historic brick foundation.

From a sturdy timber standing area to an artistically constructed wooden skeleton, all five kiosks allow visitors to take a moment out of the daily grind to stand back and enjoy the view.


1

2


3


4


5

1. Chicago Horizon
Architect: Ultramoderne
Location: Chicago, IL
PHOTO CREDIT: Tom Harris/Hedrich Blessing

2. Flower Kiosk
Architect: Archio
Location: London, England
PHOTO CREDIT: Charles Hosea

3. Story Pod
Architect: Atelier Kastelic Buffey Inc.
Location: Newmarket, ON
PHOTO CREDIT: Bob Gundu/Shai Gil

4. East Village Kiosk
Architect: MoDA, Modern Office Design + Architecture
Location: Calgary, AB
PHOTO CREDIT: Jamie Hyatt

5. Ravelijn Kiosk
Architect: RO&AD Architecten
Location: Bergen op Zoom, Netherlands
PHOTO CREDIT: Bastiaan Musscher

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THE LANGEBERG NIJMEGEN
BURO SBH ARCHITEKTEN

SDF - 4 years exposure

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The Langeberg Nijmegen Treatment Clinic in Nijmegen, the Netherlands, uses wood extensively to create a natural environment designed to improve patient treatment outcomes. Since their goal was to make people healthier, it seemed only natural for architects Buro SBH to choose Sansin's low-VOC Enviro Stains to protect the stunning wood exterior – enhancing the warm natural beauty of the Radiata Pine treated siding and proving that beauty and performance doesn't mean sacrificing healthier people and the planet.

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New Construction Codes Enable Six-Story Construction Across Canada

The 2015 edition of Canada's National Model Construction Codes, now known as Codes Canada, includes 600 changes. Among the changes are higher standards for automatic sprinkler systems that will accommodate the construction of six-story wood buildings, new design requirements for improving the accessibility of washrooms and stairs, and new requirements for flow rates in showers that will reduce water usage in buildings. The federal government has announced an additional $40 million over five years to integrate climate resilience into building design guides and codes in response to climate change. The additional funding will support the revised national building codes and building design guides that will be ready for adoption in 2020.

Call for Conservation and Community Partnerships Grant Proposals

The Sustainable Forestry Initiative (SFI) has announced its annual request for proposals (RFP) for the SFI Conservation and Community Partnerships Grant Program. Since 2010, SFI has awarded 85 grants worth more than $3 million to foster research and pilot efforts to better inform decisions about forests, and to build understanding of the importance of forests to communities. This new grant cycle will focus on helping to quantify the impacts of well managed forests on water, biodiversity, and the mitigation of climate change impacts. Grants are available to academic institutions, non-profit organizations and Indigenous groups. Applications will be accepted until October 10, 2016.

China Showcases Environmentally Friendly Products at Annual Fair

Exhibitors from across China will be showing off their latest environmentally friendly products and technologies at this year's China Yiwu International Forest Products Fair. The theme for this year's fair is "Share Green Practices" in categories that include Furniture & Accessories, Timberwork & Wooden Building Materials, Wood & Bamboo Handicrafts, Wood & Bamboo Daily Necessities, and Forest Food. Organizers say as the largest forest products fair in the world, it is the best platform in the Asia-Pacific region for boosting forestry-related business opportunities. The annual event is in its ninth year and is expected to attract 1,200 exhibitors, more than 100,000 visitors and deals worth an estimated US$ 603 million. The China Yiwu International Forest Products Fair will take place Nov. 1-4, 2016.

APA Releases New Yearbook

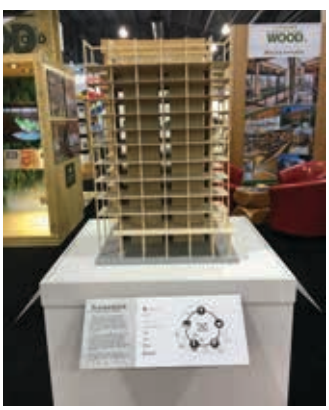
APA has released its *2016 Structural Panel & Engineered Wood Yearbook*. The yearbook includes an analysis of American, Canadian and global economics, focusing on factors that influence demand for engineered wood products across several market segments, as a basis for forecasting expected production over the next five years. The book also includes historical data on engineered wood production and covers topics such as residential construction in the U.S. and Canada, outlook and production statistics for structural panels (OSB and plywood), and North American imports and exports.

AWC Supports Formaldehyde Regulation

American Wood Council (AWC) has issued a statement regarding the use of formaldehyde in wood products. In response to the U.S. Environmental Protection Agency (EPA) finalizing regulations for the Formaldehyde Standards for Composite Wood Products Act, AWC President and CEO, Robert Glowinski, stated that his organization supported the legislation, which was consistent with the industry's commitment to the safety of its products. Glowinski added that implementing this rule essentially extends California's regulations nationwide, "creating a consistent system on how we regulate formaldehyde emissions for composite wood products manufactured in and imported to the United States."

New Standards for Architectural Woodwork

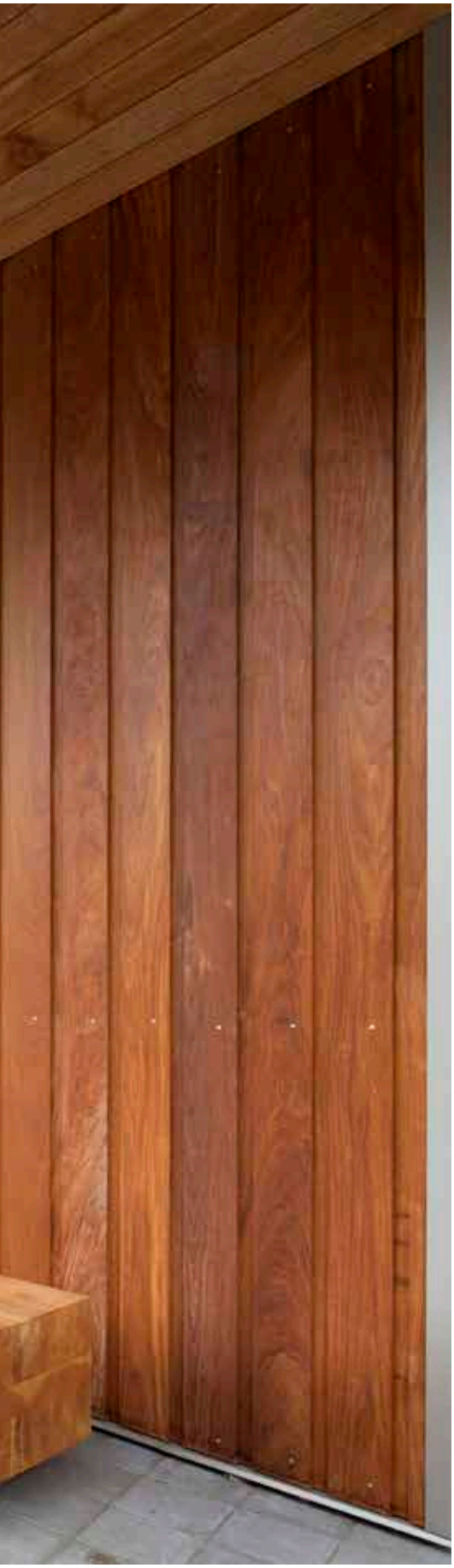
A new AWI/ANSI Standard for Architectural Woodwork is in development and will involve the collaboration of the Stairbuilders and Manufacturers Association (SMA) and the Architectural Woodwork Institute (AWI). Expert volunteers from SMA will author a draft ANSI/AWI/SMA Stair and Railing Section for the industry's next generation of architectural woodwork standards, which is one of many sections to be compiled under AWI's authority as an ANSI Standard Development Organization (SDO). Under the agreement, both associations will use the American National Standard Institute and AWI's approved standard writing procedures for creating the first voluntary industry consensus standard. AWI is working to involve other stakeholders in the architectural woodwork industry in the ANSI consensus process to provide an accredited definitive standard of quality for Architectural Woodwork.



