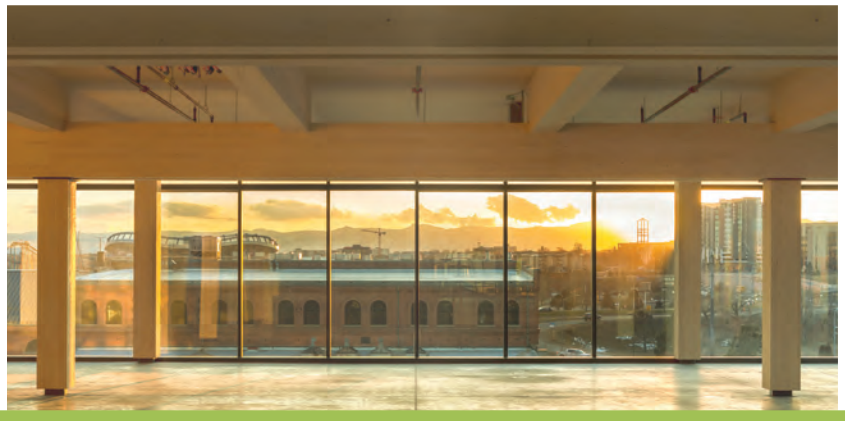
Platte Fifteen

Denver's First CLT Commercial Office Building Puts Sustainability to Work



WoodWorks™
WOOD PRODUCTS COUNCIL

Architects had a unique opportunity with this coveted building site near the South Platte river in Denver—the chance to connect an historic neighborhood with modern building technologies using sustainable building materials. Designers of the innovative five-story office building used a brick and glass exterior to wrap a mass timber frame, built using glued-laminated timber (glulam) beams and columns supporting cross-laminated timber (CLT) floor and roof panels. The exposed wood structure, visible from both outside and in, provides tenants with a contemporary yet authentic workspace.

PROJECT DETAILS

LOCATION:
Denver, Colorado

SIZE:
Five stories; 150,418 square feet

CONSTRUCTION TYPE:
Type III-B

COMPLETED:
2019

PROJECT TEAM

CLIENT/OWNER:
Crescent Real Estate LLC

ARCHITECT:
OZ Architecture

STRUCTURAL ENGINEER:
KL&A Engineers & Builders

GENERAL CONTRACTOR:
Adolfson & Peterson Construction

TIMBER SUPPLY AND INSTALLATION:
Nordic Structures/FGP Construction

When a developer known for making smart investments in better buildings chooses wood, people take notice. Designers for this new office structure, located on a prominent corner in one of Denver's most popular neighborhoods, drew architectural inspiration from the surrounding historic buildings while using wood to create a distinct, modern presence. The mass timber structure blends authenticity and sustainability with state-of-the-art construction technologies, linking Denver's pioneering past with its carbon-friendly future.

Platte Fifteen is a five-story office building with ground floor retail and two levels of concrete parking below. With soaring interior ceiling heights, outdoor patios and a rooftop deck providing unobstructed views of downtown Denver and the nearby Rocky Mountains, the project holds plenty of appeal for potential tenants. But for many, the real appeal is the wood structure itself.

Authenticity Appeals to Sustainability-Minded Tenants

Like several other cities in the U.S., Denver has a growing number of companies seeking a more sustainable ethos, a philosophy that many choose to reflect in their office address. While technology companies have traditionally been targeted tenants for what some refer to as an authentic aesthetic, Crescent Real Estate is finding that sustainable architecture, including buildings with a lower carbon footprint, appeals to more traditional tenants as well.

Because of this, Crescent wanted to build a project that featured natural materials, improved thermal performance and energy efficiency, and better indoor air quality. They'd had recent success working with OZ Architecture and KL&A Engineers & Builders on The Loading Dock,[1] a CLT structure in nearby Boulder, and decided to apply what they'd learned to a bigger building in a bigger market. With its exposed wood structure, tenant interest in Platte Fifteen was immediate and strong.

