

# REDISCOVERING WOOD

With a plethora of sustainable benefits, wood also offers an under-appreciated value as a **structural material**.

While natural wood is famous for its warmth and beauty, when it comes to interiors, its application as a structural system in larger commercial buildings remains largely untapped. Fortunately, a number of high-profile projects are helping spur wood's potential as a sturdy, structural building material.

BY BARBARA HORWITZ-BENNETT, CONTRIBUTING WRITER

▶ PAGE 24

# Bullitt Center

Seattle's Bullitt Center offers one example of wood's versatility. Described as "the greenest office building in the world," Miller Hull Partnership defines this net zero phenomena as 83% more energy efficient and 80% more water efficient than a typical Seattle office building.

Yet Brian Court, project architect with The Miller Hull Partnership in Seattle, points out that, even though the project's energy-efficient achievements have received a lot of attention, the building team was just as excited to discover how heavy timber came out with the best

life cycle assessment profile—earning its place as the building's main structural system. "Ultimately, the carbon footprint of a concrete structure greatly exceeded that of timber frame," explains Court. Furthermore, "timber is actually carbon negative once the carbon sequestered within the wood is considered."

Miller Hull took advantage of wood's architectural beauty by leaving the structural frame's Type IV heavy timber Douglas-fir glulam beams and columns exposed. Their choice also minimized interior finishes—and the challenge

of finding non-toxic products. This essentially helped the building team avoid many Red List-banned chemicals in its quest to achieve Living Building Challenge certification.

Interestingly, the use of wood also helped the architect achieve greater daylight penetration. As opposed to other building materials—which would have shortened the occupied floor-to-ceiling height—the use of 2 × 6 wood floor panels, instead of deeper floor joists, delivered an extra two ft. of open floor-to-ceiling space, essentially increasing daylight penetration to the interior by four ft. In addition, there was no need for a perimeter beam; this enabled the window to fully extend to the bottom of the decking, further enhancing daylight penetration.

**Heavy timber came out with the best life cycle assessment profile—earning its place as the building's main structural system.**

In considering a more extensive application of wood, fire protection concerns are sure to come to mind; yet larger wood members actually offer natural fire resistance. While wood does burn, it does so at a slow and predictable rate, says Court. So in the event of a fire, while the wood is smoldering, there would be ample time for occupants to egress and firefighters to arrive. That said, Court says the fear of fire in twentieth century American cities forced timber to take a back seat to noncombustible concrete and steel. "However, as carbon becomes an increasingly important part of the material selection process, we see wood becoming the structural material of choice to handle gravity loads in buildings up to six stories," says Court.

However, he is quick to point out that concrete and steel are still necessary below grade and to handle lateral loads. Another issue to be aware of, according to Court, is that wood shrinks over time and can be compressed if it is loaded perpendicular to the grain. To work around this issue, the contractor connected the timber columns with a steel tube so that any radial shrinkage in the beams and girders would have no effect on the columns.

▷ PAGE 26



2 × 6 wood floor panels instead of deeper floor joists delivered an extra 2 ft. of open floor-to-ceiling space essentially increasing daylight penetration to the interior by 4 ft.

Photos courtesy: PPG/Tom Kessler



**PROJECT SPECS**

Owner: **Bullitt Center**  
 Design/Construction: **Miller Hull Partnership, Seattle**

Structural frame's Type IV heavy timber Douglas-fir glulam beams and columns exposed

**BEAUTY AND PERFORMANCE**

The Bullitt Center features Forest Stewardship Council 100% certified lumber for the structural frame and interior finishes. To balance costs, a more industrial grade beam was selected.

# Federal Center South

Only five miles south of the Bullitt Center is another example of a highly sustainable project's use of wood. Charged with reusing materials from the U.S. Army Corps of Engineer's (USACE) former warehouse as part of the U.S. General Services Administration's Design Excellence program, the building team reclaimed approximately 100,000 board ft. of salvageable structural timber and 200,000 board ft. of decking to form the commons foundation, structural system and interior cladding for Federal Center South—the new USACE Seattle District Headquarters.

Inside the building's stunning 3-story, skylit atrium, a wood-clad "treehouse" is the centerpiece of a peaceful courtyard where harvested rainwater flows across rocks and boulders. Wood is also showcased as wall paneling, exposed beams, ceilings, flooring, staircases, bridges, benches and railings. "Throughout the atrium, super graphics on both wood and glazed surfaces enhance wayfinding while offering technical data on the area's waterways—the focus of the U.S. Army Corps of Engineers work," adds Todd Stine, partner, ZGF Architects, Seattle.

Of course, a major aspect of the project's construction was salvaging the reclaimed wood, which involved a phased demolition process where wood components were individually harvested from the old warehouse. "The team—led by G.R. Plume Co.—pulled nails, unfastened bolts, removed brackets and devices, trimmed out fractures, and sorted the wood before it was shipped to a local mill for structural grading and fabrication," relates Stine.

The team then built a mock-up to test the structural integrity of each beam slated for use as part of a unique composite timber/concrete beam system. The test process required each beam to hold twice the design live load

(2 × 80 psf) for 24 hours, and then recover at least 75% of the measured deflection within 24 hours of being unloaded.

After passing the test with flying colors, the different wood pieces were sanded, but not too heavily, in order to maintain the original appearance of the reclaimed surfaces. "Wood surfaces not subject to heavy wear, such as wall cladding and structural members, were finished with a waterborne polyurethane spar varnish; wood subject to greater wear, such as stair treads and floors, were finished with a waterborne urethane/acrylic polymer," explains Stine. Ultimately, the reclaimed wood enabled the team to reduce structural materials by 30%.