Timber Innovation Act Advances Tall Wood Building Construction in U.S.

A senate bill that would establish a performance-driven research and development program to advance tall wood building construction in the U.S. is receiving strong support from The American Wood Council (AWC), American Forest Foundation (AFF), Binational Softwood Lumber Council (BSLC) and Southeastern Lumber Manufacturers Association (SLMA). The *Timber Innovation Act* also includes language allowing the Wood Innovation Grant program to support proposals to use and/or retrofit existing sawmill facilities in areas with high employment to produce mass timber materials. Recent advances in technology, engineering and safety have made it possible to build taller wood buildings using mass timber products. In the last five years, 17 buildings between seven and 14 stories have been built using mass timber construction globally.


3530
Whole Bowl



The Radiator

Building meets high demand for timber in commercial spaces

Portland, OR

SITE PLAN

The Radiator aspires to live up to the "20-Minute Neighborhood" model to support and help progress Portland's Climate Action Plan. These neighborhoods are places where residents have easy, convenient access to many of the places and services they use daily, including grocery stores, restaurants, schools, parks and work, without relying heavily on a car. They are characterized by a vibrant mix of commercial and residential establishments, all within a one-mile walking distance. They have higher concentrations of people and are designed with wide sidewalks, bike lanes and bus routes that support a variety of transportation options.

The Radiator is a five-story, 36,000-sq.ft. community-conscious building that reflects Portland's high standards, environmental values and culture. Ground floor retail overlooks an accessible 14,000-sq.ft. courtyard equipped with 123 covered bike parking stalls. Creative office spaces are located on floors two to four, and an office with a roof garden occupies the fifth floor. It is an attractive civic amenity made possible through partnerships with surrounding buildings, community organizations and Portland's regional government.

The building was the leader of a surge of mid-rise mass timber buildings constructed in the United States. Demand is higher than ever for the look and feel of timber construction in commercial spaces, and the Radiator is a contemporary version of a historical classic; its engineered timber beams and columns create interior spaces that are direct descendants of the huge timber warehouse buildings that remain popular to this day. The extensive use of wood throughout the project begins with the building's structure; gravity loads are handled through a system of glulam beams and columns, and light-framed lumber and plywood walls provide the structure's shear capacity. A thick timber decking is then used to create the structural floor diaphragm and exposed ceilings. Wood's light weight translates into an efficient, resilient and sustainable structural system. On each interior floor of the Radiator, the timber construction is put on display for the tenants' enjoyment. Beams, columns, and the underside of the floor decking are left exposed, and a raised floor system hides utilities and conduits, showcasing the building's dynamic blend of traditional and modern building techniques.

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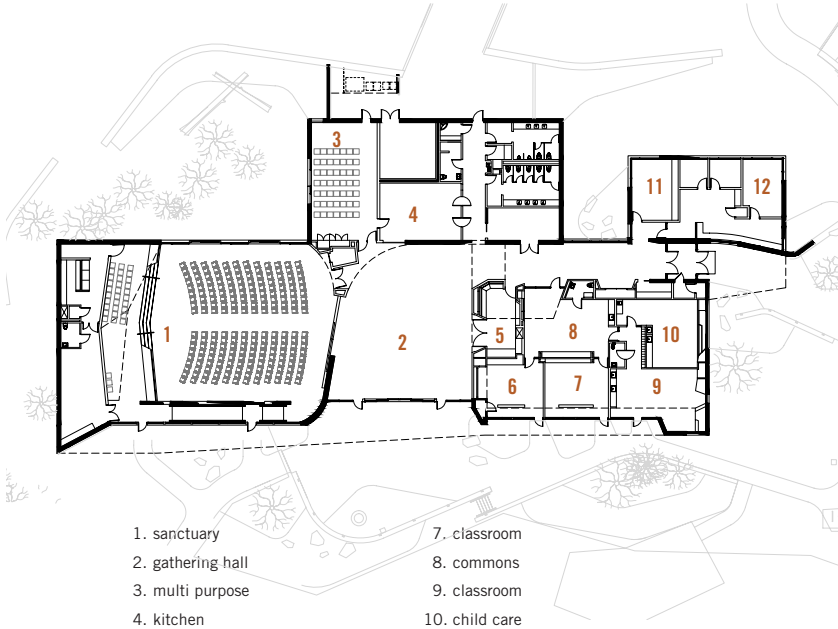
Unitarian Universalist Fellowship of Central Oregon Church

Cedar interior enhances acoustics of choir performances

Bend, OR

There is a sublime purity, a crispness in the dry air, and a profound sense of connection to the land and its geology in the high desert landscape of central Oregon. Here, the processes of erosion and renewal, from deep canyons to lava flows, are highly evident. The Unitarian congregation wanted their new home to be a symbol of their respect for the earth and a welcoming, warm space for their community. The project achieved a Net Zero-ready status through a variety of strategies that included: optimal orientation for passive solar heating, radiant floor heating, thermal mass walls, natural ventilation, on-site stormwater collection, and use of sustainably harvested wood products.



1. sanctuary
2. gathering hall
3. multi purpose
4. kitchen
5. fireside
6. classroom
7. classroom
8. commons
9. classroom
10. child care
11. conference
12. minister's office

N

FLOOR PLAN

The simple palette of natural, warm and rich materials, included cedar, stone, plaster, concrete, and glass. These materials were selected not only for their ability to create warm and inviting spaces, but also for their organic and simple chemical composition. Low-volatile organic compound (VOC) or no-VOC paints and coatings were used throughout to protect these long-lasting, natural materials, and no formaldehyde-based materials were installed. Floor coverings, acoustic treatments and other finishes were chosen for their recycled content (denim is used for insulation), recyclability, lack of off-gassing, as well as their proximity to the site to minimize transportation impacts.

Unitarian principles guided the design team to find a form that embodied the ideals of inclusiveness, exploration and community. Charcoal sketches were created as a meditation on these ideals and during the search for archetypal forms. These sketches inspired the floor plan and sectional design. The wood structure is arranged as a series of fractured blocks, with the main circulation area and gathering hall occupying the space between.

The use of wood inside celebrates Unitarian principles by making the spaces warm, inviting and welcoming. Large sliding wood doors are located between the sanctuary and the gathering hall, as well

as between the multipurpose room and the gathering hall. These Western red cedar doors were CNC-machined and hand-carved. A cozy wood-paneled fireside room can be closed off from the larger spaces to hold private meetings or comfort crying babies.

The sanctuary is acoustically designed to serve as a concert venue. Two different acoustic wood plank products were used, one slotted and one perforated, both in a cedar veneer. Solid cedar boards were spaced to provide open area and acoustic insulation. Above the choir, a cedar bandshell reflects and refracts the choir music, directing it to the back of the room.

The natural geological processes of central Oregon also inspired the building. The design team considered the forces of formation and erosion, as well as the resulting topography, forms of rock, and other regional materials. From this study, a concept emerged that would see the building embody these processes in its form, appearance and materiality. Every aspect of the design has a story that relates to this idea: from the layered stone walls, to the columnar basalt-inspired relief carvings, to the unique sculptural look of the exterior cedar siding which was achieved by using an innovative wood truss system.

There was also an effort to intensify the connection between the landscape and the building's interior. This goal informed all aspects of the building from material selection, to site placement and the design of the openings. The building was carefully placed within the site's existing trees to celebrate and preserve them and to establish a relationship between the interior spaces and the grounds. The thoughtful openings carefully edit and frame views while also modulating sunlight and maintaining continuity between inside and out.