The intersection at Platte and 15th is considered a gateway to the downtown area. "It's such a remarkable site, a great location," said Joseph Anastasi, Senior Associate at OZ Architecture. "We were inspired by the architectural character and context of the neighborhood and spent time studying the facades of the surrounding historic brick buildings for inspiration in terms of proportion, scale and detail. We felt it was important to respect this historic site and reinterpret it in a contemporary way as part of this transformational opportunity for the City."

Anastasi's colleague at OZ Architecture, Senior Associate and Project Manager Jacob Levy, agreed. "Platte Fifteen gave us the opportunity to showcase the new generation of mass timber buildings in Denver," he said.

Thoughtful Design

The resulting Platte Fifteen design includes 3-ply CLT panels on a 30x30-foot grid with glulam beams and columns, all left exposed to the interior with minimalized connections. A unique double girder system is comprised of dual black spruce glulam beams (9 inches wide x 27 inches deep) spaced at 30-foot centers, combined with glulam purlins (12.875 inches wide x 25.25 inches deep, also black spruce) at 10-foot centers. The CLT floor panels were topped with 3 inches of concrete. The roof, which is also 3-ply CLT, was designed to support a terrace with large tree planters and Colorado snow loads. It is mostly un-topped, except for a 4-inch normal weight damping slab under the mechanical units. It also includes tapered insulation with an R30 value.

The design team undertook a thorough analysis at the start of the project, studying not only grid options but construction types. "We explored both Type IV and III-B and settled on a Type III-B over a Type I-A podium," said Dr. Greg Kingsley, president and CEO of KL&A Engineers & Builders. "The interior structure didn't have a fire rating requirement because of the Type III-B construction type, which allowed us to use the efficient 3-ply CLT floor panels, and to expose all of the wood structure."

In addition to construction type, the analysis covered different grid configurations, numbers of girders and beams, and materials—including an all-steel option. "I would argue that we could not have been any more efficient with the CLT for Platte Fifteen," said Chris Kendall, Principal at KL&A Engineers & Builders. "It's important to respond to what owners and developers want while also finding the most economical system that meets their needs. We did an extraordinary number of studies on Platte Fifteen to confirm that we had both."

Platte Fifteen has a relatively conventional lateral system for a five-story structure. There were no wood shear walls in the design; lateral resistance is provided by the concrete core in combination with a glulam frame with steel rod bracing.

The team also used the CLT as the diaphragm instead of the concrete topping. "Techniques are rapidly evolving for CLT diaphragm design," said Kendall. "We did a lateral analysis considering the diaphragm as rigid and did a second separate lateral analysis considering the diaphragm as flexible. Next, we took the worst case loads out of each of the analyses and applied them to things like collectors, vertical lateral force-resisting elements, and the diaphragm itself. Our diaphragm connection is a nailed plywood spline that's probably more flexible than a half lap connected diaphragm, but I believe the true behavior is semi-rigid. However, I also believe that determination and calculation of the stiffness of that semi-rigid diaphragm is challenging. We're confident the envelope design was the right approach."

Kingsley added, "If we'd used the topping slab as the diaphragm, it would have limited future tenant improvement options. Using the CLT frees the topping for possible modification without shear transfer issues down the road, giving future tenants more flexibility."

Sustainable in Both Design and Execution

Mass timber tells a good sustainability story and tenants are becoming more knowledgeable about its benefits. Aesthetics are also important; Platte Fifteen's emphasis on exposed wood has created an iconic address in this already desirable neighborhood.

"When tenants see the warmth of wood, it definitely resonates," said Conrad Suszynski, Co-CEO of Crescent Real Estate. "It also resonates with us. We're committed to sustainable building; it's intrinsic to who we are and what we aspire to be. We wanted to reduce the carbon footprint of Platte Fifteen, and mass timber helped us get there. We think it's industry's job to be pushing these trends, and we are committed to finding a way to make it all work."

But it takes more than just wood. A design is more sustainable when the building itself can be quickly, easily and efficiently constructed. Platte Fifteen's mass timber system delivered on every level, reducing construction time by 20 percent compared with a traditional steel structure.

