CASE STUDY

Adidas East Village Expansion

Innovative mass timber designs meet ambitious construction timeline

When Adidas announced plans for a two-building expansion of their North American headquarters, speed and budget were key criteria. They wanted a campus that reflected their culture and commitment to quality, authenticity and innovation, but had a strict 24-month deadline. In response, the design and construction team chose a hybrid of precast concrete and mass timber for one building, and a mass timber post-and-beam solution for the other, using prefabrication to reduce the overall construction schedule by more than three months. Construction took place during one of the wettest winters in Portland's history, highlighting the importance of moisture management and use of coatings to protect the wood. The resulting LEED Gold project plants the Adidas brand firmly in the Pacific Northwest.

Adidas stayed true to their competitive ethos when they sponsored a national design competition for the expansion of their existing North American campus, located just north of downtown Portland. LEVER Architecture, located just a mile away, won the job.

"It was a unique design competition in that we paired with Turner Construction to provide a high-level budget, which then had to be met," said Thomas Robinson, founding Principal of LEVER. "So, we had to be cautious about the design we proposed. We quickly determined that the only way to hit both the timeline and budget was to use prefabrication and efficient logistics."

Mass timber fit both requirements, but the job still required value engineering, said Levi Huffman, Director of Technical Services at DR Johnson Wood Innovations. "We pre-assembled mass timber cassettes, factory-applied coatings to protect the wood, scheduled just-in-time deliveries … it was all for speed and efficiency."

Two Different Buildings, Two Unique Challenges

LEVER designed two distinct buildings to meet the site requirements. The Gold Building has five floors of office space over a new five-level, below-grade parking garage. The Performance Zone Building, constructed over an existing three-level underground garage, contains a gym, café and juice bar, and roof deck. A central sports plaza with soccer pitch connects the two buildings.

GOLD BUILDING

The design team originally considered a conventional concrete structure for the Gold Building. "But that came with a 27-month construction schedule and Adidas had a hard 24-month deadline," said Kyle Warren, Project Executive for Turner Construction Company.

Taking advantage of the 30-foot grid of the existing parking structure below, the team landed on a unique hybrid system, combining perforated precast concrete girders topped with prefabricated mass timber cassettes.

- ***Mass Timber Cassettes***

The 10x30-foot cassettes, formed using glue-laminated timber (glulam) beams and cross-laminated timber (CLT) panels, were prefabricated and coated at the DR Johnson facility in nearby Riddle, Oregon, then transported to the site and lifted into place. Each cassette consists of two 30-foot-long glulam beams, each 8-3/4 by 18 inches, fastened to and running parallel with a 3-ply, 10x30-foot V1M1 Douglas-fir CLT panel.

LEVER designed the top edges of the precast concrete girders with inset pockets, sized to hold the beams of each cassette. Once delivered, the cassettes were simply dropped into place. "Since it was gravity bearing, the installation was simple and fast," said Robinson. "We left exposed stirrups on the top of each girder, then laid rebar on top and tied the 4-inch topping slab back to the core. So, we used the diaphragm to tie the building together; it was an efficient way to connect the structure for lateral."

Anne Monnier, a Principal at KPFF Consulting Engineers, added, "We placed the concrete core and shear walls in the middle of the building to create an open floor plate for flexible space planning. So, the concrete topping slab served four functions—diaphragm, fire, vibration, and floor finish."

- ***Perforated Precast Girders***

  The precast concrete girders were perforated to allow utilities to run through, keeping the visual focus on the wood. “Once we decided to use precast concrete, we knew we needed to look for ways to accommodate the mechanical systems; we didn’t want them running underneath those girders,” explained Robinson.

  Monnier added, “We did a structural girder penetration analysis, and decided to go with a patterned penetration design. This simplified the precast process since all girders were fabricated the same. This also means that not all penetrations are currently being used, but it allows for future flexibility.”

> Vibration design was an important consideration for both buildings. As members of the team that wrote the *WoodWorks U.S. Mass Timber Floor Vibration Design Guide*,[1] KPFF used the two Adidas buildings as case studies. They modeled each building and conducted field testing to confirm their calculations, allowing the team to compare analytics with actual field data, which helped inform the Guide.