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Lara Swimmer Photography
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Bar Raval

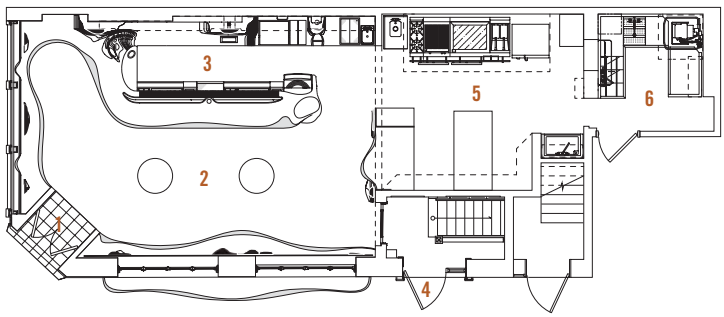
Interior hewn from sinuous mahogany embraces patrons

Toronto, ON

Carefully hewn from what looks like Mobius strips of sinuous mahogany, Bar Raval is a 21st-century reinterpretation of Spanish Art Nouveau architecture that introduces Toronto to the pintxo bar, a cornerstone of social and gastronomic culture in the Basque Country of northern Spain.

The architects were commissioned by Canadian chef Grant van Gameren to execute an ambitious task: create an art piece that would become an enduring culinary and civic institution. The directive was interpreted through two aesthetic lenses: Spanish design and the physicality of the three owners who became the team's muses. Raval's sculptural sentience ultimately pays homage to tattooed musculature in the context of Art Nouveau tropes and craftsmanship reimagined for contemporary Toronto.

The fluid smoothness of the final product belies the rigorous research and development required to achieve the vision. The biggest challenge was identifying a fabrication technique that would not only permit the development of intricate 3D geometries but also allow a layer of rich detail to emerge from the fabrication process itself, revealing those inherently textured qualities of wood that are akin to muscle tissue. Those efforts were synchronized with fabricators and software engineers to rewrite software patches that would enable the customization of toolpaths to execute sculptural engravings on complex 3D surfaces.



1. main entry
2. bar/restaurant
3. service space
4. entrance vestibule
5. kitchen
6. washing space

N FLOOR PLAN

The result is approximately 5.5 miles of serpentine engravings on 75 panels of seamlessly aligned wood.

The architects were also challenged to reimagine the functional aspects of the classic bar as a stage for performance and interaction. Each workstation and vantage point was optimized for efficiency and every back-of-bar detail was personalized down to the custom-made drip trays and brass beer pulls, which the owners moulded in clay with their own hands.

Bar Raval's soft curves foster intimacy, fluidity and community. A series of 3D "tattooed limbs" enfold patrons in a warm mahogany embrace, and their rippling surfaces encourage patrons to lean into and become part of the woodwork.

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PARTISANS
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The Dune House

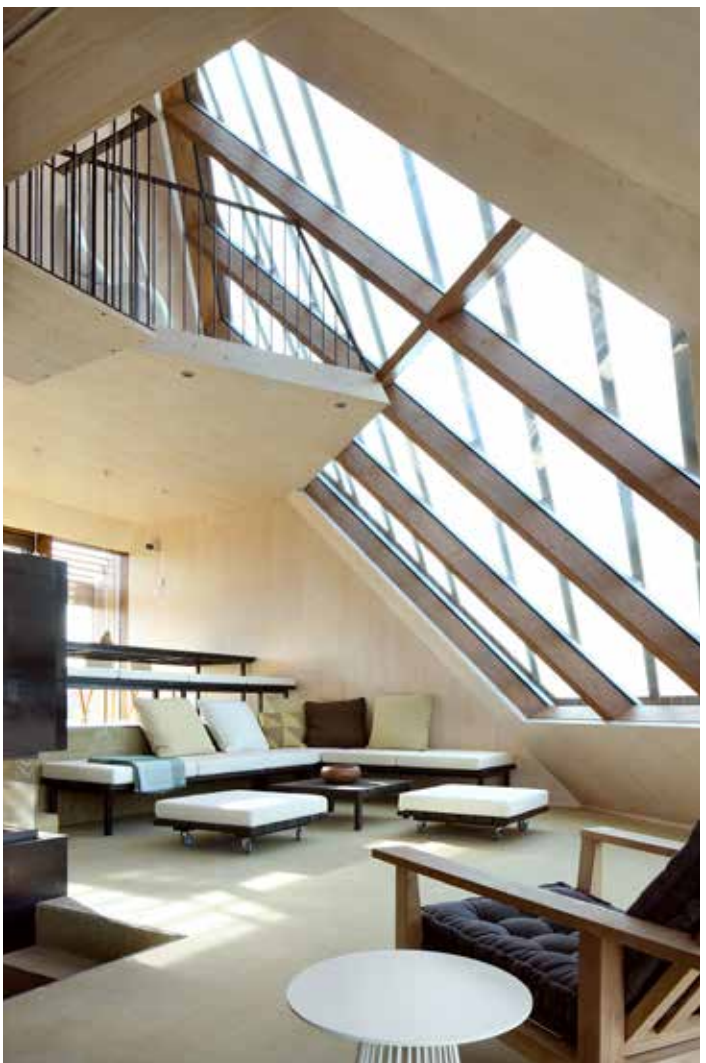
Western red cedar cladding changes with the seasons

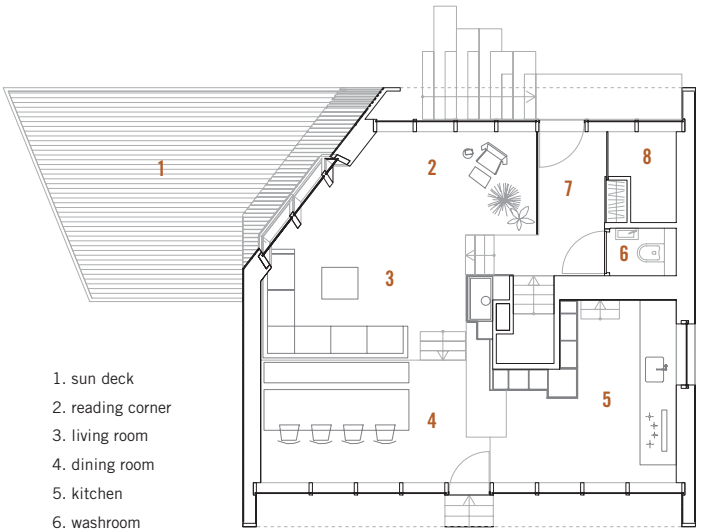
Terschelling, Netherlands

The Dune House, half-sunk into the dunes in Terschelling, Netherlands, is an environmentally friendly design with a minimal ecological footprint. It is, above all, a contextual design; every material was chosen after close examination of the colors and textures found in the environment. The result is a peculiar architectonic object: a wooden diamond that is experienced very differently from each of its sides.

The use of wood was inspired by the sandy landscape, native vegetation and the local naval industry. And, since it does not react with salt, it is ideal for this seaside site.

The exterior surfaces are materialized with Western red cedar wood cladding that give the project a homogeneous, natural and lively appearance. The untreated wood will age and fade with time, turning from ochre into a grayish gold color. The appearance of the house will shift between seasons like the surrounding landscape: darker in the rainy seasons, glowing and reflective in the summer.





1. sun deck
2. reading corner
3. living room
4. dining room
5. kitchen
6. washroom
7. entrance hall
8. storage

GROUND FLOOR PLAN

The open and ventilated wood-clad facade acts as a tropical roof that keeps the inner thermal layer protected from direct sunlight; due to the differences in pressure between the exterior and the air gap beneath the cladding, the hot air that accumulates is quickly removed, greatly reducing heat gains.

