

How Building with Wood Helps Multifamily Developers Succeed

Wood construction achieves height, density, unique design aesthetics and superior fire safety in apartments and condos.



Origine, Quebec City.
Courtesy of Nordic Structures | Photo: Stephane Groleau

By Joe Bousquin

In today's competitive environment, wood construction is often the go-to choice for residential developers looking for a cost-effective, proven building technique with a readily available labor pool.¹ As a building material, wood's mature supply chain, established labor force, and expansive breadth of products make it a natural fit for residential projects both in the urban core, ex-urban suburban ring, and, indeed, rural environments as well.²

Since wood can be "shaped" on-site with simple tools to meet unforeseen situations in the field,

it's also viewed as a highly versatile building material that doesn't lock developers into design decisions, as can be the case with concrete or steel construction.³ Its relative abundance as a renewable resource contributes to widespread availability and, when sourced locally, faster delivery and reduced carbon emissions due to transportation.⁴

Not only is wood frequently less expensive in terms of "hard costs," it can also result in a lower installed cost, as laborers who work with wood are relatively numerous compared to other trades and prefabricated assemblies can

often mean fewer workers required on-site.⁵ Other advantages include wood's inherent light weight—wood buildings weigh less than one-fifth as much as comparable concrete structures—which further reduces expenses via smaller foundations, footings, and piers, as well as less excavation of the site.⁶

Wood's light weight also makes it an ideal material for prefabrication in factories into pre-assembled components that can then more easily be transported on-site. Prefabricated wood component manufacturing is an increasingly common practice that produces

panelized wall and floor sections of traditional dimensional lumber, I-joists, trusses, and oriented strand board, as well as, in the case of the emerging mass timber market, newer elements such as cross-laminated timber (CLT) and glulam posts, beams, floor decks, and walls. The use of these components, which can be rapidly installed on-site, also results in a significantly accelerated speed to market and occupancy at a residential property, one of the most crucial factors in determining a project's viability.⁷

Finally, wood's sustainable characteristics and its ability to actually sequester carbon during the harvesting, milling, and manufacturing process means its environmental footprint is exponentially smaller than concrete, which is estimated to contribute up to 8% of all CO₂ emissions globally.⁸ Wood's inherent green properties offer an increasingly advantageous marketing tool.

Some residential developers perceive challenges associated with building with wood in both its physical and structural characteristics as well as limits imposed by building codes. However, innovative developers have created unique, design-forward apartments and condominiums with wood construction—buildings that appeal to both renters and homebuyers while providing a cost-effective pro forma return. Additionally, the International Code Council accepted 14 tall mass timber code change proposals in early 2019 that created three new types of timber construction and set fire safety requirements and allowable heights, areas, and number of stories. The code includes provisions for up to 18 stories of Type IV-A construction for business and residential occupancies.⁹

The following case studies focus on new design, manufacturing, and construction techniques, coupled with evolutions to building codes and a heightened awareness among residents of environmental impacts, that allow light-frame wood and mass timber buildings to achieve higher heights and densities while emphasizing unique design aesthetics and superior fire safety characteristics in residential buildings.



TMBR, Minneapolis, Minn.
Courtesy of TMBR

TMBR: height + speed + density + sustainable marketing

While residential buildings higher than six floors have commonly been built using concrete or steel, mass timber components are quickly becoming a popular choice for developers who want to build higher while differentiating their product and increasing speed to market.

Those were the characteristics that led Todd Simning, president and CEO of Excelsior, Minn.-based design-build firm Kroiss Development, to choose cross-laminated timber for TMBR, the 10-floor, 79-unit, 119-foot-tall condominium building he's currently developing in Minneapolis's trending North Loop neighborhood.

The building will be constructed using CLT posts and beams as well as floor decks and walls to create a sustainable, warm condominium tower with plenty of exposed wood accents and features. "I really didn't want to just do another post-tension concrete condo," Simning says. "We wanted to differentiate ourselves."

