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High-performance commercial buildings and homes perform well on multiple levels: energy efficiency, sustainability, occupant wellness and safety. Learn how exterior shading made of high-performance Sunbrella fabrics can help contribute to each of these goals.

EXTERIOR FABRIC SHADING BOOSTS ENERGY EFFICIENCY BY REDUCING HEAT GAIN.

Exterior shade structures, such as canopies, shade sails, and adjustable and fixed awnings not only block light, but also most of the heat generated by sunlight. Studies by the American Society of Heating and Air-Conditioning Engineers show that fabric awnings reduce heat gain in commercial buildings by 55% to 65%, and for windows with western exposures they reduce heat gain by 72% to 77%.

LEED, the green building certification program, recognizes the energy savings from exterior shade by including stationary awnings, adjustable awnings, exterior solar shades and stationary commercial canopies in points-contributing roles for the heat island reduction and optimizing energy performance credits.

And the same concept applies to homes as revealed by a study that used computer modeling to simulate the effects of window awnings on homes in different climates in the United States. The study, "Awnings in Residential Buildings: The Impact on Energy Use and Peak Demand in Twelve U.S. Cities,"[1] showed that if all windows are equipped with awnings, they can reduce energy consumed for cooling by over 25%.

EXTERIOR FABRIC SHADING BOOSTS OCCUPANT COMFORT BY REDUCING GLARE AND MAINTAINING VIEWS.

No one wants to work in a space without windows. People thrive in buildings with ample natural light and views to the outside, but these features can also be sources of discomfort in the form of glare. Glare can cause eye fatigue, visual discomfort and headaches, and people over 50 are especially sensitive to glare.

Fixed and adjustable exterior shading, such as solar shades, awnings and canopies can contribute points for their glare-reducing features in LEED and the WELL Building Standard.

Similar techniques can be used on homes to ensure connections to nature and the use of natural light to synchronize circadian rhythms while also controlling glare.

MOST FABRIC SHADE STRUCTURE COMPONENTS CAN BE RECYCLED.

Sunbrella shade fabrics returned to the Recycle My Sunbrella program are recycled into industrial products such as felt, automotive insulation and filtration. Shade structure components, including aluminum tubing and steel hardware, can be recycled via scrap metal recyclers as well.

Similarly, a shade structure can start its life with fabric that includes recycled content: Sunbrella Renaissance and Unity shade fabrics contain 50% postindustrial fibers.

FABRIC SHADE STRUCTURES ARE A COST-EFFECTIVE WAY TO EXPAND USABLE SPACE.

Create protected outdoor dining for restaurants, playgrounds for preschools and gathering spaces for pedestrian malls with fabric shade structures. Shade is essential to pedestrian-oriented shopping malls, which, without shade, become overheated no-go zones during the hottest times of the year. Adding shade structures contributes to the economic viability of these spaces by providing comfortable outside areas for people to gather.

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[1] "Awnings in Residential Buildings: The Impact on Energy Use and Peak Demand in Twelve U.S. Cities" by John Carmody and Kerry Haglund, Center for Sustainable Building Research, University of Minnesota and Yu Joe Huang, Lawrence Berkeley National Laboratory, August 2007.

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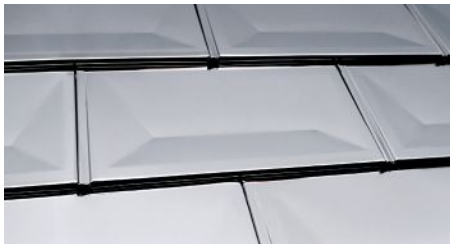

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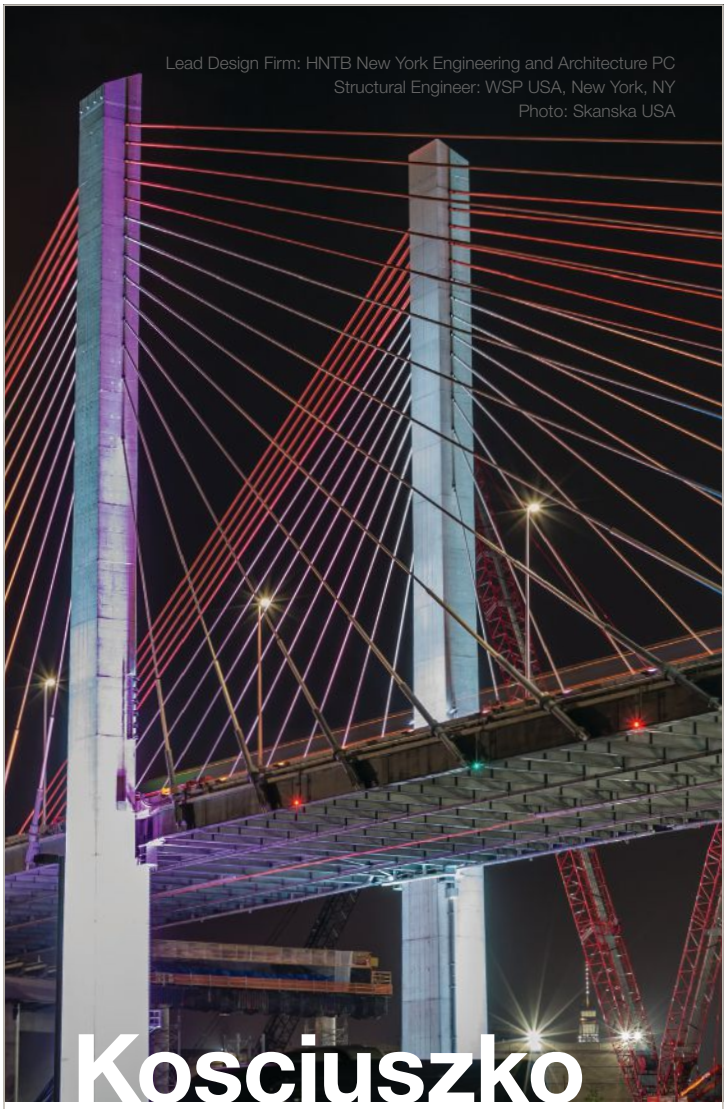

Lead Design Firm: HNTB New York Engineering and Architecture PC
Structural Engineer: WSP USA, New York, NY
Photo: Skanska USA

Kosciuszko à Gogo

The design of urban infrastructure affects city life as much as the design of its buildings. That's why replacing the **Kosciuszko Bridge**—a notorious pinch point in traffic between Brooklyn and Queens—was a high priority for Governor Cuomo. With heavy lifting from **HNTB**, **WSP USA**, and **Skanska**, a striking cable-stayed span has risen where the outdated bridge once stood, ensuring New Yorkers may still have trouble saying its name, but they never have trouble getting home. Read more about it in **Metals in Construction** online.