The Dune House was inspired by the experience of walking on the very dunes around which the house is built. The idea of walking from dune to dune, going up and down in search for the spot with the best views over the sea, is translated inside the house as a promenade architecturale: a spiraling path around its core – the fireplace and chimney – that finds its climax at the top platform of the house.

This stepping, spiraling path through the house connects the more private rooms in the basement with the more open areas above and forms a continuous sequence of spaces, each one just a few steps higher than the previous. This creates very direct and interesting spatial and visual relationships between all of the rooms and the natural light entering from the many openings in the facades freely invades the whole house, giving the feeling of a much bigger space.

The glazing that dominates the main space of the house offers many different views. In each transition from one platform to another, the perspective shifts and the visitor establishes a different connection to the surroundings. Arriving at the top platform feels like being at the top of a dune, facing the sea.

Walnut is used throughout the interior in cupboards, closets, kitchen elements and bathroom furniture. These elements bring warmth to the interior and relate

to the colors of driftwood found of the region. Green and brown colored textiles and furniture upholstery echo the vegetation that grows in the dunes and shifts between these two colors throughout the seasons.

The interior wooden surfaces give warmth to floors and walls that do not need any additional finishing and provides the interior a homogeneous and sculptural look. Only with such a holistic approach, aesthetically blending craft and modern technologies, was it possible to achieve an intrinsic integration between interior design, architecture and landscape, resulting in a house that is both tough and sophisticated, unique and contextual.

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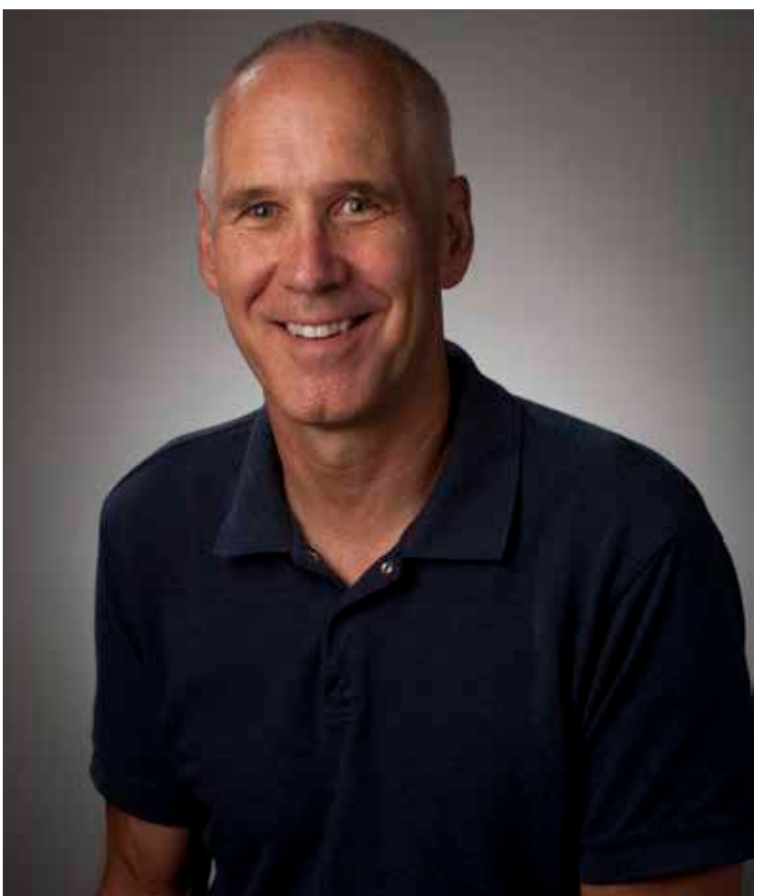
PHOTOGRAPHY
Filip Dujardin
Amsterdam, Netherlands

Eagle's Nest. PHOTO CREDIT: Christopher Marona

Tedd Benson

Celebrated timber framer shares his life's work and mission to bring quality, craftsmanship, sustainability, and affordability to all

Theresa Rogers



He's been timber framing for 45 years and there's no question Tedd Benson, Founder of Bensonwood and Unity Homes, has shaped the industry as much as it shaped him.

As a young carpenter, Benson quickly realized that many of the buildings he most admired for their inherent beauty and durability were timber frame structures: the houses, barns, and churches that are iconic in the New England landscape. Hailing from Colorado, Benson grew up in a very different setting; surrounded by structures with a legacy driven by utility and economy, the product of the fast-moving, temporary, western-expanding towns of the gold rush era.

When he headed east to finish college, Benson fell in love with the classic old buildings – still cherished and very much in use – he says came out of an era when craftsmanship was expected and demanded. Those carefully crafted buildings still define many New England communities today. As he began working and building a company, its value proposition was clearly in quality and craft. Four books and more than a thousand structures later, Benson is often credited with America's timber framing revival.

Why are you a wood champion?

Early in my building career, I discovered that many of the most adorable, beautiful, loved buildings that I knew of – buildings built before approximately 1870 throughout the northeast and along the east coast – were virtually all timber frame buildings. That was the motivation for starting the company. When I started out, my thinking was that we need to develop a better way to build and that better way to build, in my view, had to do with reviving an old methodology by bringing it into the 20th century. My love for wood has a lot to do with the fact that I started out as a carpenter and a woodworker but this whole idea of durability and sustainability is fundamental in my thinking about where the whole industry should go.

But you were from Colorado.

Yes, and that is significant because in Colorado the legacy of building is different. So much of the early building in Colorado was really bad, not very sustainable or durable or lovely. They were miner shacks, and towns that sprouted up overnight, and that mentality of temporary building seeped into the building culture in Colorado in the 1950s and 60s.

How did you revive timber framing in America?

As a young carpenter I wondered why we had given up this craft. I took off and taught myself by studying the old barns and churches and town halls and attics of houses and learned by looking at the very real and quite visible evidence left. Our first timber frame buildings came out well; people loved them and I had a business. That was in the 70s. I knew I didn't want to be a lonely carpenter-builder in southern New Hampshire doing this by myself, I wanted more people to do it, and I wanted a movement, so I wrote a book called *Building the Timber Frame House* that came out in 1980. That book really took off and through that I discovered there was a huge interest in the idea of reviving the craft and I also discovered I wasn't completely alone because other people started to emerge from other parts of the woods around New England. In 1984 we founded what we called the Timber Framers Guild of North America and we had 80 people show up to the first meeting. By 1989 we had 1,000 people and it's alive and well today. There's timber framing happening in nearly every state across the U.S. and certainly into Canada. I'm not going to say I did it by myself but certainly our work here and my books became critical elements of the revival which I would say is now very mature. There are hundreds of very talented timber framers across the country today; a well-developed apprenticeship program; new authors and new books. Timber framing is vibrantly back and will play an ever more vital role in the building industry.

Why did timber framing die out in North America?

Its demise was very much pushed by the advent of water-powered sawmills in the late 1800s and then the invention of the wire nail. Nails were made previously one at a time on an anvil. Nails were extremely valuable and precious so when the wire nail was invented, these innovative fasteners became practical and cheap. Wire nails and water-powered sawmills that could cut a large log into smaller pieces really sounded the death knell for timber framing because suddenly you didn't need all those skills or that time, and you didn't have to haul those massive timbers, you could carry these small sticks onto the building site, cut them with a hand saw and nail them with a hammer and anybody could do it.

Did you learn from older craftsmen?