"Sustainability matters to us as well so we were pleased to be involved," said Shawn Brannon, Project Manager with Adolfson & Peterson Construction. "We appreciate the fact that wood is the only true sustainable building material; it literally regrows itself. We also appreciated that the wood portion of the project went together so well. It took a lot of planning and dedication for our team to learn about building with mass timber for the first time, but we're proud to be at the forefront of this exciting technology here in Denver."

Grid Analysis

While a 30x30-foot grid is the prototypical office grid many tenants expect, the design team ran extensive studies to confirm that it was also the most cost effective and structurally efficient for Platte Fifteen. As part of the pre-design analysis, they considered more than ten grid configurations, including 25x30, 24x24, 30x40 and others, and carried several through initial pricing exercises.

Ultimately, Crescent Real Estate chose the 30x30-foot grid based both on its structural economy and their opinion that it would bring the most value in terms of leasing. The resulting design also gave them the 9-foot interior clear heights tenants expected.

"When we design using materials and building systems that have been around for a long time, we often just know what grid spacing works best," said Kingsley. "But we recognize that mass timber is different, with different opportunities, so we knew Platte Fifteen warranted a closer look. We even looked at hybrid systems with steel beams and girders with CLT panels. It was a good exercise to undertake."

Beyond the Calendar – The Value of Planning

Wood is generally underutilized in office construction in North America and this was one of Denver's first commercial uses of CLT, so some of the subcontractors were unfamiliar with mass timber. But all involved heralded the value of their upfront planning.

"We selected our most trusted trade contractors for Platte Fifteen, the people we knew could do this job effectively," said Brannon. "We provided CLT samples to get them comfortable with the material and our expectations, and really dug into the details in terms of the aesthetics. We also let them know that speed of construction would be different. Wood construction is so fast, and the tolerances are so accurate; it was important they knew what to expect. Lack of familiarity

can lead to unnecessarily high bids because subcontractors price the unknown risk into their estimate. Our philosophy is to communicate well, use mock-ups if possible, and get the trades comfortable up front."

It was a collaborative effort from the very beginning, even during the design stage. Nordic Structures worked closely with the team at KL&A Engineers & Builders and OZ Architecture to help optimize CLT panel size and connection details. They also coordinated early with the HVAC contractor, so that every penetration 2 inches or larger could be precut in the CLT panels. This close collaboration ultimately reduced costs on the project.

Planning also saved time in the field; subcontractors knew exactly what to expect when they arrived at the jobsite, which led to a more reliable construction schedule.

Simon Gallagher, team leader from Nordic Structures, said Platte Fifteen went smoothly in large part because Crescent got everyone to the table as early as possible. "The early involvement of not just us as the wood manufacturer, but also the mechanical, electrical, and all the trades people was important, and allowed us to plan all the openings in advance."

Building a Better Office Building

As a developer, Crescent Real Estate is focused on building better buildings. Two things that led to Platte Fifteen's quality and tenant appeal were acoustics and vibration.

Acoustics

A well-designed office space provides a comfortable environment in which people can both concentrate and collaborate. Acoustics are critical to both.

Although guidelines related to acoustical performance in office occupancies do exist, they are not requirements under the International Building Code (IBC). The most relevant guidelines can be found in Section 1206 of the 2018 IBC, which lists requirements for acoustical performance of walls, partitions and floor/ceiling assemblies in multi-family buildings:

- Sound transmission class (STC) rating of 50
- Impact insulation class (IIC) rating of 50 for floor/ceiling assemblies
- Ratings can be reduced to 45 if field tested

Mass timber is a great choice for projects where acoustics are important. The Platte Fifteen design team evaluated several different floor assemblies for performance and cost, using WoodWorks' *Inventory of Acoustically-Tested Mass Timber Assemblies*,[4] and companion paper, *Acoustics and Mass Timber: Room-to-Room Noise Control*.[5] They chose a floor assembly with a 3-ply (3-1/2-inches thick) CLT panel, a 3/4-inch acoustical mat, and a 3-inch normal weight reinforced concrete topping. Field testing corroborated the design with an STC rating of 53 and IIC rating of 45.