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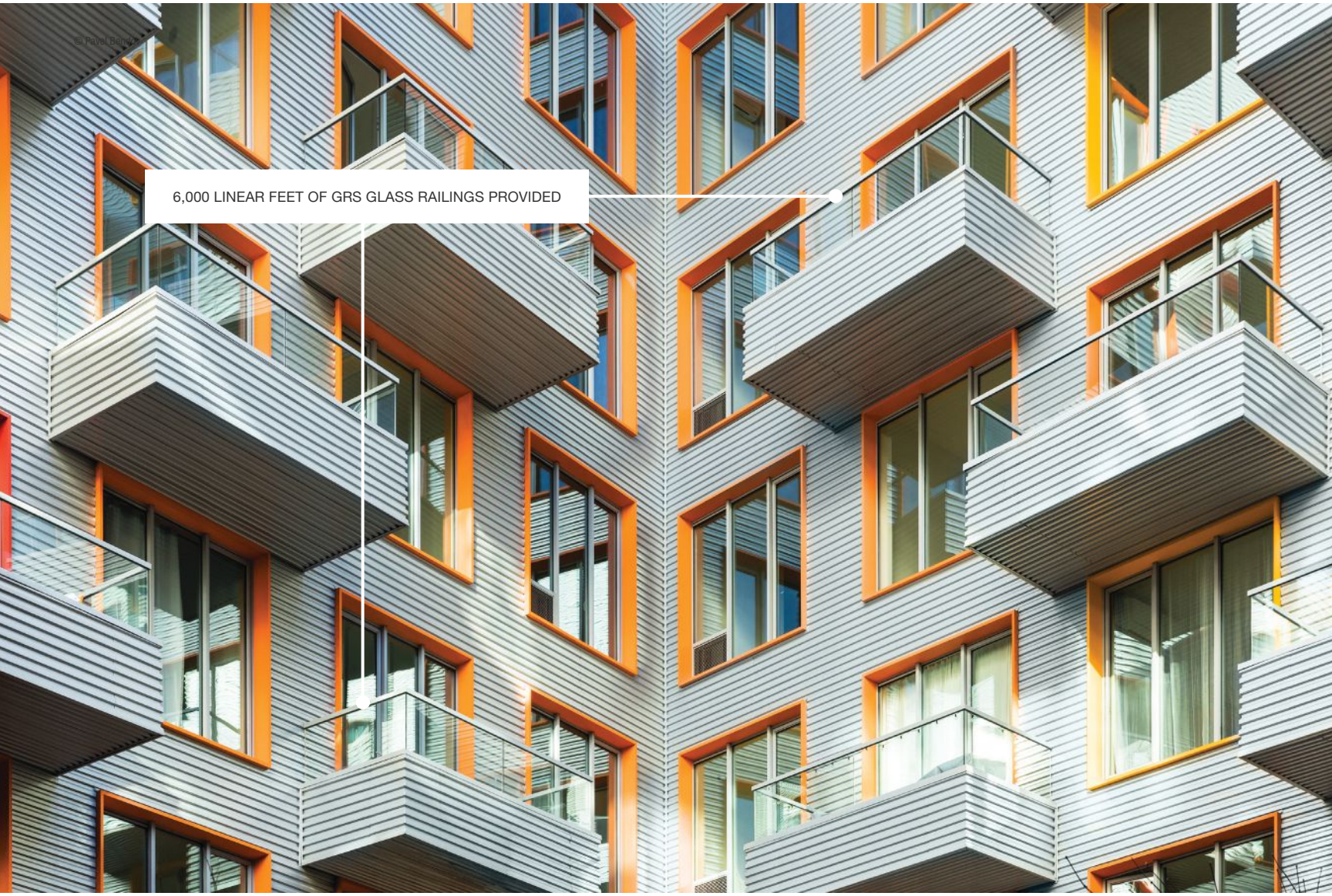

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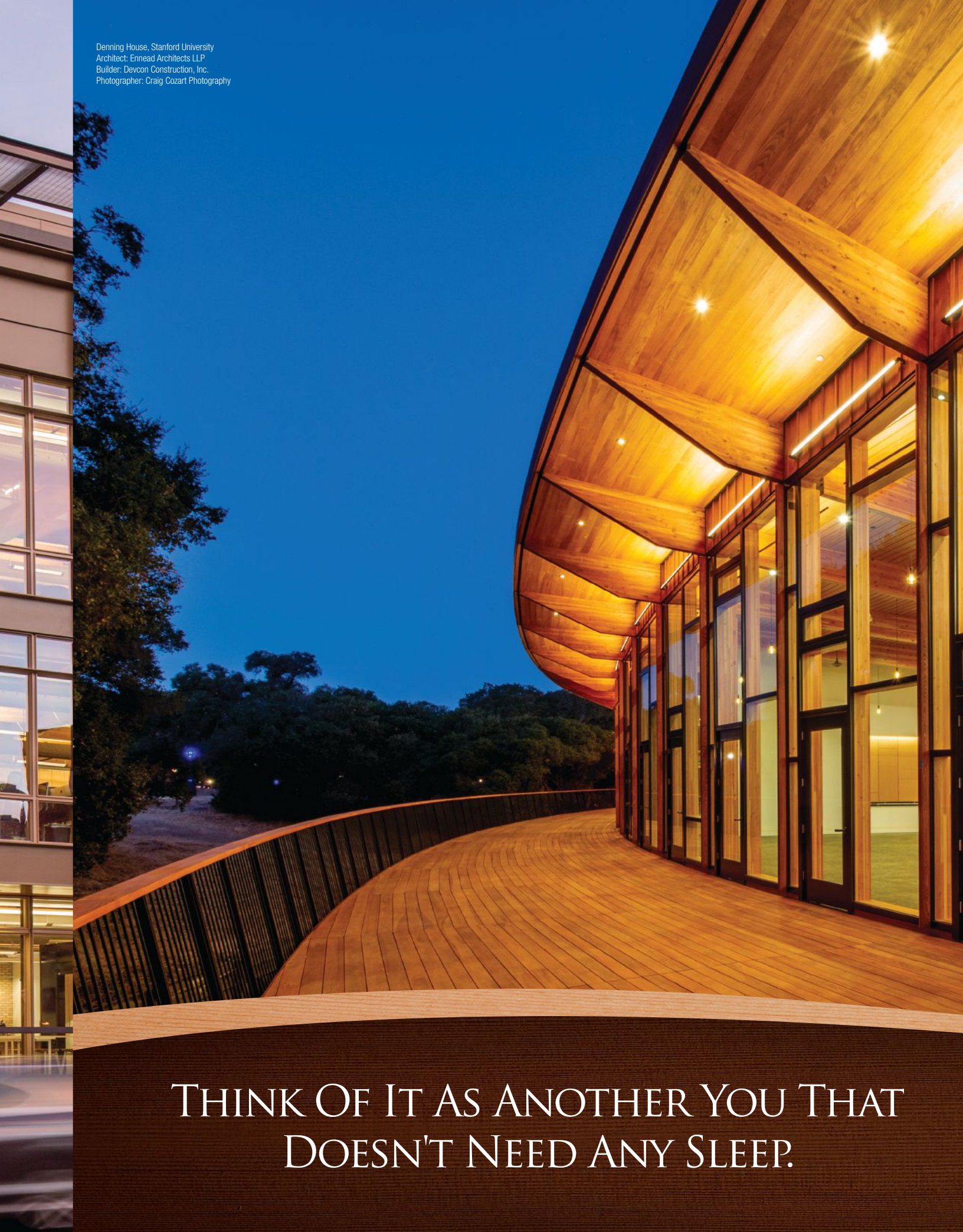

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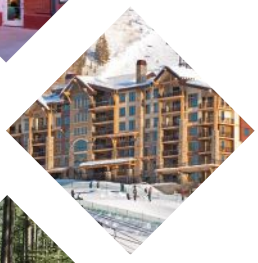

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The Gardening Geniuses of 2019

Chicago-based urban designer Emmanuel Pratt (pictured) and Bay Area landscape architect Walter Hood are two of 26 MacArthur Fellows in this year's newly named class. Pratt, a graduate of Columbia University's Graduate School of Architecture, Planning and Preservation, is co-founder of the Sweet Water Foundation in Chicago, which operates a 2-acre farm on the city's South Side and works with the local community to transform abandoned buildings and lots into sustainable urban agriculture sites. Recent projects include the rehabilitation of a vacant residence into a venue for cooking demonstrations and design workshops. —KATHARINE KEANE

> *Read more about Emmanuel Pratt and Chicago's Sweet Water Foundation at bit.ly/2019MacArthurFellows.*

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On Oct. 20th, the 75th anniversary of the return of General Douglas MacArthur to the Philippines, a new visitor center designed by Richter Architects of Corpus Christi, Texas, opened at the Manila American Cemetery and Memorial. Burial place for 17,058 service members and memorial to 36,286 missing soldiers, most of whom died in the Philippines and New Guinea, the 152-acre site is the United States' largest World War II graveyard. "You're overwhelmed by the magnitude of loss," says the head of the firm and 2015 AIA president Elizabeth Chu Richter, FAIA.

> *To learn more about the cemetery, memorial, and visitor center, visit bit.ly/ManilaCemetery.*

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Life on Mars

The exploration and colonization of space poses fascinating design challenges. Occupants of the Skylab station, which orbited the Earth from 1973 to 1979, dined from a tray with three built-in heating modules (pictured). *Moving to Mars: Design for the Red Planet*, an exhibition at the Design Museum in London, taps into a century of speculation about an even more extreme destination. Habitation on the fourth rock from the Sun has to address globe-encircling dust storms, massive solar radiation, extreme temperatures, and a barely there atmosphere of 95% carbon dioxide. On view through Feb. 23, 2020.

> *The* Moving to Mars *exhibition includes a family-friendly Instagram story at bit.ly/MarsMuseum.*

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Recession-Proofing: How to Retire in a Downturn

TEXT BY ALICE LIAO

Retirement during a recession can upend years of planning. With economists predicting another downturn by the end of 2021, late-career designers must plan accordingly. Here, practitioners and financial planners offer guidance on preparing for retirement during an economic low.