In the U.S., they either weren't alive or they weren't doing it. Here's an interesting story that transformed us quite a bit: Between '83 and '84 a Japanese timber framer named Masahiko Ishikawa, who we met through a friend, came over and joined us for a year. Timber framing did not die in Japan. The legacy stayed alive and is still alive today. So, after 10 years of bootstrap learning, we were all of a sudden learning from someone who had learned from the people, who had learned from the people, going back 2,000 years. It was a huge eye opener, mind expander, and we were ready for it. Our skills were developed enough at that point that we were able to grab all of that information; it advanced us by another 10 years in one. Our timber framing became very international because we took on some of the techniques from Japan. He was and always will be a hero in our company and a life-long friend.

What Japanese techniques did you take on?

Some were subtle. In North American timber framing, the common elements of typical joints are: mortise, tenon and wooden peg to pin the connection. This makes it an all-wood connection. That's the basic timber frame joint. It's very strong

Burr and Burton Academy – Mountain Campus.
PHOTO CREDIT: Al Karevy

The White Mountain School – The Catherine Houghton Arts Center.
PHOTO CREDIT: Jamie Solomon

Coastal Maine Botanical Gardens – Bosarge Family Education Center.
PHOTO CREDIT: Robert Benson

and very effective. However, when you test it in tension, some of the tenons are not long enough, and some of the woods, especially in soft woods like fir, are not really strong enough to meet modern engineering requirements. As we were advancing our craft, we clearly had to do a lot of testing, and we discovered some of the traditional American joinery doesn't measure up. There's a technique that's been used in Japan for centuries where you use a third member spline and basically two mortises and the third member spline doesn't have some of the deficits of a projecting tenon because you can make the spline as long as you want, just make the mortise deeper and longer. We started using spline joinery where the traditional mortise and tenon wasn't strong enough. Today, splines are common and that's an example of the mix of traditional North American and other international timber frame traditions.

You've touched on the evolution of timber framing through the use of modern tools. How else has it evolved?

When we started, we were trying to replicate and adapt more than invent. We were using solid section timbers, much like the timbers in the historic barns and houses and churches. Initially that was oak. It's very strong but shrinks a lot so over time we graduated to using softer woods like fir, cedar, Eastern white pine, and local hemlock, but still almost all solid section timbers. Today, because glulam technology has improved so much and the manufacturing has improved, we're using a lot more glulam timbers. They are beautiful, durable and sustainable. Some of the glulam we use is from northern Quebec and they're incredible. We're using a lot more of that kind of technology, either from Quebec or Douglas fir from the west. That's changed how we think; it's also changed what we can build. We're also beginning to use cross-laminated timbers (CLT), which are huge glue-up slabs that are starting to make their way into many forms of residential and commercial buildings.

What would the original timber framers think of this?

I think the original timber framers were very practical people. When you look at these old structures, almost always there are timbers in there that came from previous buildings. They wasted nothing and if they could save some labor, they jumped at the opportunity because every timber had to be hewed out of a tree by hand, which was a monumental labor effort. I think the original timber framers would see this technology as a godsend.

You use what you call "Montage Building". Is it the same as prefabrication?

The montage idea comes from Europe and basically they call any activity where you are assembling parts into a whole, a montage. In Germany, Austria, Sweden, Denmark, the crews that go out to assemble a building, as opposed to cutting and shaping it, are called montage crews. Our company is trying to fabricate nearly everything off-site and when we go on-site we only want to perform the montage, not cutting and shaping, because doing

that work on the site is so much less efficient and accurate. We're also a millwork company so we do trim and interior doors, which is also done in a way to achieve site montage, so when we go on-site to frame windows for example, all of the frames are made, like picture frames, and they're installed as units. We try to take everything as far as we can off-site and efficiently complete that work on-site.

It's taking everything you've learned and applying it in-house.

In the late 80s I made my first trip to Europe. I was there to give a presentation to a large building conference in southern Germany about the revival of timber framing in North America. There, I met the leaders of timber framing in Europe and started a whole new adventure for the company because I was introduced to the timber framers of Germany, France, Austria, Switzerland, Belgium, and England and my eyes got really big. We developed a connection to a French guild training program and from 1991 'til today, we have frequently had a French compagnon apprentice with us. In addition, we got connected to some trade schools in Germany and Switzerland so we've also had a continuing series of interns from these trade schools and through that process we've become very European in our thinking and techniques. There is deep education in wood technology and off-site homebuilding and PhD-level training that we just don't have here. We're building a new plant right now and the new tools in the plant will be very German, but we're organizing it with inspiration from the Swedes as well, adapting everything that we've been studying in all these plants. And in those areas, wood technology is even more advanced than it is in North America, especially in Austria and Switzerland and southern Germany. There's amazing stuff going on. If the companies in North America could make glulam as beautiful as they typically do in Germany and Austria, I would be in heaven. We're still catching up.

What inspires you? Do you ever get bored?

I get bored about a lot of things, but not about building. Here I am all these years later, we actually have two companies here – Bensonwood and Unity Homes – and I don't get to go out on the site as much any more. That's not boredom, that's frustration.

How would you make time to do that?

We started Unity Homes in 2012. I call it the 44-year start-up. It's still requiring a lot of effort to get it off the ground and into maturity. On the other hand, I'm surrounded by a team of people here who are really incredible. Fine craftsmen and good people; highly skilled and motivated. Wood in itself is such a rewarding material to work with; you don't have to motivate people if they're into the craft and into the idea of building, they like holding wood in their hands every day and at the end of the day, seeing what they did and how our clients respond. And if they are architects, engineers and project managers, they get to see the fruits of their efforts rise from the ground, giving them a real and direct reward for their work.

Are you an accidental entrepreneur?

You could say it that way. All of this wasn't necessarily a plan.

Why have people responded to what you're doing and gone on this journey with you?

First of all, we have a collective mission in our company. We're in this together. We have 40-plus owners in the company who are clearly leaders and who've been with us for a long time. We have more owners every year. I always thought if we're going to be a company, I would want to treat people the way I would want to be treated. From that basis, we have developed a culture where individual authority and responsibility is expected. And in our business, it's also necessary. I'm not on those sites every day, so to know they have the skills, the inherent motivation (from their heart, not mine) and they're self-managed is essential. When that client is interacting with them, they're the heroes, not me. They're out there doing the work, and getting the reward of watching a building go up that they impacted in such a personal way. They can see how beautiful it is, and how exact it is, and how efficient the methodology is as individuals and as a team. And they get the reward of the client thanking them. The other thing that's important is that as a company – or a connected tribe of individuals – we've never been stagnant. We're a different company this year than we were last year and that will be true next year.

What makes people respond to your architecture?

The buildings tend to recall their ancient traditions with classic, simple geometry. With wood at the core, they are inherently beautiful and evoke security and durability. The underlying structure is usually exposed and celebrated. The architectural honesty and authenticity is compelling.

How do you promote innovation in wood architecture and construction?

Wood as a structural material is coming back. There are many architects exploring the use of wood in substantial buildings. Our job is to be there and to serve as partners with them to help bring these buildings to reality in any way we can. Sometimes we're only cheering them on, but often enough, we're the engineers and timber frame specialists to actually execute the work. Of course, our own architects are also constantly exploring the edges and challenging our craftspeople with inspiring designs as well.

What are your thoughts on tall wood buildings?

Very excited. The time has come. With the advent of CLT, wood buildings will be getting taller and taller, and we're ready to build them!


Denver Public Library. PHOTO CREDIT: Bensonwood

What is your favorite wood project?
We had the opportunity to build a structure/sculpture on the fifth floor of the Denver Public Library, working with the great Michael Graves. I'm pretty proud of having our work in that iconic building, not far from where I grew up. My parents didn't travel much, especially in their later years. That's the only work from our company they actually saw in person.

Is there something you'd like to do you haven't done?
Through our new company, Unity Homes, we are on an audacious mission to make high-performance, high-quality homes accessible and affordable. If we can do that, it will be the achievement of my life. Of course, it might take longer than the years I have, but I'm okay with that too, and confident the mission will live on.

