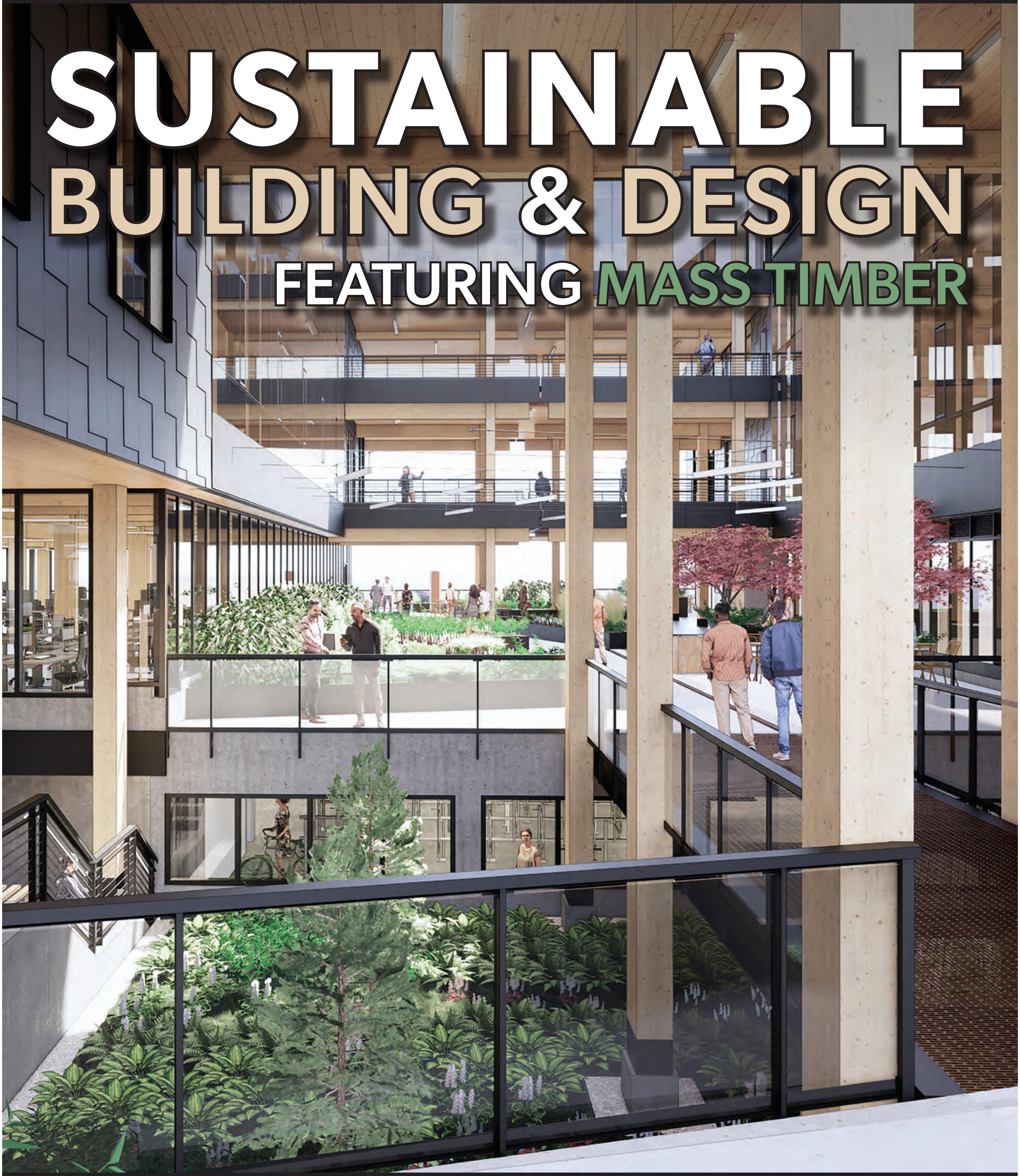
Seattle Daily Journal of Commerce

SUSTAINABLE BUILDING & DESIGN

FEATURING MASS TIMBER



August 31, 2023

EMBRACING THE MASS TIMBER REVOLUTION

Mass timber construction speeds up schedules, reduces carbon footprints and enhances aesthetic appeal.


BY STEVE CLEM & DEAN LEWIS
SKANSKA USA BUILDING

As we grapple with the challenges of climate change, the construction and design industries have turned their attention to an age-old material with a modern twist: wood.

Once widely used in construction, wood became subordinate to concrete and steel in the 19th and 20th centuries. This meant less research and fewer use cases for wood construction.

In the last few years, however, wood – mainly in the form of engineered mass timber products – has experienced a resurgence, as testing and research has established wood construction as not only as safe as concrete and steel, but also sustainably superior.

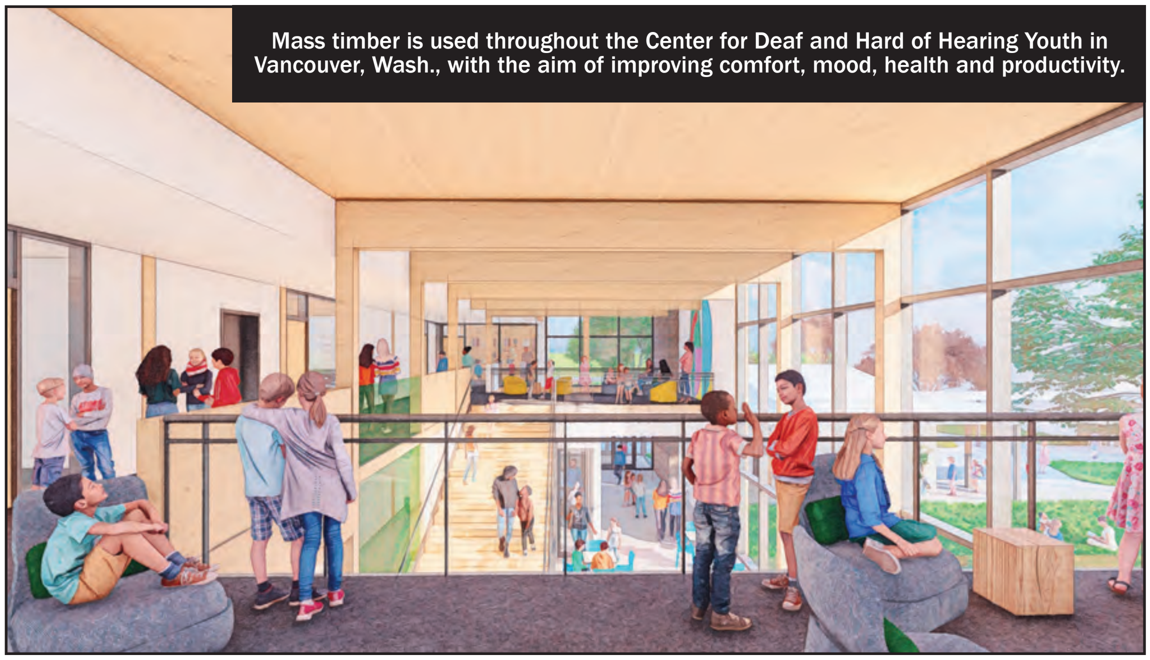
In our decade of working with mass timber at Skanska, we've seen how it has sped up construction schedules and reduced cost. Using mass timber also significantly reduces a project's carbon footprint, while satisfying clients' desire for biophilic design through mass timber's rustic, natural aesthetic.

In short, mass timber is redefining the way we build for a sustainable future, bolstering sustainability, construction efficiency and aesthetics.

SUSTAINABILITY

It's regenerative

Sustainability is a key differentiator between mass timber and other building materials like concrete and steel. Countless elements make mass timber one of the most sustainable building materials today, and chief among them is its regenerative nature.



Mass timber is used throughout the Center for Deaf and Hard of Hearing Youth in Vancouver, Wash., with the aim of improving comfort, mood, health and productivity.

IMAGE COURTESY OF MITHUN

Sourced from a correctly managed forest, timber is not only carbon friendly, but also an inexhaustible resource. Removing gravel, limestone, iron, or sand from the ground is inherently extractive; those resources do not replenish naturally. However, with mass timber, sunlight, water, chlorophyl, and good soil eventually convert into structural building materials – an outstanding regenerative cycle.

A more complete carbon picture

Carbon footprint is critical when determining sustainable building plans. Skanska teams evaluate the carbon impact from

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sourcing mass timber overseas versus locally, as well as the intricacies of forestry practices, shipping, delivery and installation. Timber's comprehensive carbon-tracking supply chain, encompassing forestry, harvesting, and milling, allows a more thorough identification of carbon impact levels that can be discussed with clients. That's not always the case with other building materials, which often rely on calculations that overlook significant contributors to the production process, as well as downstream effects of sourcing.

Deconstruction is possible

Timber also offers more modularity, as you can deconstruct a building and reuse large parts of the timber in nearly full structural capacity, whereas most other structural building materials get downcycled.