Save, Save, Save

Recession or not, "Retirement planning is not a short-term exercise," says Michael Strogoff, FAIA, president of Mill Valley, Calif., management consulting firm Strogoff Consulting. "If one starts thinking about it when they start hearing news about an upcoming recession or downturn … it's way too late."

According to AIA, 83% of all firms and 100% of firms with more than 100 employees offer some form of defined contribution retirement savings plan, such as a 401(k), Simple 401(k), or Simple IRA. Some companies incentivize larger deferrals by matching employee contributions up to a certain percentage of their paycheck. In this case, "the company is giving employees free money [for] their retirement plan," says John Piombino, head of human resources for the U.S. offices of BuroHappold Engineering.

For those who might not have saved earlier in their career, architects can—and often choose to—practice long past what society traditionally considers retirement age, Strogoff notes. Many work into their 70s or 80s because "architecture is more a passion and a calling than just a job," he says. "So if you are fortunate enough in a recession to have a well-paying position and have the energy to continue to work, I think that's the best thing you can do."

Create a Payment Plan

Having a comprehensive buy–sell agreement that offers a blueprint for selling ownership in a business can make it easier for owners to retire if a slowdown does occur. Savvy firms include provisions that allow them to delay or extend the duration of payment to an outgoing owner when there isn't enough liquidity, Strogoff says. When Princeton, N.J.–based KSS Architects co-founder Allan Kehrt, FAIA, retired in 2011, he continued to receive monthly payments with interest for his share of the company for five years.

Firms should also establish a system that regularly ensures all owners agree on the worth of their practice. KSS's partners, for example, begin each year by reviewing the valuation of the business and signing off on the value of the firm and the individual shares. If profitability is down because of a recession, "everyone would understand that," Kehrt says. A partner who decides to retire anyway would have to accept that they would be leaving with less.

In the current market, Strogoff suggests owners looking to retire can start gradually selling their interests—if they haven't already—to better prepare themselves for the next downturn. He also advises monitoring project backlogs and modifying staff levels if necessary. "It's counterintuitive, but making adjustments now will make it easier for retirement later," he says. "Owners [need] to take decisive action early to ensure the firm remains financially viable."

> "Owners [need] to take decisive action early to ensure the firm remains financially viable."
>
> —Michael Strogoff, FAIA, president, Strogoff Consulting

Consider Additional Income Sources

Senior interior designer Terry Harris, who plans to retire from the Boston office of Dyer Brown Architects at the end of 2019, envisions picking up a part-time job either in design or a new field altogether. "I can see a lot of possibilities in doing something and still [earning] a little income if need be," she says.

Harris, who doesn't have ownership stake in her company, is counting on her 401(k) savings as her principal source of retirement income. She has always paid into a workplace retirement account, but after being laid off during the last downturn—as was her husband—Harris boosted her 401(k) contributions when she rejoined the workforce, deferring as much as 11% of her salary.

While Harris and her husband have planned their next stage of life carefully, she admits to being nervous about a future slowdown in the economy: "We've been through two of them and it's scary."

> *This is the first in a three-part series on prepping for a recession. For more on retirement planning, visit bit.ly/ARRetirement.*

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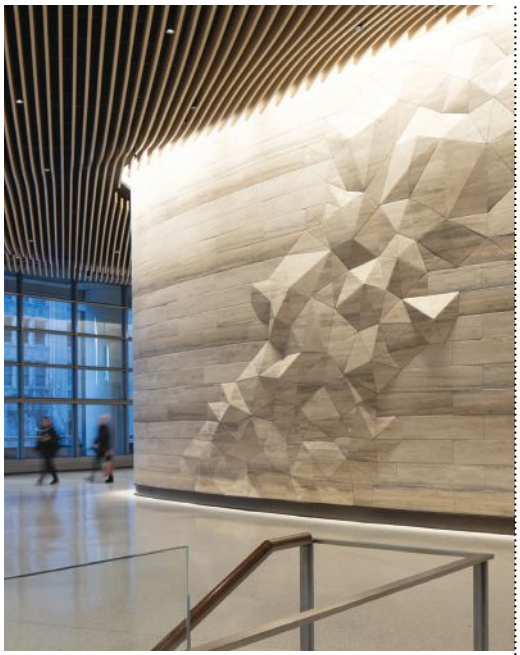
Detail: Two Union Square Tectonic Wall

TEXT BY TIMOTHY A. SCHULER



In creating a feature wall that abstracts the rock bluffs of the Puget Sound region for Two Union Square's third-floor lobby renovation, in Seattle, NBBJ senior associates Sarah Steen and Daniel Cockrell wanted to use parametric design "in an unpredictable manner," Steen says, similar to the way tectonic activity is uncontrollable by humans.

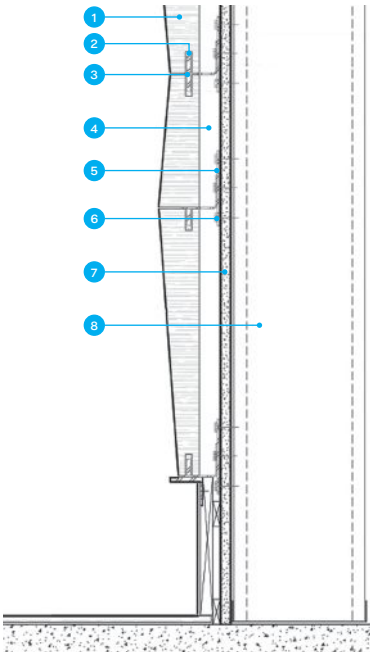
NBBJ wrapped the tower's reinforced concrete core in approximately 1,650 curved panels of pale travertine, quarried and custom fabricated by the Poggi Brothers in Tivoli, Italy. For the focal point, the design team used Grasshopper and Rhino, establishing a set of parameters that would maximize the number of triangular sizes and shapes to keep the panels as irregular as possible. Then they "allowed the script to connect the dots and create this network of angles," Steen says.

The result is a nearly 20-foot-tall by 20-foot-wide 3D sculptural ribbon of 415 fractal panels that cuts diagonally across the wall plane like a mountain range. (A smaller tectonic wall feature occurs near the elevator bank.) Their texture is amplified by the natural banding in the stone, which was preserved meticulously by NBBJ working with the Poggi Brothers and local stonemason Synergism Stone. "It's laid up on the wall as it [appeared coming] out of the Earth," Steen says.

The fractal panels are effectively pinned into place through pre-drilled holes in their top and bottom edges. The holes accommodate steel dowels welded to bent steel plates that are screwed into horizontal strapping, which, in turn, is secured to an 8-inch-wide stud wall covered with gypsum wallboard.

"We did a lot of lighting experiments to make sure that we weren't protruding from the wall too far and creating too many shadows," Steen says. "And we did a lot of cardboard mock-ups [following the modeling]. We went analog."

The entire travertine wall took Synergism Stone 15 months to install. The luminous end effect is testament to the team's persistence. It's critical, Steen says, to maintain "that clarity of concept and [continue] pushing for those big ideas when challenges arrive."



1. Honed travertine fractal panel, 1¼" to 3¼" thick, dimensions vary
2. Ø⅜" drilled hole, filled with sealant
3. Ø$\frac{3}{16}$" × 1" stainless steel dowel welded to load-bearing tieback (12-gauge bent stainless steel plate, 2⅛" wide × 2" × 2")
4. Void, 1½" maximum
5. Galvanized sheet metal horizontal strapping, 4½" × 12 gauge (12" o.c.)
6. #3 self-drilling screw (typ. 2, 16" o.c.)
7. ⅝" gypsum wallboard
8. 8" × 16-gauge metal stud (16" o.c.)