Re-introduced to North America in its modern form in just the last decade, mass timber



TMBR, Minneapolis, Minn.
Courtesy of TMBR

components are manufactured out of smaller pieces of wood that are glued or fastened together to create larger, stronger members that can span wider spaces.¹⁰ In CLT timbers, those pieces are joined together at perpendicular angles, increasing the material's strength in multiple directions. The posts, beams, and floor and wall sections snap into place via male-female connectors that lock together as they're craned onto the structure. "It's kind of like an erector set that goes up," Simning says. "Or it's like getting a kit from Ikea, looking at the instructions, and putting it together. There's a lot less waste."

Because mass timbers are manufactured from smaller pieces of wood, trees take just six to eight years to grow large enough to be used in

the manufacturing process, which uses far less energy than concrete or steel. At the same time, mass timber buildings actually help lessen the amount of carbon released into the atmosphere by sequestering carbon within the wood itself.¹¹

For those reasons, mass timber has quickly become a rallying cry for sustainability-minded architects and builders who see the material not only as an environmentally positive choice but one that addresses the crippling labor shortage within the construction industry today. TMBR's constructability will, according to Simning, use fewer workers on-site—a crew of just six can easily maneuver entire floor decks into place—while cutting the overall construction timeline of the project to just 17 months, about five months faster than a similar 10-story build using post-tension concrete. Similar projects have been able to erect a floor a week or more. Since mechanical tradespeople don't have to wait for each floor to cure, they have immediate access. Those schedule savings are compounded with each phase of the build.¹²

There are now already 221 modern mass timber buildings in existence or underway in the U.S. with another 378 in design, for a total modern mass timber footprint of 599 buildings.¹³ While leading-edge projects such as TMBR still pencil at about 5% higher costs than concrete, proponents say the material will become more cost-effective quickly, given its rapid adoption.

Indeed, the speed of constructability is an aspect that allows TMBR, which is slated to break ground by the first quarter of 2020, to pencil out. "The quicker you can get something up, the better return you get on the time value of money," Simning says. "The interest ticker adds up pretty fast, especially when you're dealing with millions of dollars. So the faster you can close and get buyers in those units, the more profitable your project will be."

While a new addition to the International Building Code will allow for tall wood buildings up to 18 floors in 2021, TMBR received a variance to build with mass timber that allows it to exceed the typical 85 feet and six-story height restrictions of conventional stick framing. That extra height, in turn, helped add units and

increase the overall density of the building, which further helped the project pencil out. "Increasing the density helps spread out your costs," Simning says.

In addition to the speed and density of the project, its use of mass timber and its sustainable characteristics have gained attention. Buyers' increasing focus on the environmental footprints of homes has helped TMBR's marketing push—the building was already 25% sold at the time of this writing.¹⁴

"We always talk about getting cars off the road, but what about the impact of buildings?" asks Simning. "Transportation only accounts for 33% of our carbon emissions, while buildings contribute almost 40%.¹⁵ We've got to think about what we can do on the construction end to lessen those carbon emissions and build more environmentally friendly buildings."

He says half of his buyers are enticed by the sustainable aspect of using mass timber, while