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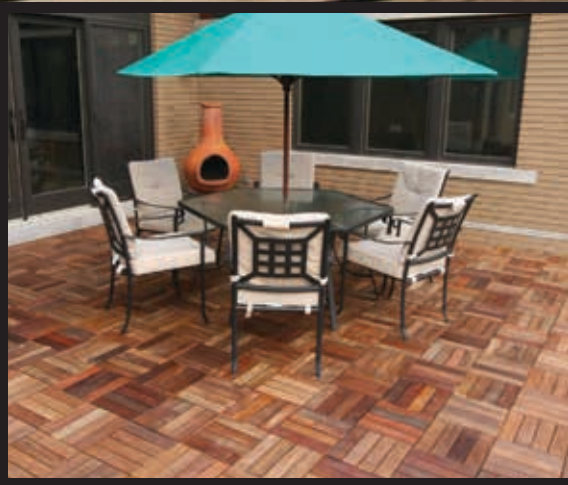

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Part 2 of a Series

Prefabrication for Mid-rise

Mark Kaustinen

Installation of wall panels. Photo Credit: ACQBuilt and CSG Inc.

Figure 1. Automated machinery for panel production and multi-function bridge.
PHOTO CREDITS: Top, Randek. Bottom, ACQBuilt

In Canada, prefabrication of mid-rise buildings is gaining support, with large builders and manufacturers committed to major investments in equipment and manufacturing facilities. This article, the second part of a series, explains and describes aspects of the prefabrication manufacturing process that are typically used for mid-rise buildings. Each manufacturer has their own processes and standards so it's always best to consult with them directly to ensure it meets your project needs.

In Europe, equipment used to produce factory-built wood housing comes from solution providers that include Randek AB, Hundegger, and Weinmann who manufacture automated machinery and solutions for wood building production. These solutions and others like them have been instrumental in helping to drive the gains in productivity the building industry has achieved from factory-built housing solutions. Figure 1 shows manufacturing systems marketed by Randek and Weinmann.

Some of the advantages of factory production and using automated equipment include:

- Preplanning and optimized engineering and cost efficiency through use of computerized programs
- Precision construction of all components
- Weather-protected construction as components are built in the factory limiting weather exposure
- Predictable production schedules, resulting in predictable delivery schedules
- Predicable factory pricing resulting in better cost control for builders
- Ability to provide improved energy efficiency (with closed wall panels)

Modern panelization plants generally focus on the design and manufacturing of the panels, though in some cases, operations may provide additional services above and beyond manufacture. Typically, prefabricated components – panelized or modular – are built individually based on shippable element sizes and then assembled on-site.

To create these elements, manufacturers use sophisticated BIM and CAD tools to ensure the wall, floor and roof components are properly designed so they can be accurately manufactured for installation.

Various types of commercial CAD design software are available to the panelization industry.

The manufacturer's design and/or engineering team typically deconstructs the design to value-engineer it for optimum panel performance and efficiency. This analysis usually has the best result when it starts early in the design phase of a building. For each project, all parameters of the architectural and structural specifications are fed into the program; the program resolves potential issues prior to manufacturing and construction through in-depth reviews, 3D modeling or through the use of BIM.

The typical design steps for a panelized system are:

- The building's architectural/structural drawings are provided by the builder or developer
- Structural design completed by engineering software
- BIM or 3D modeling created using manufacturing CAD/CAM software
- Building deconstructed into panels or suitable components using CAD/CAM software to meet the manufacturer's design and process standards
- Panel members, such as studs, joists, sheathing, nailing and openings/holes are configured with CAD/CAM software
- Panel layout and shop drawings for manual work and site erection generated using CAD/CAM software
- Production sequence optimized and data file generated for automatic CNC machines by CAD/CAM software

PANELIZED BUILDING ELEMENTS

Wall Panels

Depending on the manufacturer, wall panels are assembled in a factory environment through either a manual, semi-automated or fully automated process. Instead of typical framing drawings, detailed information on plates, studs, windows, doors, backing, structural sheathing, drywall, nails, and openings can be built into the design of the wall system (as described in part one of this series).

Figure 2. Wall panel production line. PHOTO CREDIT: ACQBuilt

The use of Computer-Aided Design (CAD) software for the design and manufacture of prefabricated wall panels generates the schematic views to ensure precise fit and dimensions, optimizes the spacing of the lumber used, and generates detailed material lists for ordering and production.

In a semi-automated plant, the lumber studs are placed in the jigging systems with sheathing placed manually and automated nailing of the sheathing. In a fully automated plant, placement of lumber and sheathing is usually done by machine, with the materials placed on laser-guided layout tables. The computer-controlled jigs ensure walls are square, plumb and level, and that studs are precisely spaced. The wall sheathing is then applied and fastened using automated computer-controlled machinery. Window and door openings are framed and installed, and exterior finish, such as siding, is added to the wall panels.

Closed wall panels include insulation, air barrier and others elements to create a more complete building solution. Whether rigid, spray foam, blown cellulose, batt, or wood fiber insulation is used depends on the manufacturer.

With an automated process, a high level of customization can be easily incorporated into the production line, although each manufacturer will have its own approach.

Floor Panels

Similarly, prefabricated floor panels are assembled through either a semi-automated or fully automated process in a factory environment. Detailed information on beams, rim boards, joists, lateral bracings, blocks, adhesive, sheathing, and nailing is considered in the design of the floor system.

Panel manufacturers have the flexibility to optimize the joist spans and joist spacing for a floor system to suit its depth. It is also possible to provide pre-drilled holes and duct openings for services in the floor panels to minimize the work required on site.

Roof Systems

Panelization of the roof system can also be carried out in the fabrication plant and shipped to site as large elements or assembled on the ground. In either case, installation can be done quickly and precisely match the manufactured wall elements. Key considerations for reducing the construction time at site are detailed preplanning, manufacturing and site co-ordination (Figure 4).

Inter-Panel/Element Connections

Inter-panel connections are crucial structural elements for panelized wall and floor systems. For an open panel system, the connection details are similar to site-built construction and must conform to the detailing based on engineering design. The installation needs to be well-planned and in the right sequence and is generally done by a specialized workforce with the necessary skills and safety training. Connection details for the closed wall system are more complicated and should be engineered accordingly.

The design of connections varies between manufacturers and needs to take into account the seismic and wind requirements of the building location. Mid-rise wood-frame construction places higher loads on connections than low-rise construction. In anticipation of these needs, connections manufacturers have developed innovative fasteners and connectors, such as hold-down anchors and self-tapping screws for use in these more challenging buildings. When contemplating connection solutions, a co-ordinated review that includes the design engineers, manufacturer and installation team will help identify the most appropriate type of connection system (for a specific application) to incorporate into a prefabricated system. Technical specifications for proprietary fasteners and connectors may be obtained from manufacturers' literature and code approval reports.

MODULAR CONSTRUCTION

Modular or volumetric construction requires the same project planning strategies and processes used for panelized construction. Some notable differences are that a higher level of prefabrication and planning is critical upfront to ensure all facets of the 3D modules are constructed so that when installed, they achieve high tolerances. The typical modular construction process is more manual and less automated than modern panelized factories as up to 95% of the module is completed in the factory. When combined with site construction, it is possible to construction up to 85% of the project (depending on design requirements) off-site.

Though this may vary from one manufacturer to the other, it takes up to three weeks (15 production days) for modules to be completed, although many manufacturers are capable of two to three modules a day. Check with your local manufacturers as these timelines may vary depending on their operational capacity and approach. For large projects, it is necessary to co-ordinate the off-site portion of the project to ensure there are enough completed modules ready when installation is underway.