SEAN AIRHART

> *To read more about the design and construction of Two Union Square's tectonic wall feature, visit bit.ly/AR2USq.*

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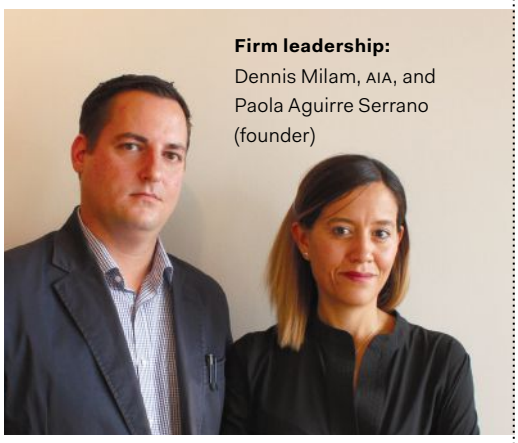
Cheyenne Botanic Gardens, Cheyenne, Wyoming – LEED Platinum *Architect:* The Design Studio, Inc., Cheyenne, Wyoming

Next Progressives: Borderless Studio

EDITED BY KATHARINE KEANE

Location:
Chicago

Year founded:
2016



Firm leadership:
Dennis Milam, AIA, and Paola Aguirre Serrano (founder)

Education:
Aguirre Serrano: B.Arch., Instituto Superior de Arquitectura y Diseño de Chihuahua; M.Arch. Urban Design, Harvard Graduate School of Design; *Milam:* University of Wisconsin-Milwaukee

Firm size:
Two to four

Where founders met:
In Chicago, on the 10th floor of the Santa Fe Building overlooking Lake Michigan

Origin of firm name:
Borderless is a mindset. We believe in the power of collaborative and interdisciplinary design work. We meet within "the spaces in between."

Aguirre Serrano: I thought about Borderless as a title for a small exhibition during graduate school. I'm also originally from Chihuahua City, Mexico, which is on the U.S.–Mexico border. Borderless reflected this aspiration for challenging boundaries, conventions, paradigms, narratives, and silos across scales, geographies, and cultures.

Mission:
Borderless is an urban design and research studio focused on cultivating collaborative design agency through interdisciplinary projects. Our projects explore city design interventions and engage the complexity of urban systems and social equity by looking at the intersections of architecture, urbanism, landscape, planning, and civic participatory processes.

Favorite project:
Creative Grounds at Anthony Overton Elementary School on the South Side of Chicago was our first self-initiated project. Starting as a research initiative addressing the closure of 50 public schools in Chicago in 2013, the project evolved into a multiyear platform for community-led activation projects using art, design, and architecture as tools for inclusion and equitable repurposing.

Second favorite project:
Co-founded with urban planner Elle Ramel, the City Open Workshop brings together urban planners, designers, architects, landscape architects, real estate developers, civic tech enthusiasts, policy analysts, and community organization members to collaborate on a variety of civic projects. Currently in its seventh season, the group is studying accessory dwelling units and the benefits of ADUs once again becoming allowed since their ban from Chicago in the 1950s.

Biggest career leap:
Aguirre Serrano: Working for a government agency in my hometown as a young architect. In many ways, that experience influenced my career and passion for public and community service.

Design tool of choice:
Card stock

A tool you would love to invent:
Ctrl-Z for card stock

The best criticism you've ever received:
"How is that architecture?" It was the perfect excuse to engage in a conversation about the value of the design process rather than an outcome.

Favorite place to get inspired:
The Chicago lakefront—20-plus miles of continuous public space for everyone's enjoyment. It is a natural resource, yet it was the public's decision to leave the lakefront "forever open, clear, and free."

COURTESY BORDERLESS STUDIO

> *To learn more about Borderless Studio and its work, visit bit.ly/ARBorderless.*

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10 second dry time[6]

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[1]Dry time and energy consumption calculated for Max mode. Dry time was determined using Dyson test method 769 based on NSF P335 to a measurement of 0.1g residual moisture.

[2]Average loudness (measured in sones) compared to Dyson Airblade™ hand dryers.

[3]Measured in Eco mode.

[4]Average electricity price $0.1/kWh as of May 2019. For calculations visit www.dyson.com/calcs.

[5]HEPA filter tested to IEST-RP-CC001.6, by an independent testing laboratory, under prescribed test conditions.

[6]Dry time determined for Max mode using Dyson test method 769 based on NSF P335 to a measurement of 0.1g residual moisture.

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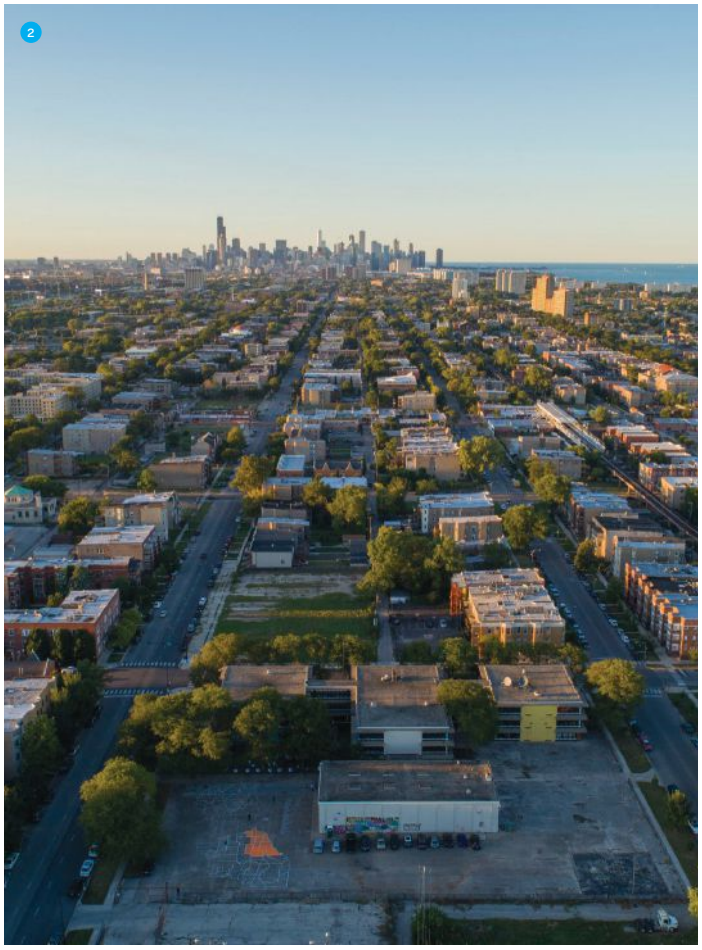
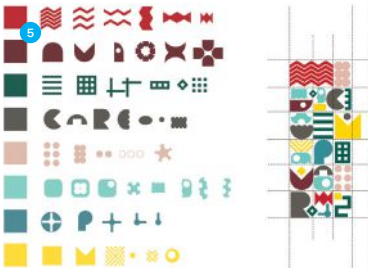
Next Progressives:
Borderless Studio



1, 6 (RIGHT): COURTESY BORDERLESS STUDIO; 2: SCRAPPERS FILM GROUP; 3: CORY DEWALD



1. In a master plan proposal for northeast Kansas City, Kan., Borderless and Chicago-based planning consultancy Camiros called for numerous amenities. 2. As part of the Creative Grounds project, this map of Chicago is painted in the parking lot of the former Anthony Overton Elementary School, highlighting school closures by neighborhood. 3. An evolution of Borderless Studio's Overton Elementary map project, Bronzeville (+) is part of the 2019 Chicago Biennial displaying a map of the neighborhood's "formal and informal assets," according to the firm. 4. Borderless collaborated with artist Sara Pooley on the *Claiming Space: Creative Grounds and Freedom Summer School* exhibition at the Jane Addams Hull-House Museum, in Chicago. Designed to help visitors visualize closed schools on Chicago's West Side, the installation features rotating yellow cubes with information on specific buildings. 5. *Love Letter to the Crump* takes the form of a large-scale curtain affixed to the exterior of Crump Theatre in Columbus, Ohio. Borderless translated love letters to the closed 130-year-old theater, written by participants over two workshops, into abstract graphics that decorate the curtain. 6. Challenged to redesign a 2-acre park in the Morningside neighborhood of Detroit for a national design competition, Borderless collaborated with Sarah Hayosh, director of land use and sustainability at nonprofit Detroit Future City, to propose an undulating layout with durable hardscaping.

4: BRANDON FIELDS/COURTESY JANE ADDAMS HULL HOUSE MUSEUM; 5: HADLEY FRUITS/COURTESY EXHIBIT COLUMBUS; 6 (LEFT): ALI LAPETINA

Opinion: Question First, Design Last

TEXT BY CATHERINE HUANG

I wanted to become a doctor. I had a degree in molecular biology and spent summers in laboratories breeding *Drosophila melanogaster*, the everyday fruit fly. The strict research protocols and search for *the* right answer were comforting. Architecture, by contrast, seemed subjective and based on an unsettling artistry.

But through a series of inexplicable coincidences, I found myself in design. After 12 years of practice, I've come to realize that science and architecture are equally ambiguous, though the former has standardized a structure and protocol to control experiments. My design approach has converged with how I pursued research—process driven, testing iterative solutions against educated hypotheses. Most importantly, I've realized that while finding the right answer remains the goal, what is more critical is asking the right question.