PERFORMANCE ZONE BUILDING

The Performance Zone Building posed entirely different design challenges. Because it was built over an existing underground parking structure, LEVER chose a lightweight timber system, avoiding the need for a seismic retrofit of the garage below. The result is an intricate post-and-beam design using glulam beams and columns and CLT panels.

Beams ranged in size from 8-3/4 inches to 12-1/4 inches wide, with depths from 13-1/2 to 33 inches, some up to 64 feet long. CLT panels were 5-ply V1M1 Douglas fir.

The design resembled a stacked, Jenga-style configuration, with two girders attached to each side of a column using a unique embedded steel pin connector, concealed within the wood to meet the one-hour fire rating. “It was a simple, elegant, easy-to-fabricate connection, inspired by structures I saw in Japan,” said Robinson. “We then ran the purlins over the tops of the double girders, leaving cavity space for ductwork.”

The building used the CLT panels as the diaphragm, with lateral support provided by four steel brace frames configured to form a tower. Crews first erected the prefabricated steel frame, then installed the mass timber around it, adding a 3-inch topping slab over the CLT panels.

PROJECT DETAILS

WOOD DESIGN AWARD WINNER

Adidas East Village Expansion

LOCATION: Portland, Oregon

STORIES: Gold Building: five-story office (182,000 sf)
Performance Zone Building: three-story amenities (31,000 sf)

SIZE: 213,000 sf total (above grade)

CONSTRUCTION TYPE: Gold Building: Type III-A over a Type I-A podium
Performance Zone Building: Type III-A

COMPLETED: 2020

PROJECT TEAM

CLIENT/OWNER: Adidas

ARCHITECT: LEVER Architecture

STRUCTURAL ENGINEER: KPFF Consulting Engineers

CONSTRUCTION MANAGER: Turner Construction Company

MOISTURE MANAGEMENT CONSULTANT: RDH Building Science

MASS TIMBER SUPPLIER: DR Johnson Wood Innovations

MASS TIMBER COATINGS SUPPLIER: Sansin

INTERIOR DESIGNER: Studio O+A

Connect with the Adidas East Village Expansion project team at *https://www.woodworksinnovationnetwork.org/projects/844*