CONSTRUCTION EFFICIENCY

Time in the factory, not on site

Mass timber offers a substantial reduction in construction time across project duration — from prefab to finish — vs. steel or concrete. The key lies in the ability to shift significant portions of the process to a controlled factory environment. With field cutting eliminated, further work simply requires mechanical, electrical, and plumbing subcontractors on site to place the ducting, electrical cables, and other items, vastly reducing construction time.

With school construction, schedules are strict because back-to-school dates are set in stone and new buildings need to open on time. Using mass timber as a major component —like in the new Fairview Middle School Skanska is building in Bremerton. — not only adds a modern design element, but also helps reduce the construction timeline when there isn't any wiggle room.

The taller the building

As building heights rise, time savings grow dramatically. Skanska recently spearheaded a comprehensive study to evaluate potential building materials in our own development of a nine-story, 150,000 square-foot superstructure in Bellevue. The findings revealed that employing the new 2024 International Building Codes for exposing the timber proved that a mass timber building would be cost competitive and slash construction time by three months in comparison to conventional concrete construction.

Timesaving is attributed mainly to mass timber's modularity and close coordination with the structural core and exterior envelope, which are pivotal in setting the project timeline. Mass timber also provides superstructure cost savings due to the prefabrication of timber components; however, the real savings comes from pre-coordination with other trades such as MEPF, stairs, elevators and exterior wall systems.

REVOLUTION — PAGE 17

Early concept drawing of a nine-story, 150,000-square foot mass timber tower in Bellevue that Skanska is developing and building.

IMAGE COURTESY OF SKANSKA USA BUILDING

INSIDE

ON THE COVER

Designed to evoke a walk in the woods, public plazas in Northlake Commons bring biophilia to the community.

IMAGE COURTESY OF WEBER THOMPSON

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CONCRETE CAN BE PART OF YOUR SUSTAINABILITY EQUATION

Design and material choices can cut your project's embodied carbon without reducing building safety or functionality.


BY JACKIE SEMPEL & LAURA LINDEMAN
COUGHLIN PORTER LUNDEEN

Concrete is a major source of carbon pollution. With increasing focus on sustainability and environmentally-sensitive choices, clients and firms alike in AEC are naturally exploring more sustainable materials like mass timber. However, not every project can afford or structurally use the sustainable benefits of wood. At the end of the day, we will all continue living and building in a world that depends heavily on concrete.

Once we accept this, the industry's mandate is clear. We must vastly improve our use of this material and affect large-scale change through systematic choices made on projects being built today. Both will be a direct result of daily work and design choices, working through the practical constraints of each new project.

HIGH SCHOOLS STILL NEED TO BE BUILT

While sustainable choices are important, creating safe and well-performing buildings always takes precedence. The new Rainier Beach High School, designed by Bassetti Architects, is targeting LEED Platinum and employs green building strategies. However, the site has poor soils and groundwater issues, requiring atypical structural foundation construction.

After thorough design, study, and meticulous review, Coughlin Porter Lundeen's structural team chose an aggregate pier foundation system with a thick mat slab to provide settlement and liquefaction mitigation for the structure. As part of internal review, the structural team used the Tally analysis tool to perform a Life Cycle Assessment (LCA) to quantify the initial embodied carbon in the structure, and create targets for embodied carbon reductions. The EC3 tool was then used to further refine the LCA and embodied carbon studies. The latter revealed changes that could be made to concrete strength and cure times to lower the carbon cost without impacting building safety. Working with Bassetti Architects, we set performance targets for Global Warming Potential in the specification and asked the subcontractor to propose mix designs that would meet the targets without impacting project cost.

The resulting design required more concrete than original estimates, but will result in a far safer structure for the Rainier Beach community. Despite the inherent site challenges, we were able to lower the embodied carbon through our design and review process, so this was a win-win.

A typical high school requires approximately 69,500 cubic feet (2,575 CY) of concrete for sidewalks, physical education, and outside activities in site flatwork alone. One cubic yard is equivalent to approximately 533 pounds of CO_2 for the acquisition of raw materials, manufacturing, and transportation to the site. This means that a high school in the Pacific Northwest could produce 1,369,810 pounds (685 tons) of CO_2 — and that is before anyone even puts a building on the site.

Knowing this, our civil team regularly uses Type 1L cement (in place of standard Portland cement) to provide a 10% reduction in embodied carbon of a concrete mix without increasing cost on Seattle-area projects. A high school site like this example could use Type 1L and realize a carbon savings equal to 74 acres of U.S. forest a year.

While we all use civil engineering-designed spaces on a regular basis, even the best designs go unnoticed, which is typically their purpose. But that doesn't mean that their hidden potential should also be ignored.

Engineers with the right approach can vastly improve a project in ways that others won't ever see, like when measuring and tracking embodied carbon. Our firm has spent years studying these problems with our Sustainability Task Group, talking to clients and vendors in the Pacific Northwest, and putting in the daily work to reach sustainability goals as early in the design process as possible.

SUSTAINABLE CHOICES DON'T ALWAYS COST MORE

It is common for clients to think that sustainability considerations automatically increase costs. For example, Jefferson Hospital was pleasantly surprised when told they could reduce their embodied (and operational) carbon on their South Campus replacement and addition with no cost increases. Their original goals were highly focused on providing the best healthcare they could; they valued sustainability and equity too, but leaned into the design-build team to develop more specific goals with a focus on cost-neutral strategies. We worked closely with ZGF Architects and Abbott Construction to understand how easy adjustments could be made to realize large carbon reductions for this project.

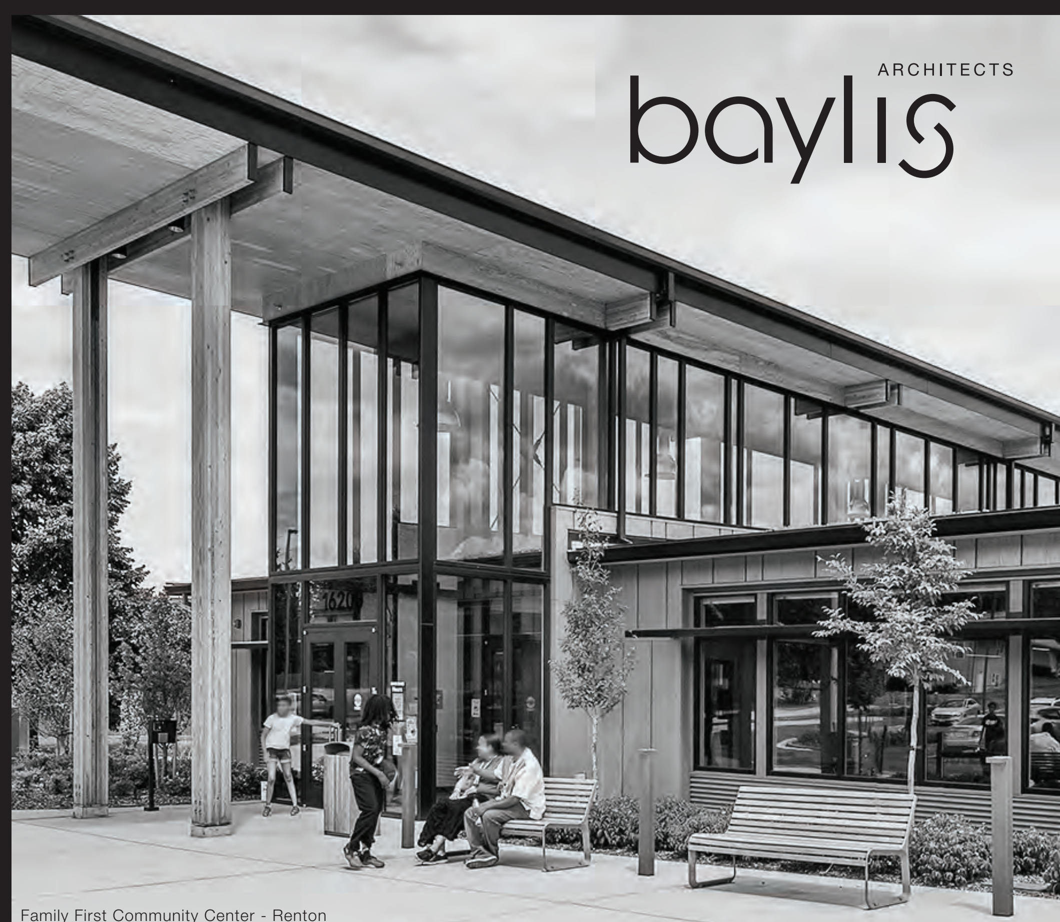
Jefferson Healthcare is located in Port Townsend. This means that large Seattle concrete mix producers can't be used on this job because the travel time would be too long for the material to be usable per ASTM code. In addition, while most of the major concrete providers in Seattle have numerous concrete mixes with Environmental Product Declarations (EPDs), many smaller concrete providers do not yet. EPDs are an important first step toward transparency in our building materials. Without EPDs, it is harder for smaller providers to show how sustainable their different mixes are, and for us to calculate the total embodied carbon of a building or site they are working on.