The quality of the question determines the quality of the architecture. Often friends ask, "What's so difficult? It's just four walls and maybe a roof." My response: "What is our ambition for architecture? Can it be more?"

The world view in Denmark, where I live now, has changed how I see the role of the architect. We make space, but we also have the agency to shape behavior and change how people think about and occupy the built environment.

As a serendipitous byproduct of Jante Law—the unofficial but widely acknowledged Scandinavian outlook that places society over the individual—the urban landscape has been shaped by delegating every citizen to improve the shared realm. The public realm goes from being no man's land to everyman's watch. Parks and plazas flourish, but private developments also contribute public space and playgrounds to the urban landscape.

Accordingly, an architect must ensure that a building becomes a productive, healthy cell within the larger organism of the city. At the next scale, the idea of community translates naturally into an obligation to take responsibility for our largest shared realm: the Earth.

These ideas now serve to frame what I would like to see the profession accomplish. It's not enough to be responsible to the client: We must expand our awareness to a larger population. The most successful projects do more than meet the constraints of typology and budget. They offer something more. Instead of elevating a narrow user group, they elevate an entire region.

Often the genesis of radical ideas arises from asking the simplest, most reduced, question. Like the child asking why the emperor is naked, it is refreshing to be skeptical and naïve—to be unafraid of asking questions that might lead to ridicule. Growing up, you are taught that much of life is about trade-offs: You can either have cake or candy; straight A's or a social life; science or art. My naïve question: Why can't we have it all?

For a recent project, my team and I asked why can't urban density and a rolling, green landscape coexist in the same footprint? People embroiled in the frenetic pace of city life would benefit from having a place to relax. How do we maximize both? Like the scientific method, the question—or hypothesis—we pose derives from systematic site and context research. The formal options are the test subjects we explore. Successful strains breed subsequent generations that vary in the prominence of certain characteristics and traits. These are then crossbred back into the test population. Over time, this evolution narrows into the most favorable solution.

The visual expression of a project is the last step of our process. In this case, it was a dense urban block that sandwiches a garden landscape. The development looks quite radical, but in truth, it was one of the most reduced and logical solutions. Architecture framed in these terms creates public and private support, which ultimately allows it to get built.

Architecture, as I've discovered, can have a right answer.

Catherine Huang is a partner at BIG (Bjarke Ingels Group). She holds an M.Arch. from the Harvard Graduate School of Design.

COURTESY BIG

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TEXT BY LINDSEY M. ROBERTS

Flek, 3Form
This terrazzo-like eco-resin panel is made of 70% recycled material collected during the manufacture of 3Form's Varia Ecoresin panel. A new material option for any of the company's workplace solutions, Flek is available in 48" by 96" and 48" by 120" sheets at ¼", ⅜", and ½" thicknesses. *3-form.com*

Metroforms with Attraxion Magnetic Attachment Technology Flooring, Metroflor Corp.
This laminated veneer lumber flooring collection has a magnetic underlayment system that eliminates the need for a locking system or adhesives. Available in multiple shapes, including hexagon, cube, and chevron. *metroflorusa.com*

Jumper, VS America
Designed by Pritzker Architecture Prize recipient Jean Nouvel, HON. FAIA, this chair is available with a polypropylene or plywood seat in six sizes for schools and two sizes for offices. Its cantilevered frame can be forward- or backward-flexing on four legs, a swivel base, or a standing/sitting swivel base. *vsamerica.com*

Semih, Modular Lighting Instruments
Inspired by the Taoist yin yang symbol, this cylindrical downlight fixture can split and tilt its head 75 degrees left and right. Available in 2700K, 3000K, and 3500K color temperatures with a 90-plus color-rendering index (CRI) and various beam spreads. *supermodular.com*

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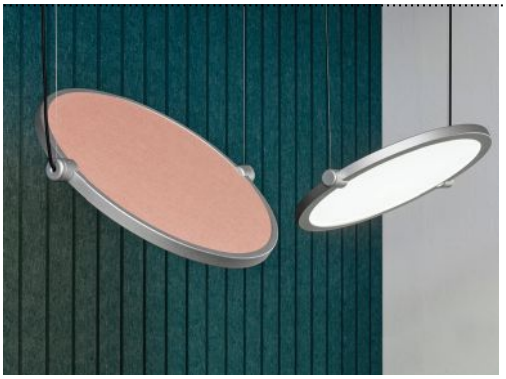
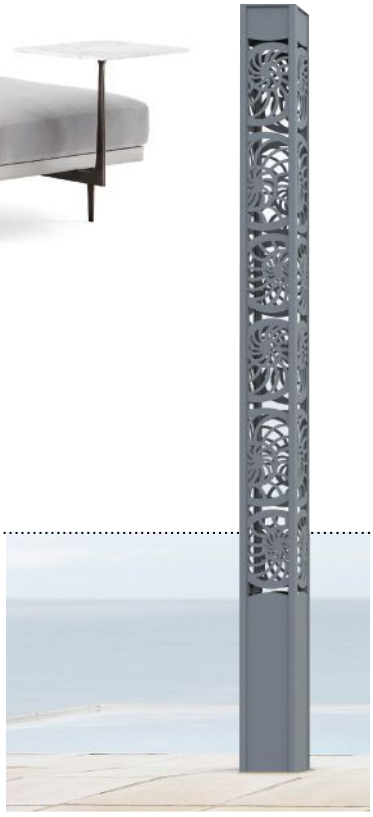


Ac-lipse Acoustic Lighting, Luxxbox
Inspired by a lunar eclipse, the 25½"-diameter Ac-lipse acoustic pendant pivots 360 degrees from a disc to a sliver and back to a disc, with an optional LED light source. Comes standard with a 100% recyclable panel in 20 colors, and with black, brass, silver, or copper hardware. *luxxbox.com*

Lyda, Rottet Studio and Haworth
Inspired by the aesthetics of residential furniture, designer Lauren Rottet, FAIA, created this lounge piece to add comfort to corporate and hospitality settings. Supported by minimalist steel legs, Lyda can be configured as a one-, two-, or three-seater, and with or without a corner. It can also be specified with a peninsula and a hidden pocket drawer with USB connections (both shown). *haworth.com*

ACOUSTIBuilt Seamless Ceiling, Armstrong World Industries
Achieving a maximum noise reduction coefficient of 0.7 and maximum ceiling attenuation class of 48, this ceiling finish emulates the look of seamless drywall and satisfies requirements for many green certification programs. *armstrongceilings.com*

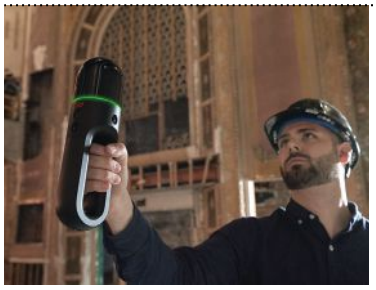
Ecophon Solo Baffles, CertainTeed
New to CertainTeed's line of acoustic baffles, Zig Zag and Wave are intended to give designers the flexibility to customize a space. This line can be wall mounted or suspended, and arranged vertically or horizontally for improved acoustic control. Available in 16 colors and two sizes. *certainteed.com*



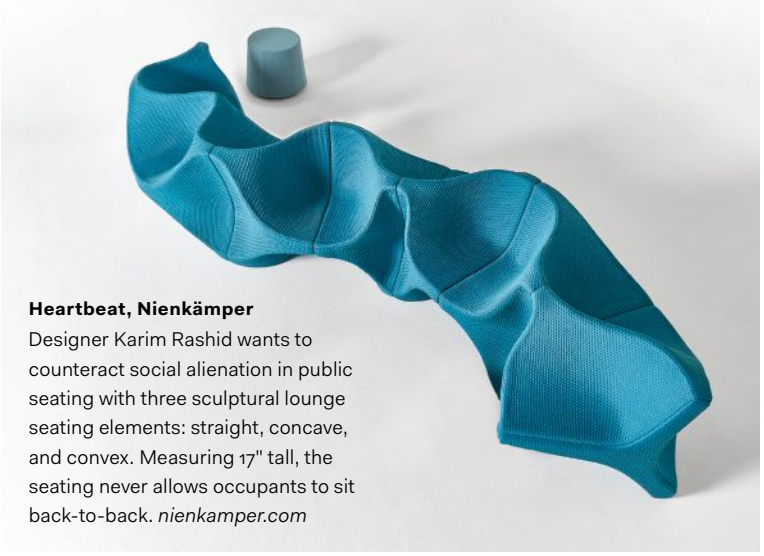
Mosaic, HessAmerica
Mosaic is a fully customizable fixture made of aluminum, which can be laser-cut into patterns depicting palm fronds, reeds, ice blooms, and more. Mosaic can be fitted with white or tunable white LEDs, or RGB and RGBW LEDs for additional color and effects. Available in 10', 12', and 14' heights. *hessamerica.com*