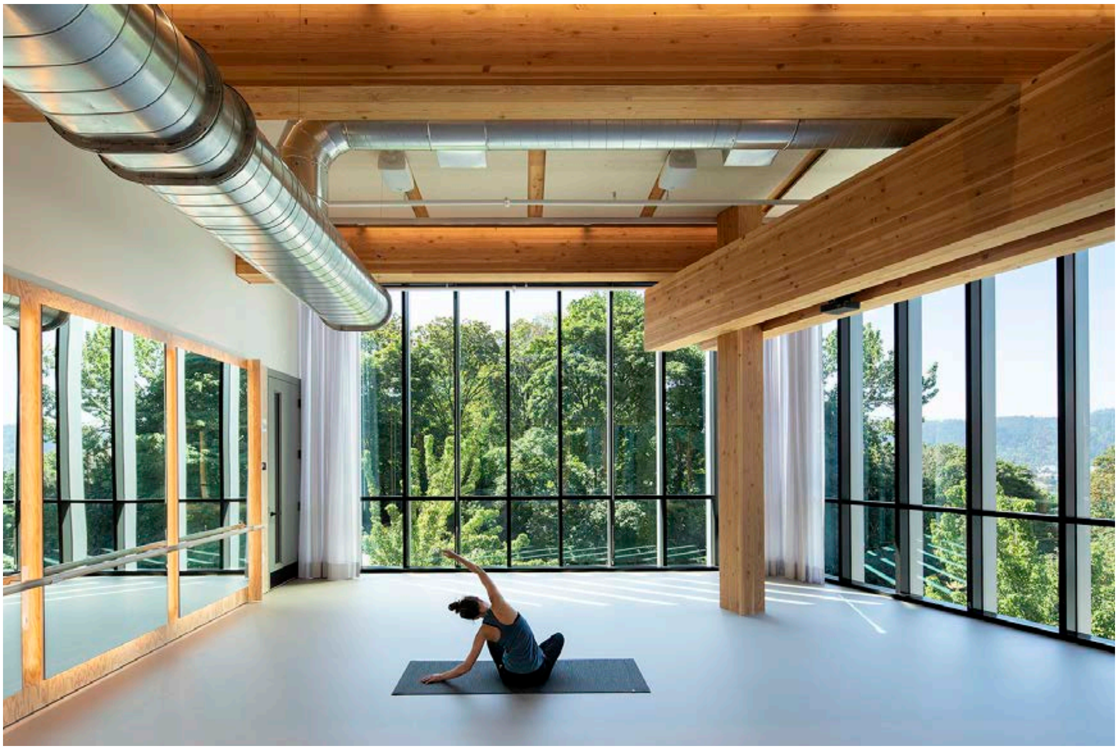
WOODWORKS INNOVATION NETWORK

Moisture Management

Nature rarely heeds a tight construction schedule, and the Adidas job was no exception—the project was built during one of the wettest winters in Portland’s history. “It felt like we built the whole thing in the rain,” remembers Warren.

The decision to add a protective coating to wood members varies for every job, but everyone on the Adidas team recognized the importance of doing so for this project. They also knew they wanted a low-VOC, environmentally friendly option that would still be high-performing. RDH Building Science, the moisture management consultant, and LEVER worked closely with Turner Construction to develop precise wood coating specifications for both buildings.

“Coatings were something we brought to the table early, and it was a good thing,” said Warren. “With the hybrid configuration of the Gold Building, we knew coatings would help prevent staining. We also knew factory finishing would improve erection speed, so we specified that all wood members arrive at the jobsite already protected.”



"A protective undercoat, especially for large buildings, is a way to protect wood from UV degradation and water absorption in transit from the factory and at the construction site," said Sjoerd Bos, Sansin Managing Director. "One never knows what might happen at the construction site. Optimally, you want a breathable, penetrating coating so that moisture is not trapped in the wood, allowing the mass timber pieces to gradually release moisture to minimize checking."

Once DR Johnson manufactured the glulam and CLT and assembled the cassettes for the Gold Building, they applied a clear protective undercoat to all faces and edges of the wood elements to protect against weathering during construction, repel moisture and guard against water absorption and staining. End grains received two coats. Faces that would be left exposed once installed received a coating that also contained UV protection. Then, they wrapped the assembly for shipping. All glulam and CLT used in the Performance Zone Building were treated with the same clear undercoating, which also helps ensure dimensional stability. "We think of coatings as an inexpensive insurance policy," said Huffman.

Commitment to moisture management doesn't end with a factory finish. Turner had a team of three people dedicated to moisture control on the jobsite. They checked moisture content of wood elements upon delivery, tested wood surfaces prior to concrete topping slab installation, ensured that all field cuts received an additional triple coat of protective coating, and continually monitored moisture in all conditions.

"Wood is an important part of this project, and we wanted to make sure both buildings were perfect when we were done," said Warren. Monnier agreed, adding, "You don't always see a moisture mitigation plan like this, but it is especially important when you mix wood with concrete and steel. This was a good example of how to do things right."

Key Challenges, Lessons Learned

Because of the strict schedule requirements, speed of construction drove nearly every decision. "We had eight simultaneous permits under review at the same time, utilizing a fast-track process," said Robinson. "Each permit was stacked on top of the other, which meant we were already digging the hole for parking under the Gold Building when we were finishing the design and detailing of the core and shell for both buildings."

Construction moved at the same breakneck pace. DR Johnson delivered three to seven truckloads of mass timber materials a day during installation, and each truck was assigned a 10-minute delivery window. Three tower cranes worked the site, and the precast erector was trained to also install the mass timber, for better efficiency. Crews installed 30,000 square feet of floor every seven days on the Gold Building, including columns, girders, glulam/CLT cassettes and concrete topping slabs.