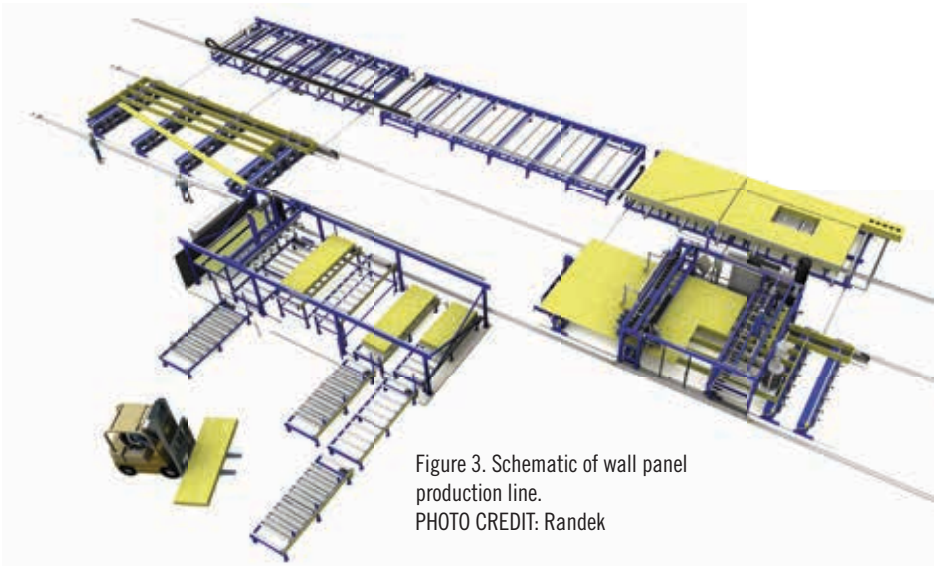

Figure 3. Schematic of wall panel production line.
PHOTO CREDIT: Randek

Figure 4. Roof panels assembled on ground and lifted onto walls. PHOTO CREDIT: H+ME Technology

SUMMARY

There are several approaches to prefabrication of a mid-rise structure; common to them all, however, is that each requires planning to ensure success. Coming next in the series is information on certification standards, logistics, transportation, installation and examples of completed projects. For more information, see the Mid-Rise Wood-Frame Construction Handbook Special Publication SP-57E by FPInnovations.

For more information, contact Mark Kaustinen at FPInnovations.

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T3 Minneapolis Office Building
NLT panels act as floor structure and exposed soffit in this 220,000-sq.ft. office building
PHOTO CREDIT: Hines

Nail Laminated Timber

Lucas Epp

Use of mass timber as a structural system is on the rise in North America. Replacing traditional structural systems such as concrete and steel, these prefabricated solid wood panels create a construction method which is fast, clean, and sustainable – not to mention aesthetically pleasing.

Nail Laminated Timber (NLT) is a structurally efficient and economic panel product which can be used for floor, wall, and roof structures. Recent larger and taller wood buildings have used NLT as floor and roof panels atop glulam beams and columns.

NLT is created from dimensional lumber stacked on edge – 2 x 3, 2 x 4, 2 x 6, 2 x 8, 2 x 10, or 2 x 12 solid laminated and fastened together with nails. Plywood or OSB sheathing is often added to the top side to provide a structural diaphragm.

History of mass timber and NLT

NLT is the oldest mass timber product, and has been in use in heavy timber structures for more than 150 years. Examples exist in the warehouse districts of many cities. Large industrial buildings like the 500,000-sq.ft., eight-story Butler Building (Minneapolis, built in 1906) used solid-sawn posts and beams with NLT floor panels to create a robust structural frame.

This system became prevalent, leading the National Lumber Manufacturing Association to create *Heavy Timber Mill Construction Buildings* in 1916, an illustrated guide to good structural and fire detailing of these heavy timber structures.

Heavy timber construction fell out of mainstream use with the industrial revolution and the rise of steel and concrete as primary building materials. This is starting to change; the industry is realizing wood is the only primary structural material which is renewable and grows naturally.

Mass timber and NLT advantages

Speed – Building with mass timber is fast – each 30,000-sq.ft. floor of NLT panels on the T3 office building in Minneapolis was installed in one week. Both on-site storage and number of deliveries are reduced, with components delivered just-in-time to the site.

Carbon footprint – mass timber can create a carbon positive structure. Trees sequester carbon during photosynthesis, produce oxygen, and absorb other kinds of particulate pollution during growth.

Cost – When accurately compared, mass timber buildings are now competing with steel and concrete. Due to the simple manufacturing process and possibilities for local manufacture, NLT is often the most cost-efficient mass timber product available.

Prefabrication – High-quality panels and quality control processes in a factory environment allow tight tolerances between structural components. Services can be accurately integrated, with penetrations and service runs precut in the factory.

Structure – Building with mass timber results in a significantly

NLT panel installation at T3. PHOTO CREDIT: Magnusson Klemencic Associates

lighter superstructure than concrete or steel, reducing foundation size and cost. The inherent fire performance of mass timber removes the need for intumescent coatings and dropped ceilings, and allows the wood to be exposed as a permanent soffit.

Manufacturing of NLT

Panelized Building Elements

NLT panels are typically prefabricated in sizes of up to 12 feet wide and 60 feet long. Prefabricated panels are factory-finished with sealers or stains and are higher quality than panels built board-by-board on-site.

North American lumber by nature has variations like wane, bow and sweep. These characteristics, however, can be addressed through careful fabrication and quality control in the factory, resulting in panels which can be relied on to be square and true when the building is put together on-site.

Surrey Christian School uses NLT floor and roof panels.
PHOTO CREDIT: StructureCraft

Although it is possible to create NLT as it was done 100 years ago – nailing boards together on-site – this is not the way of the future. To create consistent quality and dimensional accuracy, it is important that NLT panels be manufactured in a controlled factory setting.

Finish and geometric possibilities

NLT naturally lends itself to the creation of unique roof forms. Because panels are comprised of individual boards spanning in a single direction, both singly curved and freeform panels can be created by slightly indexing, offsetting and rotating each board.

Fluted panels (e.g. 2x4-2 x 6-2x4) create a unique soffit aesthetic and allow electrical conduits or sprinklers to be run in the gaps.

Structural design

All wood fiber runs in a single direction in an NLT panel, and this makes it very structurally efficient for one-way spans. Smaller two-way spans in NLT panels (up to around 2 ft.) can be achieved with screw reinforcement in the panel.

Plywood or OSB sheathing atop the panel gives shear capacity to NLT panels for use as structural diaphragms in floors and walls. The sheathing also allows for simple nailed connections between panels with strips of plywood.

When detailing NLT systems, designers need to account for moisture movement – wood changes dimension perpendicular to grain when wet. Incorporation of small gaps between panels deals effectively with this issue, and moisture protection during construction is an important consideration.

Both the IBC and the NBCC recognize NLT and provide guidance for both structural and fire design. No product-specific standard is required, as the structural design of each lamination element is covered by the building codes. It is resistant to fire, and has long met the requirements of heavy timber in North American building codes. NLT can be used in all types of combustible construction.

Testing and research

Fire Performance

The fire resistance of mass timber panels is now widely proven – the char developed during a fire creates a self-protection layer. Research recently completed at FPInnovations showed that a 2x8 NLT floor panel with concrete topping can achieve a three-hour fire resistance rating under full live load.

Vibration

The stiffness of mass timber panels is important in long-span floor systems, and consideration of floor vibrations can govern the required panel thickness.

A concrete topping is often required for acoustic reasons, and this topping can be made composite with NLT panels to increase the panel stiffness. Inclined screws are a cost-effective means of creating this timber-concrete composite (TCC) panel.

Acoustics

As with all mass timber systems, it is important to address acoustic separation between mass timber walls and floors, which can be achieved through appropriate detailing.