Products: Greenbuild Preview and More

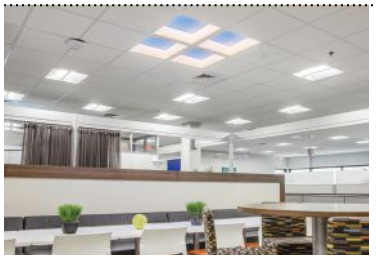
Clario Cloud, 3Form
Made of sola felt, this wafflelike acoustic solution becomes its own fixture, suspended by cables and anchors that are compatible with wood or concrete substrates. Available as a 48" square and 48"- or 72"-diameter disk, the baffle has a noise reduction coefficient of 0.7 or more. *3-form.com*



BLK2GO, Leica Geosystems
Leica's new wireless handheld imaging laser scanner features dual-axis LiDAR, SLAM, and edge-computing technologies, eliminating the need for tripods and static scanning locations. Made of aluminum and weighing 1 7⁄10 lbs, BLK2GO aggregates data in 3D point clouds. *blk2go.com*



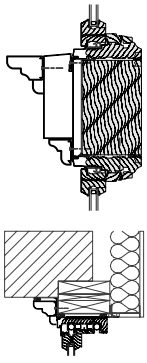
Heartbeat, Nienkämper
Designer Karim Rashid wants to counteract social alienation in public seating with three sculptural lounge seating elements: straight, concave, and convex. Measuring 17" tall, the seating never allows occupants to sit back-to-back. *nienkamper.com*



Cadiant Dynamic Skylight, Cree Lighting
Lighting-control and color-changing technology simulates the dawn-to-dusk, east-to-west movement of the sun in this faux skylight. Offers up to 3,500 lumens ranging from 3000K to 6500K throughout the day. Installs in standard T-grid ceilings. *creelighting.com*

Column Oval Boardroom Table, Union Wood Co.
This built-to-order conference table features a hardwood top in five shapes—rectangle, oval, square, circle, and barrel—with finish options that include nine wood stains, eight wood-alternative looks, and five metallike surfaces. *unionwoodco.com*

Essentialist Collection, Tarkett North America
Savant, Saveur, and Substance are three modular carpet patterns in this new collection for health care and workplace environments. The floor coverings use Tarkett's Eco-Ensure soil protection technology and are recyclable. *commercial.tarkett.com*



Preserving the past, building the future.

As Public School 186 in Harlem, New York, eclipsed 30 years of abandonment, its iconic architecture was in serious jeopardy. Dattner Architects and the Pella Architectural Solutions team worked together to bring new life to the building with custom solutions for complicated needs. Using old photos and architectural remnants found inside, Pella preserved the historical accuracy while adding modern innovations and durability.

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pella.com/historicalsolutions

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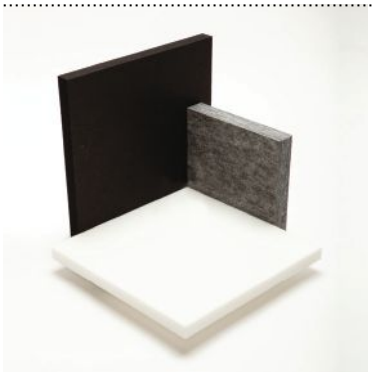
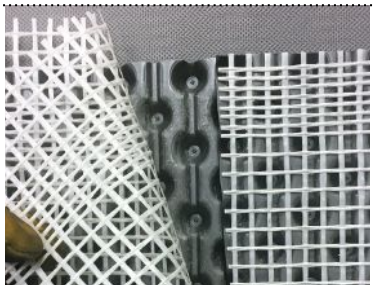


Autem Sound Control, FabriTRAK Systems
Available in black, white, and gray, FabriTRAK's acoustic solution is made from more than 80% post-consumer recycled polyester. It can be applied to any ceiling substrate or corrugated metal ceiling. Standard thicknesses are 1" and 2". *fabritrak.com*

Mistella, Selux
This geometric outdoor fixture can be specified with a single or double arm or as a wall mount. The die-cast, low-copper, marine-grade aluminum luminaire houses an LED light source in 3000K or 4000K, and with a minimum CRI of 80. Standard poles measure 12' tall. *selux.us*



Delta-Dry and Lath, Dörken Systems
This combination rainscreen and fiberglass high-density polyethylene lath system helps prevent stone and stucco installers from sharp metal ends and lightens the weight of the cladding systems. The system blocks moisture from moving through the wall and allows for vapor to dry from inside. *dorken.com*

SpectraClean, Hubbell Lighting
Hubbell's SpectraClean technology disinfects educational, office, and manufacturing environments with narrow-band, 405-nanometer visible light. The technology can remove harmful microorganisms suspended in air, trapped in objects, or residing on surfaces. *hubbell.com*

WashBar Duo, Bradley Corp.
This smart faucet combines sensor-activated soap and water dispensers in a single, chrome-plated fixture for commercial bathrooms. The fixture conducts a daily 5-second purge to minimize germ buildup. LED-illuminated icons change color to signify function and use. Fitted with a low-level soap LED indicator. *bradleycorp.com*

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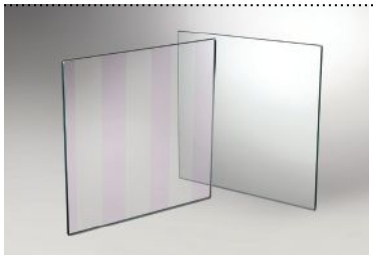
Tete-a-Tete by Samuelson Furniture
Designed for hospitality environments, this S-shaped seat offers space for privacy and conversation. The 42½"-tall and 68"-long Tete-a-Tete is equipped with USB ports and a built-in center walnut table as standard; or with veneered wood, solid wood, quartz, or metal tables. *samuelsonfurniture.com*

Sun—Light of Love, Foscarini
The newest pendant by London-based designer Tord Boontje, called Sun—Light of Love, features 390 steel and aluminum rays that diffuse light from a central 23-watt, 2700K LED source with a CRI of 90-plus. Boontje opted for white-and-gold finish to pay homage to Scandinavia, flowers, and the sun. The 25⅝"-wide fixture measures 24⅝" tall. *foscarini.com*



Guardian Bird1st, Guardian Glass
Guardian Bird1st helps prevent birds from colliding into its curtain wall glazing with an ultraviolet layer visible almost exclusively to them. The glazing appears transparent to humans in most cases, but is sometimes noticeable in wet conditions. Available in sheets up to 102" by 144". *guardianglass.com*

Kaleidoscope, Walker Zanger
Memphis style, Pop Art, and Art Deco all inspired this collection of matte and glossy porcelain tiles. Available in square (7"-square sheet) and triangular (7"-by-6⅜" sheet) shapes in white, pink, greens, and blues, the tiles can be arranged in numerous configurations. *walkerzanger.com*

Sapient Plug Load Management System, Sapient Industries
Operated through a centralized online application, this collection of smart outlets and power strips can collect live power–consumption data, reduce plug load consumption by up to 30%, and even identify which devices aren't being used. *sapient.industries*

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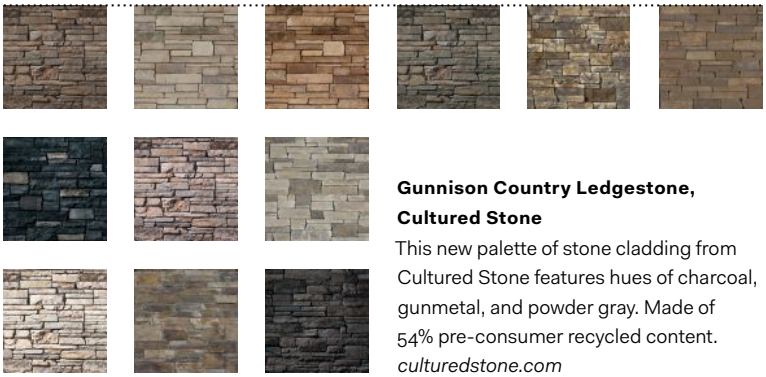