Column connected to CLT beam and girder

10 Benefits of Using Mass Timber for Platte Fifteen

1. **Sustainability** – Wood is a sustainable, renewable material, resulting in a building with low embodied energy and a light carbon footprint.
2. **Beauty** – Exposed wood provided the authentic aesthetic desired by Denver's office tenants, especially technology and creative companies wanting to attract and retain employees with appealing offices.
3. **Biophilia** – Wood's biophilic qualities promote well-being and productivity.
4. **Lower finishing costs** – Leaving wood exposed to the interior eliminated the need for additional finishes.
5. **Design flexibility** – Wood beams and panels could be configured to meet Platte Fifteen's grid spacing. Members were easily connected to the concrete podium and core using creative yet simple detailing.
6. **In-plane dimensional stability** – The cross-lamination of boards in CLT panels helps minimize in-plane dimensional change due to fluctuation in moisture content. This allowed panels to fit together precisely.[2]
7. **Construction speed** – Mass timber members were prefabricated and installed quickly, speeding construction.
8. **Less noise and waste** – Construction was quieter, and the contractor had less onsite waste, making mass timber a good choice for Platte Fifteen's tight urban infill building site.
9. **High performance** – The mass timber system provides good thermal and acoustic performance for Platte Fifteen's tenants.
10. **Higher returns** – Leasing premiums for the unique building outweighed extra costs of using mass timber.

Vibration

When asked whether vibration design is important, Kingsley answered, "Yes, but many owners and developers may not know how important it is for a timber structure. Vibration can often be the factor that governs the design."

Because of their success leasing The Loading Dock in Boulder, Crescent knew vibration mattered. "Vibration design was important to this owner, but it's also important to us as engineers," said Kendall. "When we design an office building, we know that vibration has a high probability of controlling things like member sizes, slab depths and performance. It's important for most construction, but there are specific criteria for offices that differ from other buildings."

For steel structures, vibration analysis is typically focused on the beams and girders; the deck is secondary and counts only because of the mass that the thickness of the deck might provide. With a mass timber structure, engineers must first pay close attention to the vibration performance of the CLT panel itself, and then consider the beams and girders.

Fortunately, due in part to the short 30-foot spans, the most cost-effective 3-ply CLT panel configuration met Platte Fifteen's vibration requirements.

Speed of Construction

One of the primary benefits of mass timber construction is installation speed, and this benefit rang true for Platte Fifteen. Crews began installing the wood system in November 2018, and the last panels were laid in March 2019.

"Once we got to the wood, we were building about 2,000 square feet of frame and decking a day," said Brannon. "Overall, using mass timber reduced our construction time on the major structure by 20 percent. This allowed us to get our topping slabs in much faster."

Material delivery was also important. Just-in-time delivery of the mass timber elements helped with both speed and efficiency, since the site has a zero-lot line and sits in a busy commercial district. CLT panels were shipped with penetrations already cut. Glulam beams were cut to length and wrapped for protection. Altogether, Nordic delivered 65 trucks of material, including CLT, glulam and connectors.

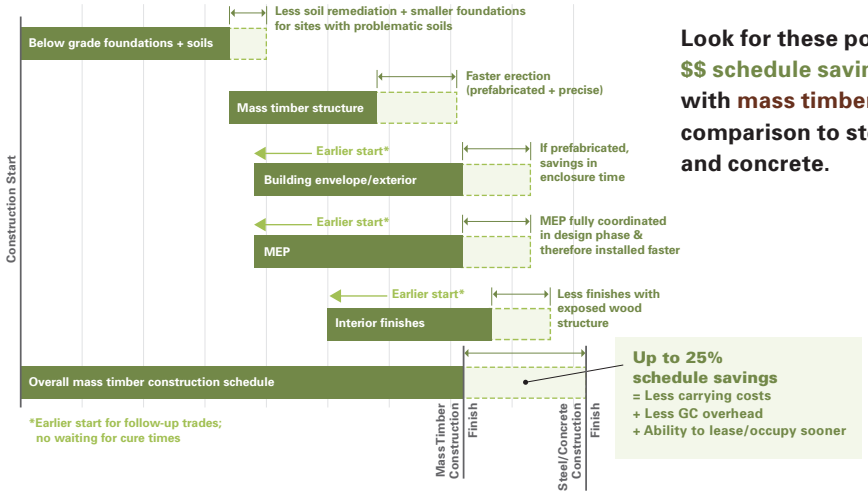
Mass timber reduced construction time by 20%