Big projects usually hold learning opportunities, and this was no exception. For example, the team modeled the big cantilevers of the glulam beams for the Performance Zone Building in their end condition but then crews were challenged to fit the long glulam beams into the hidden column connectors because the beams arrived with an inch of camber. While they eventually found a solution, Warren said they "all agreed to pull camber into the modeling process when analyzing constructability in the future."

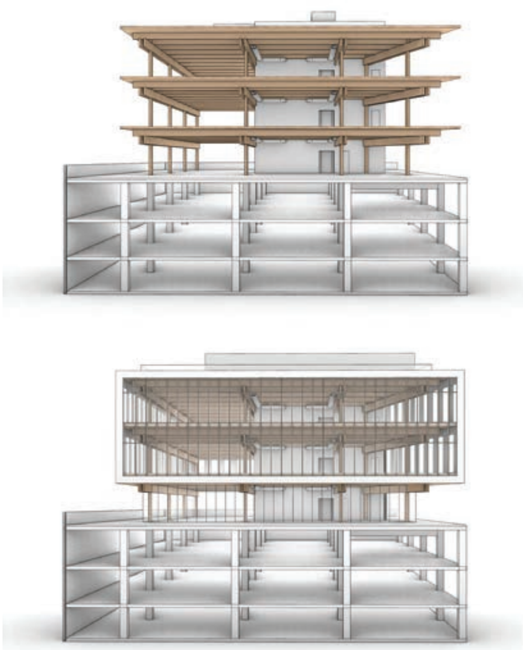
Prefabrication and Protection Led to Success

Extensive use of prefabricated materials and creative design made a seemingly impossible schedule possible. And the creative combination of prefabricated timber cassettes with precast concrete in the Gold Building resulted in a space with the raw, authentic aesthetic Adidas wanted.

Protecting the wood was also important, both for efficient construction and long-term durability. "We were pleased that the protective coating kept dirt, iron staining and other potential issues at bay," said Sansin's Bos. "The right coating protects the owner's investment in the structure and helps keep the building looking great for years to come."

"Timber's ability to be prefabricated to precise specifications played a significant role in the project," Robinson said. "Our use of wood allowed us to build faster, the mass timber was relatively light compared to other materials, and it was adaptable."

But he emphasized that the primary benefit of using mass timber really lies in the experience of the space. "By using wood, we created two buildings which are authentic, beautiful and sustainable ... all the things Adidas wanted. This is a place where people are meant to be inspired, to innovate, and to collaborate. And timber, as a material, lies at its core."



Performance Zone Building

Adidas East Village Expansion

Volume of wood products used:
114,232 cubic feet

U.S. & Canadian forests grow this much wood in:
9 minutes

Carbon stored in the wood:
2,891 metric tons of CO_2

Avoided greenhouse gas emissions:
1,118 metric tons of CO_2

TOTAL POTENTIAL CARBON BENEFIT:
4,009 metric tons of CO_2

EQUIVALENT TO:

848 cars off the road for a year

Energy to operate 423 homes for a year

Source: US EPA

Estimated by the Wood Carbon Calculator for Buildings, based on research by Sarthre, R. and J. O'Connor, 2010, A Synthesis of Research on Wood Products and Greenhouse Gas Impacts, FPInnovations. Note: CO_2 on this chart refers to CO_2 equivalent.

Reducing Carbon Footprint

The use of wood lowers a building's carbon footprint in two ways. Wood continues to store carbon absorbed by the trees while they were growing, keeping it out of the atmosphere for the lifetime of the building—longer if the wood is reclaimed at the end of the building's service life and re-used. Meanwhile, the regenerating forest continues the cycle of carbon absorption. Wood products also require less energy to produce than other building materials, and most of that comes from renewable biomass (e.g., bark and sawdust) instead of fossil fuels. Substituting wood for fossil fuel-intensive materials is a way to avoid greenhouse gas emissions and reduce embodied carbon.

[1] https://www.woodworks.org/wp-content/uploads/wood_solution_paper-Mass-Timber-Floor-Vibration.pdf

Images: Jeremy Bittermann – cover, p.2 (small), and p.5;
Garrett Rowland – p.2 (large), LEVER Architecture – photos p.3 and p.6, graphics p.4 and p.6