For the Jefferson Healthcare project, our team used the EC3 tool to produce a total estimate of the embodied carbon and ZGF's Concrete LCA Tool to estimate savings from the proposed concrete mix designs. This showed where to focus efforts and achieve realistic reduction goals. The team then contacted the local concrete provider chosen for the job, Cotton Shold, and made the case for investing in EPDs—which they did for the first time, specifically for this project, at a relatively low cost—to capture the specific savings in the local supply chain.

This is an important step to track the embodied carbon produced by using their products, and Cotton Shold appreciated the opportunity to provide a more sustainable option to their clients on the Olympic Peninsula.

Using the anticipated concrete mix EPDs from Cotton Shold, the final design is estimated to realize a Global Warming Potential impact reduction of 25,000 kgCO2e, equivalent to the carbon sequestration of 300 acres of U.S. forest for one year. All without increasing the project's budget and staying firmly aligned with the client's goal of providing the best healthcare possible for the Port Townsend community.

The best teams translate sustainable goals into practi-



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cal, achievable design choices. To do this, they create multiple iterations to fully explore the expected outcomes from key points of consideration, all while respecting and working within budget, performance, and code constraints.

There are many sustainable concrete options being researched and some are even being tested on site, but few are at a scale large enough to implement effectively in the Pacific Northwest. We can't sit back and wait for material advances to catch up with our community and regional needs. Instead, engineers and other AEC insiders must push the industry forward, using existing tools and materials, to make the carbon reduction advances the Pacific Northwest needs now.

Jackie Sempel is a leader in Coughlin Porter Lundeen's civil practice and co-chairs the firm's sustainability task group. Laura Lindeman is a structural project manager for Coughlin Porter Lundeen, leads integration of the Embodied Carbon in Construction Calculator (EC3) tool as a firm-wide standard for carbon tracking, and co-chairs the firm's sustainability task group.

Despite adverse soil conditions that required a thick concrete mat slab, the design team succeeded in reducing the new Rainier Beach High School's carbon footprint.

PHOTO COURTESY OF BASSETTI ARCHITECTS

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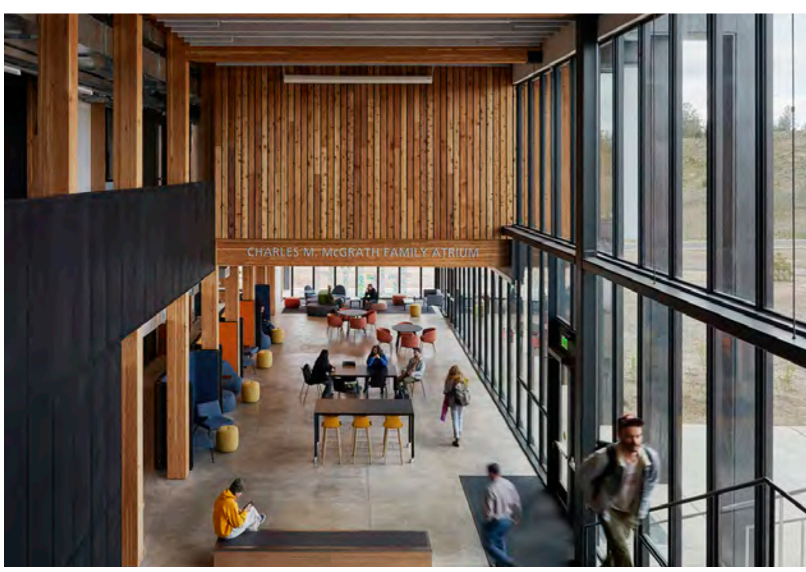


- Meeting net zero energy goal
- All-electric design with geothermal heating and cooling
- Sustainably sourced mass timber structure
- High-performance envelope with fiberglass frame windows
- Intelligent building controls
- Design Excellence Award, Education (IIDA Oregon, 2022)
- First Place, Secondary Education & Vocational Training (*DJC Oregon* Top Projects, 2022)

UM LOOKS TO MASS TIMBER TO MARK FORESTRY HERITAGE — AND FUTURE

A low-carbon structural design aims to inspire the next generation of students, and bolster the state's timber industry.

The proposed 56,000-square-foot mass timber science lab and teaching complex, designed by ZGF Architects in association with A&E Design.

IMAGES COURTESY OF ZGF



BY TODD STINE, RYAN CHENG AND JACOB DUNN
ZGF ARCHITECTS

People love Montana for a reason: they feel a deep connection to the land and its natural resources. With more than 25 million acres of forest, and the nation's most-visited national parks, sustainable forest management plays a critical role in the state's economy, its fight against climate change, and its determination to preserve the land for future generations.

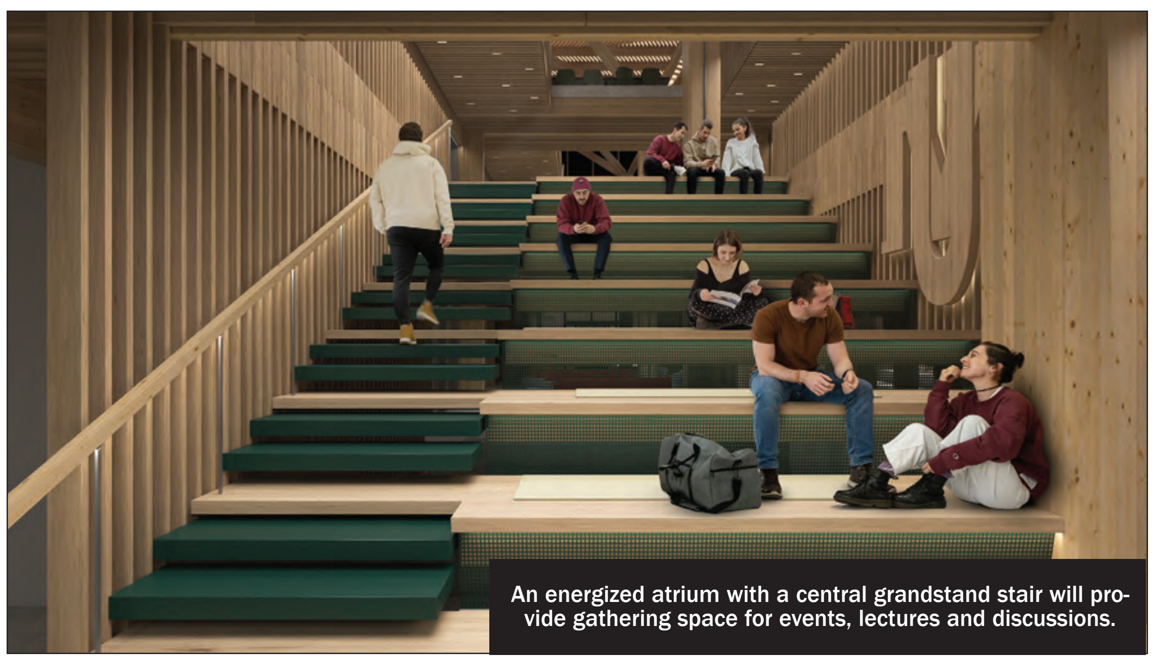
In Missoula, home to the University of Montana, forestry represents heritage — but also opportunity for innovation. The W.A. Franke College of Forestry and Conservation is a globally recognized leader for its academic programs, but time has taken a toll on its current facilities.

The University of Montana is currently fundraising for a new 56,000 square-foot mass timber science lab and teaching complex, designed by ZGF Architects in association with A&E Design, which will co-locate disparate academic and research activities under one roof, host core courses offered to all students, and create a campus focal point for the Grizzly community and prospective students.

BRINGING THE FOREST INSIDE

A key component of the project is demonstrating the potential of mass timber construction — large, structural components made by gluing smaller pieces of wood together to form beams (glulam beams) or panels for wall or roof and floor decks (cross laminated timber, or CLT). Areas of exploration include:

- Creating a living-learning environment that exposes students and visitors to mass timber's inherent beauty, strength, flexibility, and low carbon footprint. The building will serve as a teaching tool for the possibilities of mass timber design, material application, and supply chain transparency.
- Attracting industry partners to provide hands-on research and experiential learning opportunities to solve real-world problems.
- Showcasing the possibilities of new and innovative market solutions while linking students to the forestry industry they will work in after graduation.
- Highlighting and celebrating Montana's rich history in the timber industry as well as the multitude of ongoing efforts to ensure it is a sustainable industry far into the future.



An energized atrium with a central grandstand stair will provide gathering space for events, lectures and discussions.

CARBON BENEFITS

The building's size and location make it an ideal candidate for exploring a low-carbon structural design. Mass timber assemblies take less energy and carbon emissions to extract and manufacture than steel or concrete structural approaches. Additionally, the wood stores the carbon it absorbed through sequestration while the trees were growing in the forest. These two wood-specific carbon benefits can reduce the project's structural carbon footprint by more than 50%. To reduce the carbon impact of the project even further, the team is exploring the potential to reuse the wood structure, in addition to using low-carbon concrete technologies and steel produced from clean-energy grids.