CLT panels were hot loaded—that is, loaded and delivered on trucks in sequence for direct installation. Once the truck rolled up to the jobsite, panels could be directly craned into place.

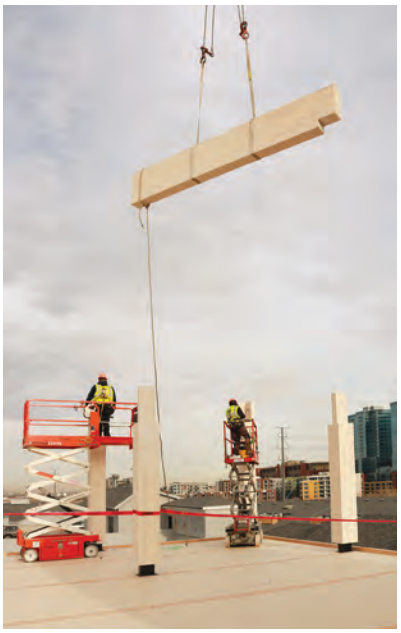
While the concept sounds simple, it required meticulous coordination. Panels were delivered to the site in the order they would be installed, but it was a three to four-day drive to Denver from the manufacturing plant in Quebec. "It was a logistical challenge to sequence things right," said Gallagher. "We tried to time deliveries so that we were always a little ahead of the curve, so that if there was a problem with trucking, there would be no delays."

Construction itself was another achievement in speed. All the glulam and CLT was installed by a seven-person crew from FGP Construction. The quiet installation was appreciated by the neighborhood, and efficient material deliveries minimized traffic interference.

Compressing the Typical Construction Schedule



Source: *Mass Timber Cost and Design Optimization Checklists,* WoodWorks[3]



Material Cost: Only Part of the Equation

Early estimates showed that mass timber itself came at a slight premium over other systems, but the project team knew this was only part of the equation. Faster installation and quicker completion meant that the building could be leased sooner, providing a quicker return for Crescent Real Estate. They were also able to spend less on tenant improvements, since there was no need to cover the wood with interior finishes.

The design team also worked hard to optimize the building system. "The biggest contributor to cost was wood volume from CLT thickness, so it was important to be efficient there," said Kendall. "Our ability to make the design work with a 3-ply CLT panel was key." Additional cost savings came from the simplicity of connections and grid regularity.

Most important, however, is the improved financial return that mass timber will provide over the long run. "We knew we could recover any extra cost through faster speed of construction and less expensive tenant improvements," said Suszynski. "We also believed that people will pay a premium for being able to lease this building. It's unique. It's aesthetically pleasing. We think our tenant retention will be much higher than in a more generic building."

Lessons Learned

Although Platte Fifteen was Denver's first commercial use of CLT, the developer, architect and engineer had experience working together on The Loading Dock. "We had teamed well together and knew what it took to coordinate a mass timber project like this," said Anastasi. "And because the subcontractors were brought on early, it led to a truly integrated design approach."

Their extensive grid study is one example of how experience helped, said Kingsley. "In the past, we've done what engineers and architects typically do. We think that, just because you can get a CLT panel to span 25 feet, that's what you use. And then you have this nice open floorplan, and it looks terrific, but it may not be the most economical choice."