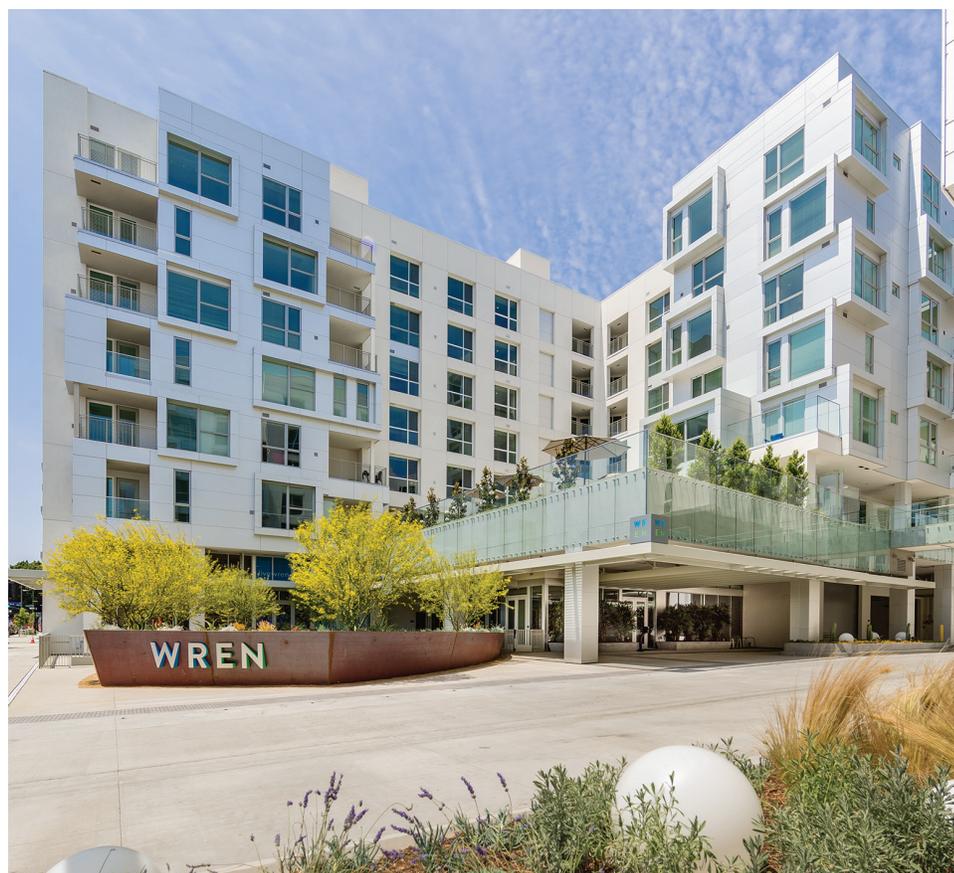
the other half just love its natural beauty. But while those aspects of the building have helped it sell itself, Simning says being at the forefront of the mass timber movement in the U.S. is helping him quickly develop a new brand as a developer.

"What we're discovering is that if you're one of the first ones to go to market in your area with mass timber, you're going to have a captive audience of other developers and real estate investors looking for partnership opportunities," Simning says. "It's creating a lot more opportunity out there with other developers who want to learn more about what we're doing."

Sounds like just one of the competitive differentiators of building with mass timber.

WREN: Concrete-like density using traditional light-frame wood construction, by design

While wood is a common choice for low- and mid-rise apartment buildings, its cost-effectiveness as a building material often comes



WREN, Los Angeles, Calif.
Courtesy of Togawa Smith Martin, Inc. | Photo: Kevin C. Korczyk

at the price of lower density compared to taller concrete and steel buildings. Getting density right is a key component for ensuring that multifamily buildings pencil out.

Given that reality, the challenges facing Togawa Smith Martin (TSM), the architects behind the seven-story WREN Apartments in Los Angeles, were staggering. But as it turned out, “staggering” was the exact solution the project needed to rise above those hurdles.

While traditional light-frame wood construction of multifamily buildings rarely results in overall densities of more than 100 units per acre¹⁶, developer Mack Urban needed a density of 195 units per acre in order for the project to succeed.

WREN is a 362-unit, \$144 million community five-over-two podium structure with one-, two- and three-bedroom apartments ranging from 487 to 1,750 square feet and 22 two-level townhomes. As the first phase of a six-building, \$1.2 billion project in Los Angeles’ burgeoning South Park neighborhood—slated to add over 2,000 rental units to the city’s housing stock—it was imperative that they get it right.