The proposed program includes a mix of teaching and research labs, computer labs, active learning classrooms, seminar rooms, faculty offices, and a multipurpose room for larger gatherings. Collaboration spaces throughout the building aims to spark student-faculty engagement and cross-pollination of ideas across departments and disciplines.

In the heart of the building, an activated three-level atrium supported by towering Douglas Fir glulam columns is designed to capture the expansive feeling of being in the forest. Interior glazing and transparency showcase new ways of thinking about forest management.

SOURCING GOALS

Sourcing the mass timber regionally and tracing it back to the forests of origin will serve double duty, celebrating Montana's wood products industry and helping stimulate demand in a rapidly-growing market.

Three wood sourcing goals emerged from our engagement with the Franke College:

- Cultivate connections between the Franke College and the regional timber industry.

The project will target manufacturers in Montana and Pacific Northwest supply chains. Our team researched three aspects of mass timber manufacturing — growing, milling, and fabricating — to identify supply chain opportunities within the state and region. The goal was not to establish a rigid requirement for only local sourcing, but to maximize material coming from Montana.

- Trace the timber back to its forests of origin to measure impact.

Transparency and tracking are key to making the connections

HERITAGE — PAGE 15

SETTING A NEW SUSTAINABILITY STANDARD FOR AFFORDABLE HOUSING

Lessons learned from the initial phase of the Exemplary Buildings Program help normalize a cost-effective, high-performance standard.

Project teams collaborated early on design and product choices to ensure buildings like Sawara in Yesler Terrace are air-tight and weather-resilient.

PHOTO COURTESY OF MARPAC CONSTRUCTION

BY BECKY BICKNELL & DAVID REDDY
SPECIAL TO THE JOURNAL

Explosive growth. Unprecedented housing inequity. Climate change. How can King County address all three?

Navigating the delicate balance between energy efficiency, sustainability and cost containment is a challenge faced by many multifamily developers. This tension is even more pronounced for affordable housing owners who are working to deliver high quality, resource-efficient buildings within limited capital and operating budgets.

In 2018, the Housing Development Consortium of Seattle-King County (HDC) established the Exemplary Buildings Program to provide financial support and technical guidance to affordable housing owners looking to pursue an ultra-efficient building standard while still delivering as many homes as possible at reduced rent levels.

The goal of the Exemplary Buildings Program is to improve performance above code, and to document lessons learned to help inform future projects to normalize a cost-effective, high-performance standard for affordable housing. The program has been successful in helping affordable owners prepare for the energy code changes that took effect in 2021 as well as the forthcoming updates that are scheduled for later this year.

Partners and projects

Building design and performance experts, including O'Brien360, Ecotope, Coughlin Porter Lundeen, DCI and 4EA Building Science, have developed best practice guidelines around building ventilation, domestic hot water heating, solar energy, and exterior wall assemblies. Seattle City Light was also a key partner in launching the program, and providing significant financial incentives and technical support to affordable housing owners.

The Exemplary Buildings Program has five initial demonstration projects — four projects in Seattle and one in Bothell — creating over 500 new affordable homes to address our region's need for affordable housing. Each of these owners are motivated to create better living environments for their residents, ranging from individuals coming out of homelessness, families with children and seniors, while reducing the long-term environmental impacts of their buildings.

These demonstration projects made an initial commitment with Seattle City Light and HDC to design their buildings to a performance standard of 20 EUI (Energy Use Index), or 40% less energy than the 2015 Washington State Energy Code (WSEC), or a Passive House (PHIUS) standard. The average EUI for new affordable multifamily buildings in the past decade has been between 30 to 35 EUI. Imagine Housing's Samma project and DESC's Hobson Place project also participated in the State's Ultra High Energy Efficiency program, which provided additional financial support to construct to the PHIUS building standard.

CHALLENGES AND LESSONS LEARNED

All five projects shifted to 100% all-electric building systems — a significant leap from a design and operations perspective. An important component of making this leap was utilizing heat pumps to generate hot water for all of the apartments. Heat pumps are significantly more energy efficient than natural gas and electric water heaters.

Another new system incorporated into all the buildings is balanced ventilation with heat recovery for apartment ventilation. These systems provide reliable, filtered air to the apartment, while also reducing energy use by recovering the energy of air exhausted from the building to heat incoming air. Each building incorporates different ventilation designs, both centralized and in-unit, enabling the EBP to disseminate the design and construction benefits and challenges of each approach.

At the time the demonstration projects started design, these high-efficiency technologies were uncommon in housing developments. It is risky for affordable housing owners to commit to new technologies. However, the technical assistance developed by the EBP program helped guide decision-making, and the lessons learned have been invaluable as the 2018 and 2021 energy codes have rolled out with new requirements to incorporate these new technologies.

In addition to enhanced building systems, building envelope performance has been critical to hitting the proposed Exemplary Building performance target. It was crucial for project teams to collaborate early on the design detailing and product choices for the roof, exterior walls, windows, and other details to ensure these buildings are air-tight and weather-resilient. This diligent coordination paid off for the DESC Hobson Place South project, which met the Passive House air-tightness standard of 0.08 cfm/ft2, over 60 percent better than the code-required 0.25 cfm/ft2.

WHAT'S AHEAD?

As the remaining four projects finish construction, HDC and SCL will continue to aggregate final design and cost information and monitor projects through their initial occupancy periods. The 2018 energy code and forthcoming 2021 code update are now requiring many of the "exem-

STANDARD — PAGE 19

EXEMPLARY BUILDING DEMONSTRATION PROJECTS

	Othello Square U-lex	Hobson Place South	Sawara	North Lot	Samma
Owner	HomeSight	Downtown Emergency Services Center	Seattle Housing Authority	Seattle Chinatown International District Preservation & Development Authority	Imagine Housing
Location	Seattle Rainier Valley	Seattle North Beacon Hill	Seattle Yesler Terrace	Seattle North Beacon Hill	Bothell
Project Type	Family & workforce housing (Co-op ownership)	Permanent supportive housing (rental)	Family & workforce housing (rental)	Family & workforce housing (rental)	Senior Housing (rental)
# Homes	68	92	114	160	76
Timeline	Projected start late- 2023	Completed 2022	Started 2022	Started 2022	Started 2022
Architect	Sundberg Kennedy Ly-Au Young	Runberg Architecture Group	Ankrom Moisan Architects	Weber Thompson	Third Place Design Cooperative
General Contractor	Marpac	Walsh Construction Co.	Marpac	Marpac	Synergy

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RESHAPING SUSTAINABLE DESIGN WITH MASS TIMBER

Designers look to hybrid structural approaches, close design coordination and increased residential application.


BY CODY LODI & BRITTANY PORTER
WEBER THOMPSON

The world of development is experiencing a seismic shift in perceived value by prospective tenants as we emerge from the pandemic. A flight to quality with a focus on healthy buildings and restorative spaces has reinforced the value of sustainable architecture.

In parallel, an increase in innovative mass timber projects emerging in the Pacific Northwest and nationally has resulted in a renewed interest in building with timber to better address the impacts of climate change and create healthy and restorative architecture. The benefits of mass timber are multifaceted and measurable, leading to its appeal and exponential growth.

REGENERATIVE CARBON

To meet the goals of carbon reduction, new building stock must utilize decarbonizing tools like mass timber. For years, the benefits of timber's reduced embodied carbon have been proven through industry-wide data and analysis. A recent life cycle assessment (LCA) calculating embodied carbon on Weber Thompson's Northlake Commons project, a 275,000-square foot lab office under construction in Seattle, demonstrated that the building's mass timber structural system avoided 46% of the embodied carbon that a concrete structure would have required.

IT TAKES INNOVATION

Lower embodied carbon is a big goal in moving toward using mass timber on a building and less concrete and steel. But it is important to acknowledge that timber is rarely a singular structural solution, especially on large projects. Hybrid structural approaches that utilize prefabricated steel and concrete to supplement the timber elements allow for longer spans and faster construction.

There have been exciting developments in testing engineered timber panels to replace concrete and steel typically used in building lateral systems. This spring, the Natural Hazards Engineering Research Infrastructure (NHERI) tested a 10-story mass timber tower on the world's largest shake table. The results look promising for being able to use large rocking CLT shear panels in taller structures. This could significantly increase the embodied carbon savings and further speed up construction in tall

RESHAPING — PAGE 15

Designed to evoke a walk in the woods, public plazas in Northlake Commons bring biophilia to the community.

IMAGE COURTESY OF WEBER THOMPSON

Cedar Speedster provides low-carbon restorative spaces for evo's headquarters in Fremont. Interiors by Robert Hutchison Architecture.

AN EARTH-SHELTERED FORM FIT FOR WEATHER EXTREMES

Methow Valley common house relies on Passive House principles, superinsulation, advanced air sealing, cross-laminated timber panels and a green roof to meet sustainability goals.