Gunnison Country Ledgestone, Cultured Stone
This new palette of stone cladding from Cultured Stone features hues of charcoal, gunmetal, and powder gray. Made of 54% pre-consumer recycled content. *culturedstone.com*

Rio Collection, Janus et Cie
Named for its river-like curves, the expanded Rio collection features six new powder-coated aluminum pieces by Los Angeles–based firm Rios Clementi Hale Studios, including a cocktail table, side table, and connection module. The mix-and-match collection is offered in bronze (shown), gray, and white. *janusetcie.com*

Blitz, Fondital
Made of recycled aluminum, this die-cast radiator system by Italian manufacturer Fondital is now available in the U.S. Lightweight for easy installation, Blitz comes in ardesia, black coffee, and pearl colorways. The 3⅛"-deep system is available in heights from 16" to 34". *fondital.com*

Walter Lamb Aluminum Rocking Chair, Brown Jordan
To mark its 75th anniversary, Brown Jordan is revamping a 1940s collection by Walter Lamb, which originally featured salvaged bronze and brass piping from sunken naval ships at Pearl Harbor. The updated collection is made of aluminum and rope in 21 finish options. *brownjordan.com*

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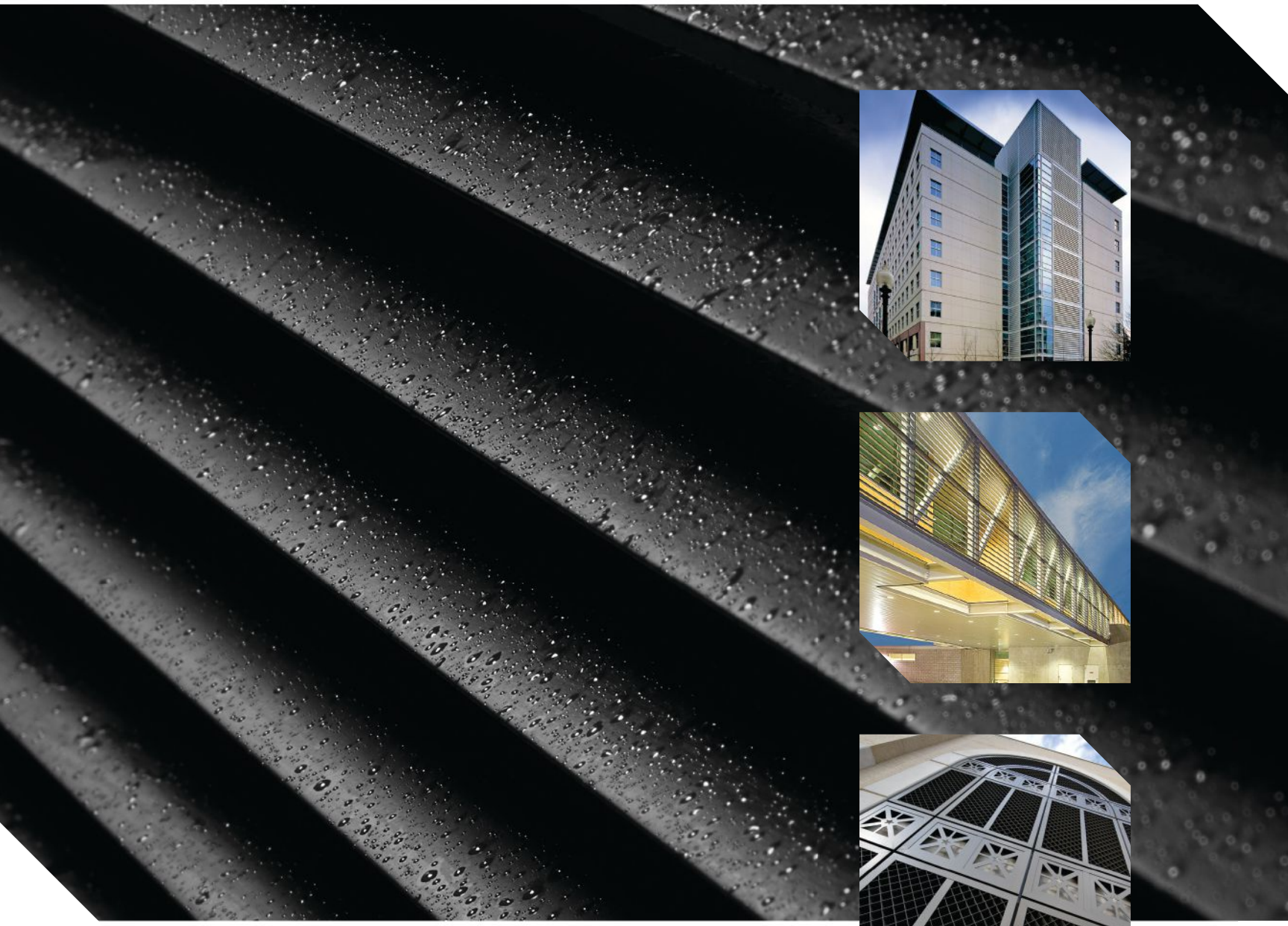

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Residential: Co Adaptive Architecture

TEXT BY KATIE GERFEN

For Ruth Mandl, AIA, and Bobby Johnston, AIA, of Brooklyn, N.Y.–based Co Adaptive Architecture, the decision to renovate their own house to meet the Passive House standard was easy. The approach is relatively new in this country—the first U.S. project built using the criteria was completed in 2003. But in Europe, the Passive House framework—which calls for an airtight envelope, minimal heating and cooling, and minimal energy usage—dates back to the early 1990s.

Mandl's parents did a Passive House renovation of a 1960s house in Vienna designed by her architect grandfather. The end result is "really something you have to experience to fully understand," she says. "It feels different: the comfort, the quality of air, and the quietness." Mandl and Johnston's own Brooklyn brownstone dates to 1889, and they wanted to keep as much of its historic character as possible, while bringing it up to the near net-zero energy-efficient standards that Passive House requires.

Mandl and Johnston's first step was to divide the property into two units (a ground-floor apartment and a two-story unit above, where they would live). Then, they focused on the most involved aspect of the renovation: creating an airtight envelope.

The front and back walls had no insulation to speak of, just plaster and lath over 2 inches of furring channels that sat directly on the inner surface of the masonry structural wall. To create a much tighter envelope, the interior

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The architects saved and restored or replicated as much historic woodwork as possible to preserve the character of the 1889 house.

Project Credits
Project: Macon Street Passive House, Brooklyn, N.Y.
Client: Ruth Mandl and Bobby Johnston
Architect/Interior Designer: Co Adaptive Architecture, Brooklyn, N.Y. · Ruth Mandl, AIA, Bobby Johnston, AIA, Yashil Mudaliar, ASSOC. AIA (project team)
MEP Engineer: ABS Engineering
Structural Engineer: Nate Bergen
Lighting: Co Adaptive Architecture
General Contractor: LB General Contracting Corp.
Size: 2,100 square feet
Cost: $720,000 (construction costs)

> *For materials and sources information, visit bit.ly/MaconStreetPassiveHouse.*

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Residential:
Co Adaptive Architecture

walls were stripped to the masonry and built back with the following layers: a 2-inch air gap; 2x6 framing; an interior membrane; 1½-inch horizontal furring strips; and drywall. After the membrane was put in place, the gaps in the framing were filled completely with blown dense-pack insulation. Windows were replaced with triple-pane tilt-and-turn units.

The new wall system is substantially thicker than the original, and results in much deeper sills. But it has benefits beyond the insulation, Johnston says. The void formed by the framing "is also used as a service cavity, so we had electrical running in that space. Everything's contained within."

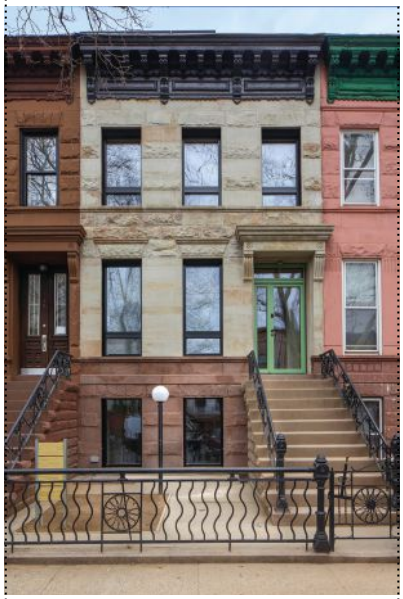
The walls were only part of the upgrade: The house now sports a rooftop solar array and pairs an energy recovery ventilator (ERV) with an efficient electric HVAC system to minimize heating and cooling loads. The ERV preconditions the air that blows into the bedrooms, and exhausts that air through the kitchen and bathrooms. "Fresh air is constantly circulating and is filtered upon entry," Mandl says. "You never get a stale room in a Passive House."