One wrinkle in the process was discovering that not enough salvaged timber had been recovered to fully frame the interior atrium if the beams were to be spaced 4 ft. on-center. The structural engineer, KPFF, proposed increasing the beam spacing to 5 ft. on center using composite construction. "This innovative approach eliminated the need for non-salvaged timber and retained the intended architectural character of the design," reports Stine.

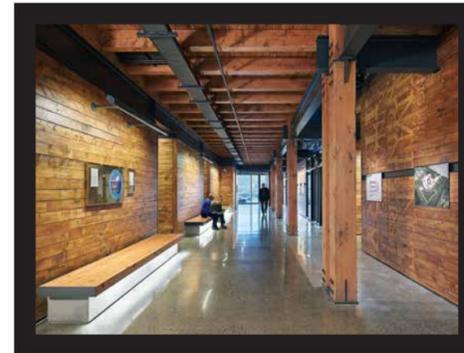
As for overall sustainable achievements, the LEED Gold-certified facility meets GSA EUI goal of 27.6 kBtu/sq. ft. per year, as compared to a regional average of 106.



## PROJECT SPECS

**Federal Center South—USACE Seattle District Headquarters**  
 Owner: U.S. Army  
 Design/Construction: ZGF Architects, Seattle  
 Structural engineer: KPFF  
 Photography: © Benjamin Benschneider/ZGF Architects

The team harvested individual wood components from an old warehouse and pulled nails, unfastened bolts, and trimmed out fractures.



## WARMTH, RECLAIMED

Wood is just about everywhere inside the U.S. Army Corps of Engineers' new Seattle District headquarters. Builders reclaimed close to 100,000 board ft. of salvageable structural timber and 200,000 board ft. of decking to create the commons foundation, structural system and interior cladding. Wood was also used for the ceilings, flooring, staircases, bridges, benches and railings.

The test process required each beam to hold twice the design live load (2 × 80 psf) for 24 hours, and then recover at least 75% of the measured deflection within 24 hours of being unloaded.

# Packard Foundation

**Seeking to make its mark as a replicable building—** not only for energy efficiency, but for the use of healthy and sustainable materials—the EHDD-designed David and Lucile Packard Foundation headquarters in Los Altos, Calif. also hoped to earn LEED Platinum and net-zero certification. FSC-certified wood was a natural choice.

For the structure, EHDD used wood as exposed columns, beams and trusses, as well as framing and roofing. As a finish, the firm selected wood for the siding and soffits, and as pavers in a landscaped courtyard. Inside the 49,000-sq.-ft. office building, the wood theme continues in the form of acoustical ceilings, wood paneling, office fronts, doors,

floors and furniture. In fact, some of the casework, doors and furniture actually use eucalyptus veneer salvaged from towering eucalyptus trees that were cut down during a road construction project at the Presidio in San Francisco.

“For the exterior, in particular, the use of wood reflects the California tradition of wood buildings, underlining the emphasis on the indoor-outdoor lifestyle and love for natural materials,” says Brad Jacobson, AIA, LEED AP BD+C, senior associate, sustainability leader for EHDD, San Francisco. “This is also clearly referenced in the building layout, as the building is centered around a wooded courtyard with operable doors all around.”

A departure from conventional framing, the building’s walls were structurally engineered to reduce wood use and thermal bridging, while increasing the area available for insulation. “Headers and double studs at jambs were eliminated, where possible, as the wall was braced back to the post and beam structure for stability,” explains Lotte Kaeffer, AIA, LEED AP BD+C, associate at EHDD. “Reducing the amount of wood reduced building cost and helped pay for the upcharge to achieve FSC certification.”

Also, by using wood framing instead of conventional metal stud framing, the team was able to achieve an overall wall R-value of 24, which was necessary to

support a passive thermal comfort design and eliminate a perimeter heating system. However, due to code requirements, all the wood studs to frame the exterior walls had to be fire treated.

While wood offers a plethora of sustainable and aesthetic benefits for this project, the building owner needed to accept the fact that regular maintenance would be required. To help minimize maintenance, EHDD specified a wood stain with a UV protective layer; however, based on several mock-ups, the owner decided to eliminate the UV protection layer for aesthetic reasons, according to Jacobson. In addition, the design team was not able to

rely on the wood structure for lateral loads, particularly due to the building’s location in a seismic zone. As such, the team used a hybrid wood and steel structure, with buckling restraint braces taking the seismic loads.

## What’s Next for Wood?

These and other projects demonstrate that wood can be much more than a warm interior finish; however, as a structural system, it remains a novelty. For now, U.S. building codes generally discourage its use in many applications; yet, as LEED and the Living Building Challenge continue to gain steam, this may eventually

bring about code changes and ultimately affect building material and structural system selection. Designers also anticipate that greater emphasis will be placed on life cycle assessment, reflecting favorably upon wood as a structural choice.

After working on the Bullitt Center, Court believes that wood has the structural capability to do far more than the industry is letting it do at the moment.

“People need to look at wood with fresh eyes, especially because it has so many environmental virtues over concrete or steel,” he concludes.

## OUTSIDE, INDOORS

FSC-certified wood supports an “indoor-outdoor lifestyle,” says EHDD’s Jacobson. “The building is centered around a wooded courtyard with operable doors all around, giving staff the opportunity to work outside, or inside with natural ventilation and direct access to the outdoors.”



**“For the exterior, the use of wood reflects the California tradition of wood buildings, underlining the love for natural materials.”**

Brad Jacobson, AIA, LEED AP BD+C, Senior Associate, Sustainability Leader for EHDD, San Francisco

## PROJECT SPECS

Packard Foundation Headquarters  
Owner: David and Lucile Packard Foundation  
Design/Construction: EHDD, San Francisco  
Photos courtesy: DPR Construction