A simple and compact shape with a sunken terrace to the south acts as a windbreak and private patio for the bedrooms.

PHOTOS BY BENJAMIN DRUMMOND

BY MATT HUTCHINS
CAST ARCHITECTURE

The Methow Valley, in the foothills of the North Cascade Mountain Range, is known for its access to nature, cold winters with abundant snowfall, and hot summers. The agricultural history in the valley is rich, and many small farms thrive today.

Sited amongst agricultural fields near the historic McKinney Mountain, the Berm House — part of a complex under development in the valley — is built into a meadow slope. It will informally serve as a common house for the larger, 19-house mixed income community.

TEAM

Owner:
Lee Whittaker
Methow Housing Trust

Architect:
CAST architecture

Contractor:
Methow Valley Builders

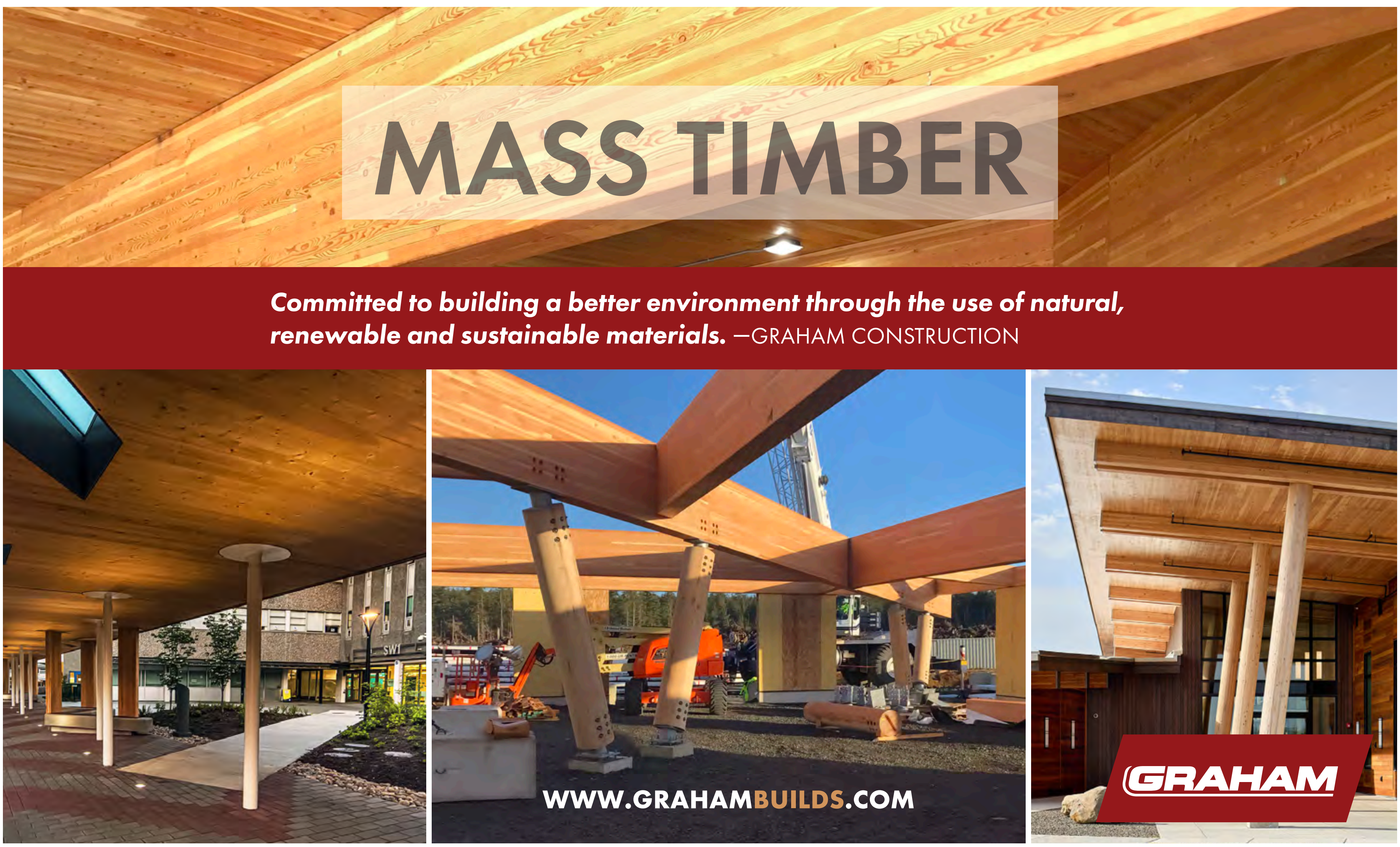
CLT:
Vaagen Timbers

Concrete subcontractor:
JR's Five Star Concrete

Geotechnical engineering:
GeoEngineers

Cold climates call for particular design elements to facilitate passive solar heating and cooling, and the cyclical changing of seasons. Planning for these strategies involved a detailed analysis of the site which sits between the Methow River on the east and McKinney Mountain to the west.

The north side required protection from winter winds, while the southern exposure needed to be designed for solar heat gain in winter and to limit solar exposure in summer, while maximizing territorial views. At the east, the winter sun tucks itself behind McKinney Mountain right around noontime, and the west



BERM HOUSE'S THREE PRIMARY DESIGN GOALS

1 Passive solar heating and cooling
The site location and natural building orientation posed opportunities and challenges explored through diagrams and massing studies. The goal of these studies was to explore passive heating and cooling design strategies.

2 Efficient construction
An efficient construction process and high-quality materials were crucial aspects of the design process. After explorations, CAST proposed a combination of concrete and mass timber, particularly cross-laminated timber (CLT) and glued-laminated timber (glulams) to carry the loads of the design efficiently, and function as an exposed finished surface.

3 Systems efficiency
Several key components came into play designing for a residence in a cold climate, including exterior thermal insulation, crawlspace and slab waterproofing, vapor barrier inside exterior walls, energy-efficient fenestration, and HVAC systems with energy recovery ventilation.


The Berm House design incorporates Passive House principles including superinsulation, advanced air sealing, and mechanical ventilation.

side would provide Highway 20 access. Considering these factors, as well as the site's orientation, it became clear the general form and massing of the architecture would be a key consideration throughout the design process.

The home's low profile opens to the valley panorama of mountains and agricultural fields while remaining virtually invisible from the McKinney Ridge residential area to the north. The south-facing building orientation optimizes passive heating, and the large overhang protects from snowfall and intense summer sun.

With the earth-sheltered strategy, other elements of the design became important and dependent on this approach. A simple and compact shape with a sunken terrace to the south was integrated into the design to act as a windbreak and private patio for the bedrooms. On the east and west facades, 'wing walls' complete the berm, provide privacy, and focus the views down the valley. Toward the north, a formal entrance is located between two berming mounds acting as a focal point yet integrates with the design scheme.

The home is post and beam structure with a Cross-Laminated Timber (CLT) roof, prefabricated in northeastern Washington. The design incorporates Passive House principles including superinsulation, advanced air sealing, and mechanical ventilation. Thermal bridges are minimized by wrapping the house in continuous external insulation, including under the foundation, isolating the home from outdoor temperature swings and the brisk winter wind.

The bermed roof, with 12-inches of soil, adds thermal mass and protection from weather exposure and fire. The roof will feature a path through the native landscaping. The Methow Valley's original one-room schoolhouse will be placed on the roof and oriented toward a peak that holds personal significance to the owner and be open as a

WEATHER — PAGE 15

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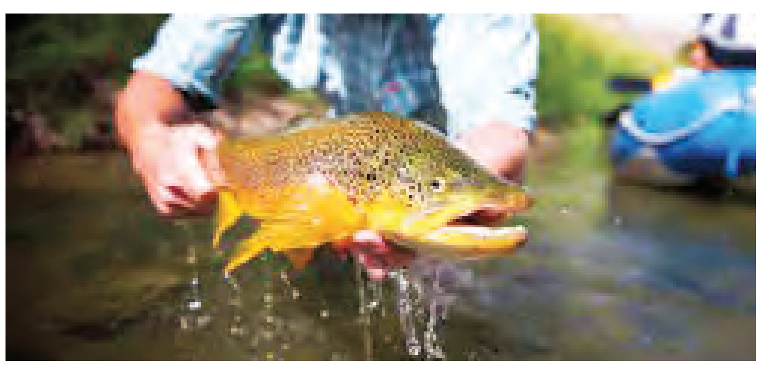

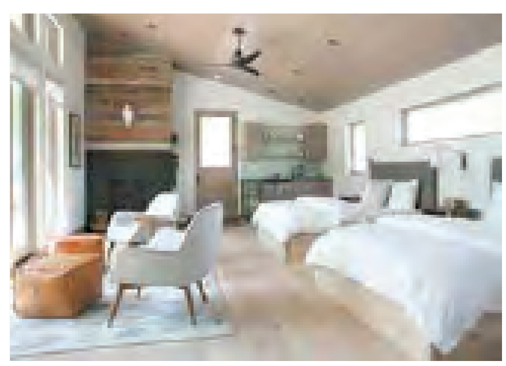

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RESHAPING

CONTINUED FROM PAGE 11

timber structures while providing more resilient seismic protection.