To meet the challenge, TSM first added a full NFPA 13 fire sprinkler system throughout the entire project to increase the allowable wood portion of the building from four to five floors.¹⁷ But when WREN was still in its design phase, single-level concrete podiums were the norm in multifamily construction in Los Angeles. By receiving a code modification to employ a five-over-two podium approach, in conjunction with the fire sprinkler five-level allowance, TSM was able to increase density without exceeding floor or height limits. In addition, by introducing a mezzanine level, which essentially staggered a portion of select townhome units, TSM was able to increase actual living area within the building even more.

“We were able to get an extra level into the building by using a mezzanine, which doesn’t technically count as a floor. Essentially, it made it into an eight-story building,” says Kyle Peterson, associate principal at TSM. “Our area of expertise is looking at what we can do, within the allowances of the code, to maximize yield for our clients.”



WREN, Los Angeles, Calif.
Courtesy of Togawa Smith Martin, Inc. | Photo: Kevin C. Korczyk

Indeed, the result was an 85% ratio of leasable square footage compared to the building’s overall area, an optimal metric for multifamily communities. TSM’s approach was so effective that multiple-level podium designs, which were later included in the 2015 International Building Code without modification, have become standard practice in Southern California.

But TSM’s design acumen didn’t only help to improve density at WREN; it also kept overall costs down by using wood framing for the majority of the levels. “Today, code allows you to build additional concrete podium floors. But beyond a

certain level, that’s not desirable,” Peterson says. “You want to do more of your building area in light-frame wood versus concrete, because the unit cost on wood is significantly lower.”

The differential in costs also went beyond materials alone. The price of labor for building with wood was also reduced. And skilled tradespeople who could do the job, compared to workers specialized in concrete or steel, were easier to find, according to the design team.

“There’s a broader base of subcontractors that can work with wood,” Peterson says. “So when



MOTO, Denver, Colo.
Courtesy of Gensler | Photo Ryan Gobuty



MOTO, Denver, Colo.
Courtesy of Gensler | Photo Ryan Gobuty

you consider the lower cost of materials plus the lower cost of labor and the ability to find people who can actually do the job, building with wood is a lot easier and cheaper. Those savings add up to make wood frame projects more cost effective by a factor of roughly 30%.”

In other words, by implementing innovative designs and using wood’s inherent versatility as a building material, optimal multifamily density is possible.

MOTO—Unique design and flair with standard, light-frame construction

The post-Great Recession apartment boom favoring conventional designs has led some to bemoan the “cookie-cutter” aspects of apartment profiles today. Much of the uniformity in today’s apartment designs comes from the structural requirement that load-bearing walls stack. But an apartment structure built of wood doesn’t mean it needs to fit into a boxy design envelope.

Take MOTO, a 64-unit community in Denver boasting four offset and cantilevered floors sitting atop a double-level concrete podium. Built out of standard light-frame lumber that leveraged panelized walls and pre-assembled floor joist assemblies, the building makes a

lasting impression that’s immediately more bold than boxy, with exposed cedar soffits on the cantilevered ends that draw in and command attention from visitors. Located in Denver’s Capitol Hill neighborhood in the geographic center of the city—MOTO is shorthand for “middle of town”—the building has an urban, hip, and ultra-modern feel.

“We really wanted to set ourselves apart with MOTO by having an extremely high level of design that’s rooted in the context of its neighborhood and demographics,” says Nick Seglie, an associate at Gensler, MOTO’s lead architect. “A lot of apartments today have a very generic vernacular that can be placed anywhere. They’re not necessarily rooted in the context of their surroundings. With MOTO, we didn’t want the light-frame wood structure aspect of it to push us down a certain design path that a lot of other projects seem to take.”

Central to that non-generic feeling are MOTO’s exposed cedar soffits, which were made possible by extending the building’s fire sprinkler system onto the balconies.¹⁹ “We decided to put the cedar soffits on the cantilevered overhangs where it’s most impactful,” Seglie says. “It’s just a two-foot expanse, but that’s what you see as you look up, so it has an instant visual effect.” Seglie



MOTO, Denver, Colo.
Courtesy of Gensler | Photo Ronnie Leone

notes that achieving a similar effect with post-tension concrete would be “much more time consuming and much more expensive.”