He added, "Historically, we've used a steel mentality but now we're shifting gears. For example, in a steel structure, when you add pieces, you generally add cost, so you try for longer spans and fewer pieces. But that's not necessarily true in wood structures. Depending on how they're connected, you need to pay attention to the volume of timber material in terms of economy, and how that relates to the grid. That's another thing we learned with Platte Fifteen."

The design team also increased collaboration with the timber supplier. "Nordic Structures brought several good ideas to the table early for Platte Fifteen," said Kendall. "This allowed us to take more control of the details specifically related to the wood structure and led to the overall structure's efficiency."

Denver's Mass Timber Pioneers

Platte Fifteen may be Denver's first commercial CLT building, but it likely won't be its last.

Special Touches

While a mass timber building system is durable, the wood still requires some protection, particularly if it is to be left exposed, so the project team took a few extra steps to preserve its natural beauty. The manufacturer applied a tinted sealer to both the CLT and glulam during manufacturing. Denver experienced an unusually wet winter with a lot of rain during construction, and the sealer helped protect the wood, making it easier to keep clean.

"Since the mass timber system was new to Denver, Adolfson & Peterson took time to share our vision for the finished space with everyone on their team, including all subcontractors," said Crescent's Suszynski. "This allowed people on site to understand how their activities would impact the finished space. They even had their workers wear gloves when handling the wood to protect it from staining."

Once the wood columns were installed, crews wrapped them with foam and oriented strand board (OSB) to protect them from dents and other damage. After the wood system was erected, they wrapped the building and installed a temporary roof to prevent water intrusion for the remainder of construction.

"It was important to understand and anticipate all the things that could impact the project and have a plan to mitigate those," said Brannon. "Installation of a mass timber system does require a few extra steps, but it really all goes back to planning."

"It was exciting to bring mass timber and CLT to Denver, to be a pioneer like this," said Anastasi. "We look forward to what's next with wood, and to finding new ways to differentiate office buildings in this market."

All agreed that it was helpful to have the City of Denver on board from the beginning. "City plan reviewers visited the site and walked through with the fire department so they could all see the timber system and understand it better," added Levy. "They were terrific, in large part because they know this is the future of construction."

Denver's leasing market appears to recognize the trend as well. "We know tenants have different objectives, and wood is playing into our ability to attract them to our properties," said Suszynski. "But what we're really seeing, and we've seen it for quite some time, is that people are actually looking for open work environments; that's where office space is headed. And when they see Platte Fifteen, with its beautiful wood beams and exposed wood ceiling, and when they compare it to a standard concrete or steel building, it's no contest. They can relate to the beautiful space and they appreciate its sustainability. Mass timber has really resonated with this market."

Glulam columns and beams supporting CLT roof panels

Considering mass timber?

Contact WoodWorks for free project support.

If you'd like assistance with a mass timber project, our technical experts offer support from design through construction on issues ranging from allowable heights and areas to structural design, lateral systems and fire- or acoustical-rated assemblies. WoodWorks also offers a wide range of education opportunities and other resources.

www.woodworks.org/project-assistance
help@woodworks.org

WoodWorks™
WOOD PRODUCTS COUNCIL

[1] The Loading Dock, www.woodworks.org/project/the-loading-dock

[2] U.S. CLT Handbook, https://info.thinkwood.com/clt-handbook

[3] Mass Timber Cost and Design Optimization Checklists, www.woodworks.org/wp-content/uploads/wood_solution_paper-Mass-Timber-Design-Cost-Optimization-Checklists.pdf

[4] Inventory of Acoustically-Tested Mass Timber Assemblies, www.woodworks.org/wp-content/uploads/Acoustically-Tested-Mass-Timber-Assemblies-WoodWorks.pdf

[5] Acoustics and Mass Timber: Room-to-Room Noise Control, www.woodworks.org/wp-content/uploads/wood_solution_paper-MASS-TIMBER-ACOUSTICS.pdf

Images: JC Buck (finished building); WoodWorks (construction photos)

WoodWorks Case Study WW-023 • Platte Fifteen

SLB SOFTWOOD LUMBER BOARD

Forestry Innovation Investment