PARTNERSHIPS ARE KEY

The nature of mass timber as a structural system naturally forces a more efficient process. The structural engineer and contractor are involved in sustainable design conversations from the beginning, resulting in more robust upfront decision-making and planning as well as early material sourcing.

Close coordination with creative structural engineering teams can present more efficient and cost-saving opportunities. This can include optimizing CLT (cross-laminated timber) spans to reduce the number of beams and columns required, or even eliminating beams completely through a point-supported design; or rigorously stacking column loads down to parking levels to avoid costly and embodied carbon-heavy transfer slabs reducing construction duration.

Working with contractor teams who have the tools and processes in place to streamline timber supply, fabrication and installation also allows projects to reap potential costs and construction time savings.

RESTORATIVE HEALTH

An intriguing study, recently released by Harvard, reinforces the positive impacts of biophilia — people's desire to connect with nature — on human health. The Department of Environmental Health, and the Population Health Sciences Program, among other departments, used virtual reality to monitor the impacts on mental health and well-being in an environment that incorporated biophilic opportunities with one that didn't.

It found that incorporating biophilic elements provided restorative benefits and helped speed recovery from physiological stress and anxiety. Mass timber buildings with exposed natural wood create interior environments filled with biophilic connection. The allure of these health benefits reaches beyond office spaces, and can also help differentiate residential buildings in competitive leasing markets.

TRANSLATING TO RESIDENTIAL

While the value proposition for mass timber is being revealed most frequently in the commercial and institutional sectors, continued development of building codes alongside new design and delivery processes should translate this value to the multifamily markets as well. We are already seeing increased interest in mass timber systems to deliver healthy high-rise residential architecture that could differentiate itself from the standard concrete models both in price and apartment tenant experience.

The proposed adoption of mass timber provisions of the 2024 International Building Code into the 2021 Washington State and Seattle Building Code will allow for taller timber buildings to expose the timber elements in structures under 180 feet in height, allowing residents to reap the biophilic benefits of timber at home as well as in the workplace.

TANGIBLE SUSTAINABILITY

Sustainable design has long sought its own architectural expression. From grand solar panel canopies to dashboards representing energy saved or produced, there's a desire to create a visual identity that celebrates its high performance. But often this identity is invisible in the completed space. Air-tight, thermally isolated wall assemblies are concealed in cladding and gypsum board, high-efficiency mechanical systems are hidden in soffits, and stormwater is discretely managed through underground vaults.

By choosing a sustainable structural system and exposing it in the finished space, the physical bones of the design highlight and reinforce a significant sustainable design decision. Making sustainability tangible means the benefits of mass timber can be both felt and seen.

Cody Lodi is design principal at Weber Thompson in Seattle, and co-chair of AIA Seattle's mass timber committee. Brittany Porter is senior associate at Weber Thompson in Seattle, sits on the AIA Washington Council's Board of Directors and was project architect of Northlake Commons.

HERITAGE

CONTINUED FROM PAGE 7

between the Franke College, community, ecology, and economy. Stories of how the project's wood was sustainably grown in the region, who harvested it, and its broader social and environmental impact will connect students to the forestry models and conservation research they study.

The project will work with manufacturers and lumber mills to track log purchasing history back to the product's forest of origin and tell the local story of that wood through narrative, mapping infographics, including interviews with landowners to document their stories. For a Montana-based manufacturer or mill, tracing back to the forest of origin will likely show a connection to federal contracts, which typically focus on forest restoration and engage the state's network of community-based forest collaborative groups to co-create management objectives.

- Scale up Montana forest restoration through hybrid-species CLT panels.

Montana is unique in the fact that its public lands account for roughly 57% of the state's wood harvest per year, based on 2018 data. This presents a meaningful opportunity for forest restoration and economic development. These harvests typically prioritize forest health treatments related to wildfire, drought and disease resilience in the state's slower growing forests.

As a result, the harvested forests produce smaller diameter and lower grade timber from a multitude of different species. Increasing use from these types of harvests into durable wood products like mass timber could increase their financial viability while supporting active forest management. However, only so much of this product can go into CLT panel manufacturing, where many panel types typically only use higher quality wood that excludes much of the product coming from this type of restoration forestry.

A market product that accommodates more of the outputs from this type of forestry is needed. This can be achieved through alternative CLT layups, for instance, that use lower grade timber for certain layers of the panel, or even different species. Our proposed project received letters of support from two regional manufacturers — Smartlam North America (Columbia Falls, Mont.) and Vaagen Brothers Lumber (Colville, Wash.) — to explore using lower grade lamstock and hybrid-species CLT panels.

NEW HERITAGE

This building will embody the University of Montana's commitment to sustainability and connection to the land and surrounding communities — all while celebrating the past and future of Montana's wood products industry.

Todd Stine is the managing partner in ZGF's Seattle office. Ryan Cheng is a design principal in ZGF's Seattle office. Jacob Dunn is a principal and building performance specialist in ZGF's Portland office.

WEATHER

CONTINUED FROM PAGE 13

space for reflection.

Guided by the client's community-oriented vision, a significant design request emerged: the ability to host guests, allowing privacy and independence for everyone. A great room was designed for friends and neighbors to gather regularly. Off the great room, a five-foot wide hall leads to three guest suites and the primary suite. The uncomplicated and efficient floor plan shows a clear division between the private and public spaces.

Varying sunlight exposures, seasonal warmth, and views are maximized along the entire south-facing wall of the heavily occupied great room and suites. The south facade is outfitted with floor-to-ceiling energy-efficient windows that intend to allow the winter sun in fully, yet be efficient enough to protect the interior environment from indirect summer heat. The mechanical and storage areas are located where sunlight is not required and there is a desire for dark, cool, and dry spaces. Back-of-house includes a large pantry, with access to a crawl space for storage, and a laundry room.

Unique openings and strip lighting accentuate the wood beams. The CLT ceiling, wood panels, deep gray slate floors and black horizontal fixtures unify the space. Dark hickory on the floor in the hall and suites add continuity. A coffee table and the kitchen bar were crafted from a fir tree felled off the property. Landscape boulders were sourced from a quarry on the property as well. The homeowners' quarry informed the rocky landscaping theme.

Matt Hutchins serves on the Seattle Planning Commission, is a strategic councilor for AIA Washington, is on AIA Seattle's Board of Directors, and is co-chair of the public policy board. He is a co-founder of CAST architecture.

MASS TIMBER BUILDING SPOTLIGHTS WASHINGTON'S ROOTS

New Olympia capitol campus building showcases salvaged lumber, celebrates Douglas fir and includes world's first all non-toxic acoustic system.

BY NICK CLESI, CHRIS HELLSTERN AND GABRIELLE PETERSON
MILLER HULL

Exterior rendering of Newhouse at night.

IMAGES COURTESY OF MILLER HULL

Over the past decade, responsibly-sourced mass timber has proven absolutely essential in the journey towards decarbonization – its lower embodied carbon, seismic resilience, and fast build times giving clients and designers alike a reason to endorse it.

Miller Hull started incorporating mass timber into its projects as early as the 1980s. The firm has worked with mass timber in a variety of hybrid iterations, from the structural system of the Bullitt Center to the FSC-certified wood of Bainbridge City Hall, and has used not only cost and program to dictate the wood's treatment, but also the concept of Biophilia; how can this material help to create a memorable and inviting place?

Someone who enters into a space and is met by soaring beams or a reclaimed wood stairwell is much more likely to experience the benefits of Biophilia, or the sense of wellbeing that is created through exposure to natural elements like wood, stone and daylight.

As designers who prioritize sustainability, we typically try to incorporate biophilic elements into our projects using low-carbon materials to reconnect users with the natural world, and lessen our impact on the earth. For the Newhouse Building replacement effort on the capitol campus, the use of timber was just as innate to the project as it is to our designers.

For one, the project is located in a region where timber is plentiful, giving us an opportunity to showcase Douglas Fir, one of the state's most precious natural resources. Secondly, invigorating regional economies and incorporating this local wood throughout the design is a nod to the hundred-year-old beloved building Newhouse is to replace, a callout to the region, and a safeguard for its future.

The Newhouse Building Replacement takes the innovative use of mass timber a step further, exploring the ways a building might reflect the region through its material structure, and introducing the world to the first all non-toxic acoustic system.

SHOWCASING SALVAGED TIMBER

Built in 1911, the state's campus contains a variety of beloved historic buildings. The Ayer and Carlyon Press houses are among these hallowed places, and are architecturally significant in their own right; the Ayer House was designed by Elizabeth Ayer, the first female architect to graduate from the University of Washington; while the Carlyon embodied the quintessential Craftsman-style bungalow, and was the only remaining residential building to front 14th avenue.