Aside from its bold aesthetics, MOTO’s panelized walls and floor and ceiling joist system allowed each level to be framed in a week, with the entire building getting framed in less than a month. As with other wood projects, the accelerated speed of construction, which didn’t sacrifice the design, was a large contributing factor to MOTO’s success.

“These are standard 2x4 walls that were built off-site in the controlled environment of a factory and then shipped on-site with each segment labeled as to where it should be put in place,” Seglie says. “The system allowed for the building to go up extremely quickly.”



Origine, Quebec City
Courtesy of EBC, Inc.



Origine, Quebec City
Courtesy of Nordic Structures | Photo: Stephane Groleau

He says wood's inherent versatility gave MOTO an advantage from a financial, labor, and on-site perspective. "The benefit of the wood is that it's economical, and there's a wide range of subcontractors who can work with it," Seglie says. "On-site, you can cut holes in it and retrofit it extremely easily."

Choosing wood allowed the project to open and reach occupancy quickly, an aspect of multifamily development that's critical to a project's success. "Speed is paramount in this type of project," Seglie says. "Time is money."

A wood-framed apartment building that is cost-effective, gets built quickly, and exudes design flair? What's not to love?

Origine—Proof of concept for fire safety in tall wood buildings

While wood construction has been limited to single-digit floor levels in the past, recent amendments to the 2021 International Building Code will allow mass timber buildings to be built as high as 18 floors. Indeed, Oregon and Washington State already allow 18-floor wood buildings in their codes.¹⁹ But even as tall wood buildings have increasingly become a realistic option for developers, many still have questions surrounding fire safety.

Origine, a \$30 million, 94-unit, 13-floor condominium that soars 135 feet into the Quebec City, Canada, skyline and was constructed of CLT mass timber in 2015, helped pave the way for the amendments to the IBC.²⁰

At the time of its construction, not only was Origine the tallest residential mass timber building in the world, it also helped Canadian provinces to abridge their building codes, which in turn have contributed to the changes to the IBC.

For example, assisted by a grant from Natural Resources Canada's Tall Wood Building Demonstration Initiative, Origine's project team set out to prove the tower would be as fire safe as a concrete and steel building.

To do so they built a full-scale, three-story stairwell and elevator shaft completely out of cross-laminated timber. Over the course of two hours and 12 minutes, they exposed the shaft to direct flames that drove the internal temperature to 2,012 degrees Fahrenheit.

At the end of the experiment, the shaft's interior remained smoke-free and intact. Indeed, sensors recorded a rise of just 37 degrees Fahrenheit on the opposite side of the CLT walls, which helped the project easily pass its two-hour fire-rating test.²¹ The experiment also contributed to a change in Quebec's building code to allow

tall wood buildings up to 12 stories, which was quickly followed by a similar building code change in British Columbia as well.

Subsequent fire tests that continued the path toward approval for the IBC to allow tall wood buildings up to 18 floors were even more rigorous. In those trials, a five-ply CLT panel wall was subjected to temperatures exceeding 1,800 degrees that lasted three hours and six minutes before failing, well beyond the two-hour limits required by code. By comparison, while steel starts losing structural integrity at temperatures as low as 450 degrees, timber develops a char on the outside while maintaining its internal structural strength.

With pioneers like Origine in Canada and subsequent mass timber tall wood buildings being developed in the U.S., building tall with wood is quickly becoming a realistic—and fire-safe—alternative for residential developers.

Conclusion

Due to its versatile nature, cost-effectiveness, innovative range of products, and evolutions in building code, wood construction is allowing residential multifamily developers to achieve new heights, densities, unique design aesthetics, and superior fire safety in apartments and condominiums today.

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Understand the science behind tall mass timber code changes at info.thinkwood.com/download-the-mass-timber-stands-tall-library-brief

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