Dowel laminated timber: next-gen NLT

Dowel-laminated timber (DLT) panels are a next-generation mass timber product commonly used in Europe where they are also known as brettstapel. Panels are made from softwood lumber boards stacked like the boards of NLT, but friction-fit together with dowels instead of nails. DLT panels are the only 100 per cent mass timber product – they involve no glue or nails.

Typically made from hardwood lumber, the dowels hold each board side-by-side, and form a stiffer and stronger connection than the nails in NLT. Further, the laminations are finger-jointed, creating a stiffer panel by eliminating the splices which are a characteristic of NLT.

The structural design of each lamination in a panel is covered by both the NBCC and IBC and applicable grading rules. The dowels connecting the boards do not serve a structural purpose, as each finger-jointed board spans between structural supports. DLT can be used in all types of combustible construction.

Integration of services inside a DLT wall panel.

Unique to DLT as a mass timber product, acoustic profiles can be integrated directly into the bottom surface of a panel. This can help a designer achieve acoustic objectives while keeping the wood exposed and allowing for a wide variety of surface finishes.

Dowel-laminated timber panel with an acoustic profile integrated into the exposed surface.

Both walls and roof in this structure are created with DLT.

DLT panels, unlike NLT panels (due to the nails) may be processed using CNC machinery. This creates a high tolerance panel which can also contain pre-integrated electrical conduits and other service runs.

There is growing interest in DLT and the first North American manufacturing plant will begin production in 2017.

Summary

Nail laminated timber is a versatile, structurally efficient and cost-effective mass timber product that is simple to manufacture.

Next-generation products like DLT take the NLT concept one step further to create 100 per cent wood panels which can be CNC'd and incorporate acoustic treatment into an exposed wood soffit.

These products extend the range of mass timber options and support the trend toward prefabrication as the future of building construction.

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Using Wood Door Frames for Fire-Rated Openings

Cory Hollenhorst

Designers and architects are often met with the challenge of maintaining their design vision when building code requirements limit their ability to bring that vision to life. Such has been the case for decades with fire-rated doorways. A cohesive design plan, rich with wood doors and trim but subject to a fire rating, often forces the use of a metal frame, breaking up the intended appearance. While many professionals simply accept that as an unfortunate reality, innovations exist, some for many years now, that resolve the conflict between design intent and code requirements.

Fire-rated wood door frames aren't new; 20-minute iterations have been widely available and used for decades, but the product category doesn't end there. With a combination of specialty materials and manufacturing processes, real wood door frames can be created that rate 45, 60 and even as high as 90 minutes. For designers, architects, and other specifiers,

this may be a revelation with some very positive impacts.

For years, hollow metal frames have been the default solution for higher-rated openings. This means that a well-designed opening, one that would benefit from the luxurious and warm appearance that only real wood can offer, has been subject to the institutional and rigid appearance of metal.

There are some solutions out there to hide the metal frames - cladding, trim kits, faux wood wraps, and fancy painting, but ultimately, when the look and feel of real wood is the design intent, real wood is the only option that will do. With fire-rated wood door frames, the design doesn't have to be compromised.

So why don't more professionals use fire rated wood door frames? Perhaps it is because they don't know about them. They are not a flashy innovation. In a marketplace where new products often impress us with LED panels or wifi connectivity or some other "wow factor" enhancement, fire-rated wood door frames quietly solve a longstanding design problem, perhaps making them easy to miss. Their impact on design and functionality, however, may be as significant as any of the higher profile product innovations professionals come across.

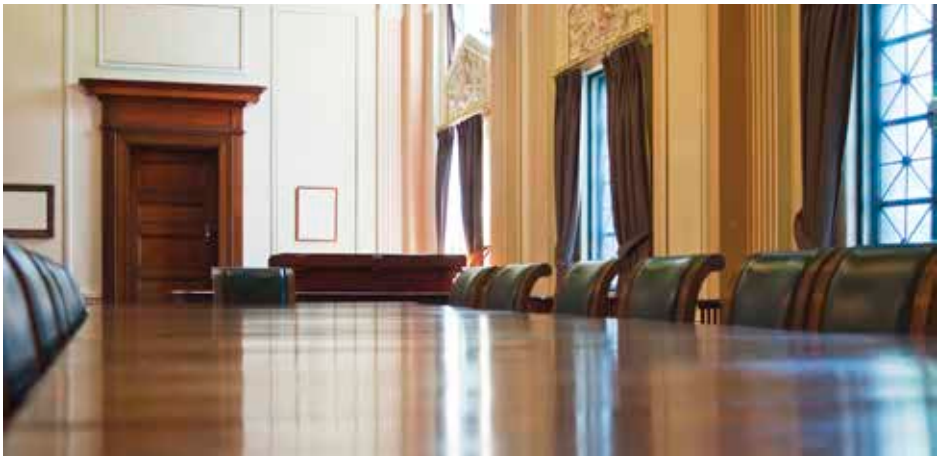
Only a small number of manufacturers produce fire-rated wood frames. The manufacturing process is demanding as is the high level of customization the marketplace requires. Demand, however, has steadily increased since the product's invention in the late 2000s.

The aesthetic advantage is clear, and designers value the ability to use real stain-grade or paint-grade wood to match doors, trim, paneling and other wood components in a design.

Fire-rated wood door frames can be configured multiple ways, but 45, 60 and 90-minute configurations will include intumescent material which is typically laminated into a substrate made of wood materials or gypsum. The wood-based laminated core typically installs like traditional interior wood jambs, nailed up with very little or no additional







Fire-rated wood frames are the ideal solution for multi-family buildings where occupants desire a truly "homey" feel, assisted living and retirement residences, and even historic restoration projects.

Cory Hollenhorst, Ferche Millwork.

preparation. The gypsum-based cores require basic preparation, such as pre-drilling, but are similarly simple to install. This relatively easy installation process typically results in labor savings which help offset the higher cost of the frame itself.

In addition to aesthetic considerations, a strategic reason for the use of fire-rated wood frames is that the frames contain a sealing agent. This is a requirement in fire-rated openings that allows for the use of Category B doors. Without the sealing product in the frame, metal frames are used and Category A doors (which contain the sealant) are required. Category A doors are more expensive and offer fewer design options. Alternatively, peripheral sealing products can be added to the assembly, but this results in more labor, less aesthetic appeal, and potentially higher total costs per opening. A fire-rated wood door frame paired with a Category B door allows tremendous design flexibility while providing a cost-effective door unit.

Fire-rated wood frames are the ideal solution in many applications, but are particularly suited to multi-family buildings where occupants desire a truly "homey" feel. They also lend themselves well to assisted living and retirement residences or any other residential environment where hollow metal frames create an undesirable institutional feeling. Historic restoration projects also present opportunities where aesthetics are paramount but modern codes exist.

Other building types that have also seen increased demand include casinos, performing arts centers, theaters, libraries, churches, office buildings and anywhere else the luxurious look and feel of real wood enhances the design of a space.

With the growing demand for high-end condominiums and more stringent fire codes for multi-family construction, fire-rated wood door frames will continue to grow as a category. The challenge for the industry is to increase awareness of the available products so specifiers can include them at the initial planning phases.

As with all other matters of health and safety, there are strict standards to which the products must be manufactured. Manufacturers are happy to provide all of their rating information as well as product specifications and installation instructions, so consult with the manufacturer when you choose to specify their product.

With a huge range of available wood species, a multitude of configurations, and the appearance and durability that only real wood can offer, fire-rated wood door frames are a valuable product option for industry professionals with uncompromising design standards.

Cory Hollenhorst is the Director of Sales & Marketing for Ferche Millwork, manufacturer of Fire Rated Frames, wood door components and solid and veneered millwork. He can be reached at (320) 393-5777 or coryh@ferche.com.

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