Despite their rich histories, the structures were built to be homes, not offices, a mismatch that grew increasingly evident as the buildings aged. After the press was relocated to the first floor of the Legislative BuildingAyer and Carlyon served as extra space for the Senate. The land on which the houses sat, however, had already been slated for redevelopment, its 1982 master plan identifying the parcels as a possible location for new construction. Due to the historic nature of the homes,the state began searching for buyers who could relocate the buildings.

When this proved unsuccessful, Miller Hull and the community lobbied for deconstruction, allowing building parts to be disassembled and reused. Our team began incorporating salvaged elements into our design concepts for Newhouse, and when we developed a strategy that involved converting salvaged timber into a four-story art wall in Newhouse's grand foyer, the state enthusiastically gave its support.

Close up of the reimagined non-toxic, acoustic dowel laminated timber (ADLT) system.

The four-story art wall sits at the head of what will be the mixing chamber, or the social heart of the building, and if walls could talk, this one would have plenty to share about newsroom narratives of the past, and spirited interactions of the future. Made with many different parts of reclaimed lumber, the wall is designed to represent the varied landscapes of the great Pacific Northwest.

A NON-TOXIC, DOWEL LAMINATED TIMBER (DLT) SYSTEM

Acoustic insulation is vital for large spaces, whether it be providing aural clarity, preventing reverberation, or absorbing errant and distracting noises. Uniquely vital to civic buildings, acoustic design helps deliver the amplification necessary to promote engagement between citizens and state.

But there's one problem: acoustic insulation can be unsightly and unhealthy. Routinely tucked away, these systems are often made available through the reduction of room height and the dropping of ceilings. Their negative environmental and health implications are also significant, containing chemicals like formaldehyde, flame retardants, and antimicrobials, along with glues that all contribute to reduced indoor air quality, and whose production alone creates a significant number of emissions. These chemicals bring a harmful side to a building material that is intended to be environmentally friendly.

Our team sought out alternative acoustic products. Crafted by StructureCraft, the selected DLT panels for the floor decks are essentially composed of two parts: the wood members that are doweled together without the typical formaldehyde-laden glue, and the insulation product that is inserted into the grooves between the wood members. This configuration leaves only neatly woven wooden strips visible, while the insulation material is mostly concealed within the grooves. This product is called acoustic dowel laminated timber (ADLT). Typically, most dowel laminated timber from StructureCraft uses spruce-pine-fir sourced from British Columbia. However, because this is a civic building, the state requested that the lumber used be from Washington.

Throughout our team's analysis of the dowel laminated tim-

Rendering of the Newhouse mixing chamber featuring a four-story art wall constructed of salvaged timber.

TEAM MEMBERS

Owner:
Washington State Department of Enterprise Services

Building occupants:
Senate members and staff

Architect:
The Miller Hull Partnership

Contractor:
Hoffman Construction Co.

Structural engineer:
Lund Opsahl

Civil engineer:
Reid Middleton

MEP engineer:
PAE Consulting Engineers

Landscape architect:
Murase Associates

Envelope consultant:
4EA Building Science

Security consultant:
Hohbach-Lewin

Lighting designer:
Dark | Light

Signage:
Mayer Reed

Vertical transportation consultant:
The Greenbusch Group

Transportation consultant:
Heffron Transportation

Acoustical consultant:
BRC Acoustics

Building code consultant:
Pielow Consulting

Cost consultant:
JMB Consulting Group

Historic preservation:
BuildingWork

ber, we discovered that 10-15 percent of the acoustic insert actually contained formaldehyde. Although no adhesive was needed to attach the strips together (as they slid into one another like puzzle pieces) the composition of the inserts themselves was not toxin-free. What followed was a process our team often engages in during our Living Building Challenge work; the collaboration with a manufacturer to develop a healthier solution.

After testing numerous options, balancing acoustics, constructability, and cost, our team determined that the best product for the acoustic insert was a material created by FSorb, a company based just north of the campus that develops chemical-free wall and ceiling panels. With a formaldehyde-free acoustic insert t combined with the dowel-laminated timber, an all-natural, economical, and beautiful acoustic system is now available, heightening the health and sustainability of the project, and giving other buildings the opportunity to do the same.

The Newhouse replacement will become an expression of the legislature's most current and pressing priorities, addressing climate, human health and local economies through the careful selection of materials.

Nick Clesi is an architectural designer at Miller Hull, a member of the firm's mass timber lab, and the project manager on the Newhouse project.

Chris Hellstern is Miller Hull's Living Building Challenge services director, the sustainability lead on the Newhouse project, and authored a book titled "Living Building Education."

Gabrielle Peterson is Miller Hull's strategic writer.

REVOLUTION

CONTINUED FROM PAGE 3

Because Skanska can self-perform not only mass timber, but also steel and concrete construction, we have been able to deliver highly complex, high-quality projects in shorter timeframes and with leaner budgets. Industry standard suggests a 20% reduction, and Skanska has seen projects that exceed that.

MORE COST-SAVINGS UNDER NEW CODES

Further reducing time and cost with mass timber – or rather increasing time and cost for concrete construction – are the forthcoming changes to building codes in seismic areas in the Northwest. Skanska recently completed conceptual estimates with both current codes and schematic estimates with new codes, finding that, in a concrete superstructure, there was a 10 percent increase in superstructure cost due to the added weight and seismic impacts. The pending 2024 IBC code adoption further optimizes mass timber by removing some of the requirements to encapsulate the timber, reducing cost and carbon impact, and retaining a natural connectivity to the wood.

AESTHETICS

Mass timber also delivers a captivating aesthetic that resonates deeply with the concept of biophilia, our innate connection to nature. Left unfinished, mass timber adds a rustic, natural and streamlined look, while eliminating costs such as wall finishes. The beautiful nature of wood allows unique architectural designs to stand out. Mass timber not only elevates a space's visual appeal, but also enriches lives through a direct impact on occupants' mood, health, and even productivity.

University of Oregon's Kevin Den Wymelenberg recently published a study surrounding the "visual effects of wood on thermal perception of interior environments." Through this, the team successfully proved that wood materials in structures improved thermal comfort. In other words, people said the room's temperature felt more comfortable with wood walls than with white painted walls.

The expansion of the campus for the Center for Deaf and Hard of Hearing Youth in Vancouver, Wash., which is being delivered using progressive design build in collaboration with Mithun, is a great example of how mass timber is being used for this purpose. Research is demonstrating that improved comfort in the classroom has a direct correlation to improved learning outcomes and reduced stress, and is beneficial to both physical and mental health.

ENTICING WORKERS BACK

Visual appeal is a big consideration in encouraging a return from home offices, as well. Traditional workplaces with acoustic ceilings and windowless conference rooms just don't have the draw of the appealing aesthetics of mass timber. Imagine bringing nature indoors – offices built with spacious layouts, large windows flooding the space with natural light, and a focus on biophilic design. This aims to create a charming workplace, enticing teams back into the office after several years of remote work.

Overall, mass timber stands as an undeniable force across construction, reflecting a harmonious blend of sustainability, efficiency, and aesthetic appeal. Embracing this approach heralds a new era in building for a resilient future.

Steve Clem is senior vice president- project planning services for Skanska USA Building in Portland. Dean Lewis is director of mass timber & prefabrication for Skanska USA Building in Seattle.

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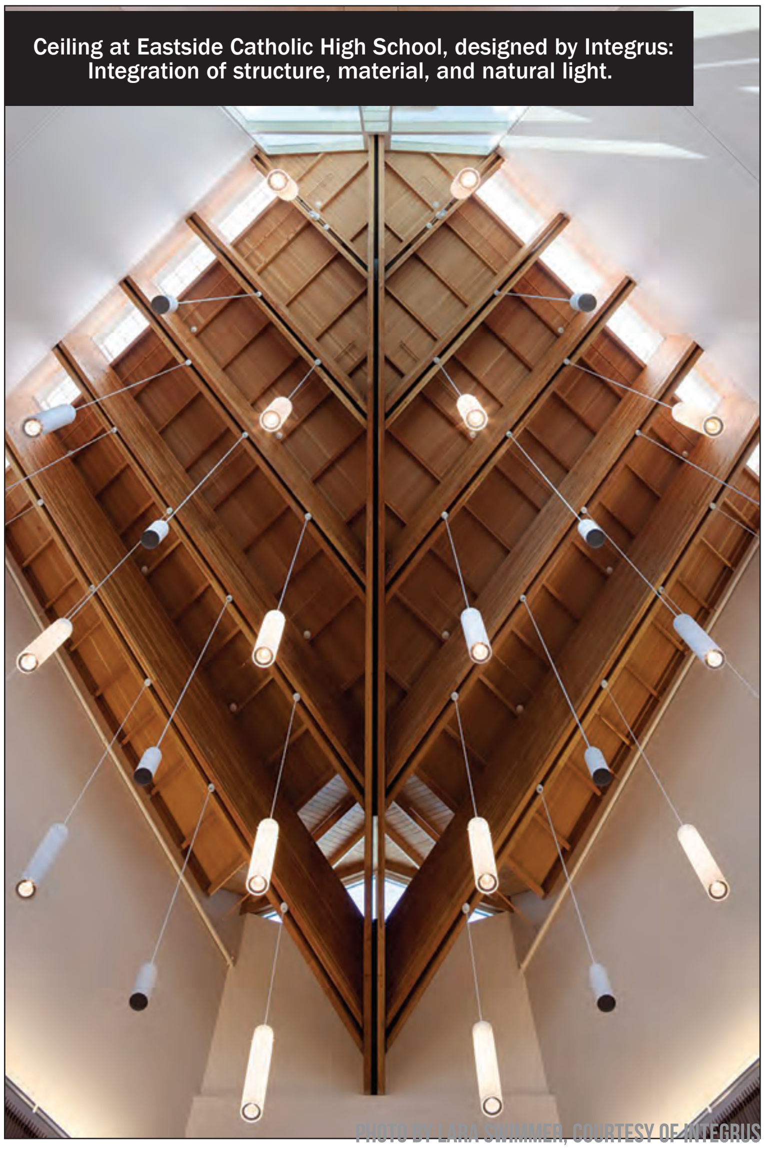

Ceiling at Eastside Catholic High School, designed by Integrus: Integration of structure, material, and natural light.

PHOTO BY LARA SWIMMER, COURTESY OF INTEGRUS

THE DESIGN LOGIC OF DECARBONIZATION

Architects and engineers should approach their work as an essential instrument of change.

Consider your good fortune! You live in a time of unprecedented opportunity. Individually and collectively, the actions we take over the next several decades to address global carbon emissions will almost certainly shape the course of human and environmental history well beyond our reckoning. Human civilization has never faced consequences of such significance.

BY PATRICK DONNELLY
INTEGRUS

The creativity and commitment with which engineers and architects have responded to this challenge is unequaled by any industry. Yet we want to continue to challenge ourselves to do more and do it faster. That is our purpose here.

Because the present moment calls for a decisive break from certain cultural norms, it is useful to consider historical examples where a similar need prevailed. Early practitioners of modern architecture understood their work in the context of an all-consuming modernity — a radical break from the past — employing new materials, industrial processes, and social programs.

We can and must embrace the example of our predecessors and approach our work as an instrument of change, in concert with a broader movement to decarbonize buildings, cities, industry, and transportation.

At Integrus, embracing the design logic of decarbonization means asking sometimes difficult questions about our own practices, and a willingness to transform that practice in the process. Here are some examples of how a deeper integration between our structural engineers and architects reduces the embodied carbon of our projects.

BEAM DEFLECTION CRITERIA AND CARBON

When an architectural solution suggests long-span steel beams, cantilevers, or heavy materials such as masonry veneer supported by long-span beams, we know that the strict deflection criteria for steel beams will result in larger beams and more carbon. This is the moment when our engineers run quick calculations of the embodied carbon of different design solutions, seeking the lowest carbon solution that satisfies the architectural criteria.

On a recent canopy design for Tyee High School, this practice resulted in a savings of 26,000 kgC02e. That's the equivalent of 29,000 pounds of coal, or the carbon sequestered by 34 acres of US forest in one year.

DON'T PENALIZE YOUR LATERAL SYSTEMS

The placement or orientation

Images © Benjamin Benschneider, Lara Swimmer

Supporting a sustainable future.

MAKING MASS TIMBER MAINSTREAM

The building sector accounts for nearly half of greenhouse gas emissions — as structural engineers we can contribute in a pivotal way by tracking the materials we use in our structures to dial down carbon intensity.

Alongside our AEC partners, we aim to lower the embodied carbon of the structures we design using a holistic and data-driven approach. When we collectively raise the bar the market responds.

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of lateral systems can result in code penalties that require larger columns or larger foundations to resist overturning, both of which add carbon. Our engineers and architects keep carbon metrics in the mix of design variables, supporting low-carbon decision-making.

KEEP IT SIMPLE

In the design of educational facilities, the need to accommodate diverse programmatic and spatial requirements often favors layouts of columns that depart from a regular and repetitive grid spacing, increasing the number of columns, and adding carbon in the process. In this instance, engineers and architects work together to accommodate program requirements within a "carbon constrained" structural layout. These are often relatively small decisions, but small decisions add up.

WHERE'S THE BRICK?

Brick is an essential material. It is beautiful, adaptable, and indispensable for conveying quality and gravitas. However, it is a relatively high embodied carbon material. As with other high-carbon materials, we exercise care in how and where we use it. The weight of brick can result in increased foundation sizes and increased load requirements in certain circumstances. We strive to use brick mindfully.

TRANSPARENCY

This measure brings us back to the architecture of the early 20th century. In 1921, Mies van der Rohe's entry for the Friedrichstrasse Skyscraper competition beautifully engaged with the technology and materials of the time, featuring exterior walls freed from their load-bearing function, transforming solidity into transparency. Conceived only a few years after the end of World War I, this seminal project presented a bold vision of the skyscraper as a new architectural typology for the modern metropolis.

Fast forward again to the 21st century. Mies' fascination with glass has become our fixation. For contemporary buildings of all types, transparency appears to be the default enclosure. This is a problem because glass curtain walls are subject to significant thermal gain, and do not meet the growing need to prioritize reductions in operational and embodied carbon emissions. If we are going to embrace architecture as an instrument of change, shouldn't we subject our love of transparency to the logic of decarbonization?

Shouldn't our response to a warming planet start showing up in our building facades? While our architectural visions have changed very little over the last 100 years, annual global carbon emissions from burning fossil fuels have. When Mies submitted his design in 1921, emissions were less than five billion tons a year. Today, they are over 36.

Fortunately, there are many examples of buildings where transparency is used, not iconically, but in ways that celebrate the experience of light in balance with enclosures that speak to more than just transparency. From modern masters such as Louis Kahn, Alvaro Siza, and Le Corbusier, to contemporary architects like Grafton and Marlon Blackwell, there are alternative approaches to thoughtfully integrating light and views while limiting glazing. And, if we look a little harder, past the typical canon of western architecture, we see myriad examples of indigenous architectures from around the world that embrace an aesthetic of limited openings, local materials, and high climate-sensitivity, all while meaningfully expressing their place and culture.

The burden and opportunity of this moment demands something extraordinary from us. We know how to do this. We have historical precedents. Our predecessors engaged critically and beautifully with the engineering, scientific, and cultural context of their time. We inhabit an entirely different context. Shouldn't our architecture inhabit that context too?

Patrick Donnelly is director of sustainable design at Integrus.

STANDARD

CONTINUED FROM PAGE 9

plary" features incentivized by the initial phase of the EBP program. HDC will therefore evolve its best practice guidelines for pursuing a high-level of energy efficiency, carbon reduction, and healthy product selection with a long-term goal of supporting owners who want to pursue a net-zero energy standard.

HDC is also working to develop standards for retrofitting existing buildings to improve performance and reduce carbon emissions. They continue to convene industry experts and public agencies to provide technical and financial support to owners in their efforts to update multifamily buildings to prepare for compliance with local and state Building Performance Standards. HDC's Decarbonize Affordable Housing Now initiative will expand the Exemplary Buildings program to support owners in their goals to comprehensively retrofit and decarbonize existing buildings across owner portfolios.

Becky Bicknell is the client relationship manager for Walsh Construction Co.

David Reddy is the principal of O'Brien360's building performance group.

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WE'RE ALL IN. HOW ABOUT YOU?

DCI Engineers is a proud signatory firm of the **SE 2050 Challenge**—a commitment to net zero structures by the year 2050.

It's an exciting time to be an engineer! Coupled with decades of green certified design experience, our team members are using the latest tools and technologies to apply sustainable solutions for the built environment. These include:

» Life-Cycle Assessment
» Embodied Carbon Tracking
» Optimized Material Use
» Reduced Carbon Materials
» Material Re-use Evaluation
» Mass Timber Design
» Modular and Prefabricated Design

Now more than ever, we as engineers have a responsibility to provide real, applicable solutions for a **greener future**. We invite you to join us!

Learn more about the SE 2050 Challenge by visiting ***se2050.org*** or connect with DCI's Sustainability Group at ***sustainability@dci-engineers.com***.

WHO WE ARE

We are a **20+ office, nationwide firm** providing **civil, structural, right-of-way, industrial & bridge engineering services**. DCI is licensed and building in all 50 States, providing our clients regional expertise backed by national experience. Our portfolio expands over a dozen markets, ranging from mass timber and modular construction to seismic/adaptive renovations to high-rise Performance Based Design and everything in between. We employ over 400 of the most dedicated technical and support staff in the industry and continuously seek out new methods and technologies that support the vision of our clients. Since 1988, DCI has been focused on providing **Service, Innovation & Value**—a belief that how you work with people is as important as what you do for them.

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