As it stands, the house is operating as net-positive energy—and the overall load includes usage for both units as well as an electric car charging station. "We get money back every year from Con Ed running the meter backwards," Johnston says. The architects have begun the process for certification with the Passive House Institute in Germany, but that is not yet complete.

Lower-Unit Plan

First-Floor Plan

Second-Floor Plan



The front façade was fitted with retractable Hella shades that help prevent heat gain.

Unfortunately, the extensive remodel meant that some of the historic aspects that Mandl and Johnston had hoped to save did not survive the process. While woodwork could be removed and stored during construction, decorative plaster could not, and some fell prey to the vibrations. But even that shortcoming has a silver lining: "We were able to do more acoustic measures to the ceiling," Johnston says. "We have resilient channels now, so it's able to move and last a lot longer. Eventually the plaster would've started cracking again."

"There was a lot of anger directed at us for 'ruining' this old house," Mandl says. That "was very much opposite of what we believe we did, which is to restore it for another 100-plus years. I believe that this is the future of our cities: we have to look at our old building stock and figure out a way to bring them into the future with these new systems."

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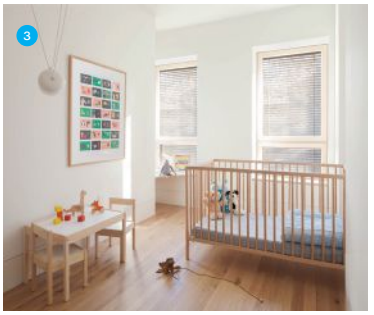

1. Several layers of insulation were added to the front and rear façades to bring the house up to Passive House standards, resulting in deep sills. The remodeled kitchen has only electric GE and Miele appliances to avoid the use of natural gas. **2.** The renovated living room features Nethermead oak floors from Madera and Cloud White paint from Benjamin Moore. Where historic woodwork either didn't exist before or couldn't be salvaged, the architects used simple, light wood trim to differentiate between old and new. **3.** All of the windows in the house were replaced with Optiwin's Purista triple-glazed, tilt-and-turn units, which provide thermal and acoustic insulation.

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PLANNING FOR DISASTER WITH EXPANSION JOINT COVERS

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Salesforce Transit Center, San Francisco, CA
The architect, Pelli Clarke Pelli, desired a high-end aesthetic that required the design to include seismic systems for glass infill—an unusual request for seismic moat systems.

LEARNING OBJECTIVES

1. Evaluate the primary natural and man-made disasters that affect buildings and understand the differences between hazards and disasters.
2. Review hazard mitigation and disaster management techniques.
3. Explore construction best practices related to disaster mitigation, including the concept of resilient design.
4. Examine expansion joint construction and detailing, as well as the use of expansion joint covers.

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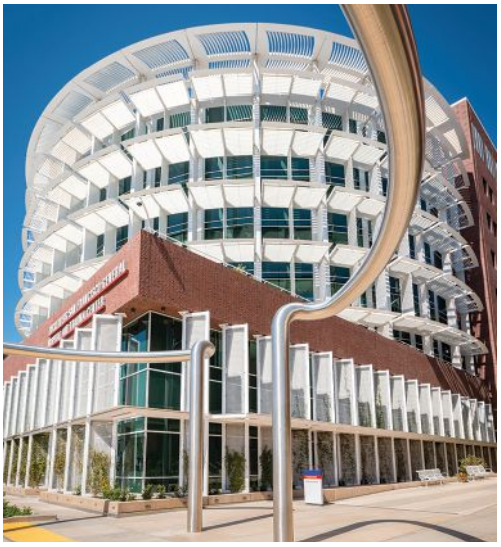
INTRODUCTION

The World Health Organization (WHO) discusses in detail the negative effects that disasters can have, not just on human well-being but also on the built environment. WHO defines a disaster as "an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community." A key component of WHO's definition and ensuing discourse is the ability to respond to a hazard, which it defines as "a natural or human-made event that threatens to adversely affects human life, property or activity to the extent of causing a disaster."[2]

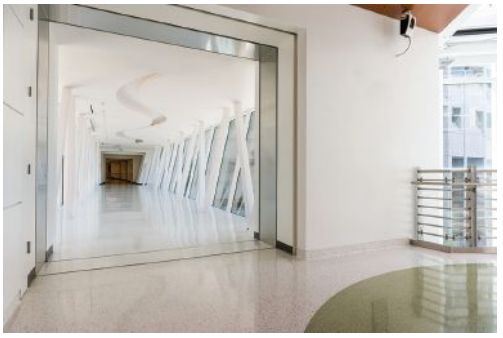
According to WHO, it is the human inability to respond, or an "insufficient capacity of response," to a hazard that results in a disaster. Such insufficient responses are the result of vulnerabilities such as poverty, lack of education or training, or a fragile physical environment.



Zuckerburg San Francisco General Hospital
Zuckerburg San Francisco General Hospital sits along the San Andreas Fault Line. Expansion joints were needed to connect the new hospital tower with the existing structure.

HAZARDS, DISASTERS, AND HUMAN BEINGS

Natural processes or events only qualify as disasters because of the presence of and the impact on human beings. In other words, if human beings are not affected by a natural event, there is no disaster.



Zuckerburg San Francisco General Hospital, San Francisco, CA
Caption: Zuckerburg San Francisco General Hospital must remain operational despite seismic events. Expansion joints allow the building to move 30-inches in every direction during an event.

The International Civil Defence Organization (ICDO), founded in the aftermath of WWI and which strives to protect people, property, and the environment, lists the following types of hazards to which humans are often exposed:

1. Natural: avalanches, earthquakes, drought, floods, forest fires, landslides, plagues, and storms.
2. Man-Made: industrial accidents (including fire and explosions); chemical, biological, and radiological accidents; transport accidents (including air, maritime, road, and railway); and pollution (including air, maritime, and land).[3]

Other conditions are categorized by Tulane University:

1. Geologic hazards: earthquakes, volcanic eruptions, tsunami, landslides, subsidence, floods, droughts, hurricanes, tornadoes, and asteroid impacts.
2. Atmospheric hazards: tropical cyclones, severe thunderstorms, and lightening
3. Other natural hazards that do not fit into either of the other categories: insect infestations, disease epidemics, and wildfires.[4]

Tulane further divides the hazards into two categories: rapid onset and slow onset. Events happening quickly and with little warning such as volcanic eruptions, flash floods, and wildfires are considered rapid onset hazards. Others like disease epidemics and insect infestations, which can take years to develop, are categorized as slow onset hazards.

Each of the processes listed above can result in a variety of effects. For instance, what is termed "primary effects" refers to results from the hazard itself. A building collapsing during an earthquake would qualify as a primary effect because the collapse has occurred as a direct result of the earthquake. Secondary effects are those which occur from a primary effect. For example, a fire started as a result of the collapsed building or earthquake would qualify as a secondary effect. Finally, tertiary effects "are long-term effects that are set off as a result of a primary event." Losing a habitat or a river changing its course as a result of a flood both represent tertiary effects.[5]

Hazards and Vulnerability[6]

As acknowledged by WHO, vulnerability to hazards can lead to insufficient responses, in turn creating disasters. In addition to poverty, lack of training or education, and/or a fragile physical environment, vulnerability can specifically be said to pertain to "proximity to a possible hazardous event, population density in the area proximal to the event, scientific understanding of the event, existence or non-existence of early-warning systems and lines of communication, availability and readiness of emergency infrastructure, construction styles and building codes, and cultural factors that influence public response to warnings."

In many cases, one vulnerability can create others. For instance, poverty exacerbates vulnerabilities to natural hazards primarily due to the fact that less developed countries might lack infrastructure and building codes; populations in cities in these countries and circumstances also tend to be denser and lack access to education or adequate communication. However, wealth, too, can create vulnerabilities. In some instances, wealth might dictate where habitation occurs, such as on a coastline that has the potential to be impacted by flooding or hurricanes.

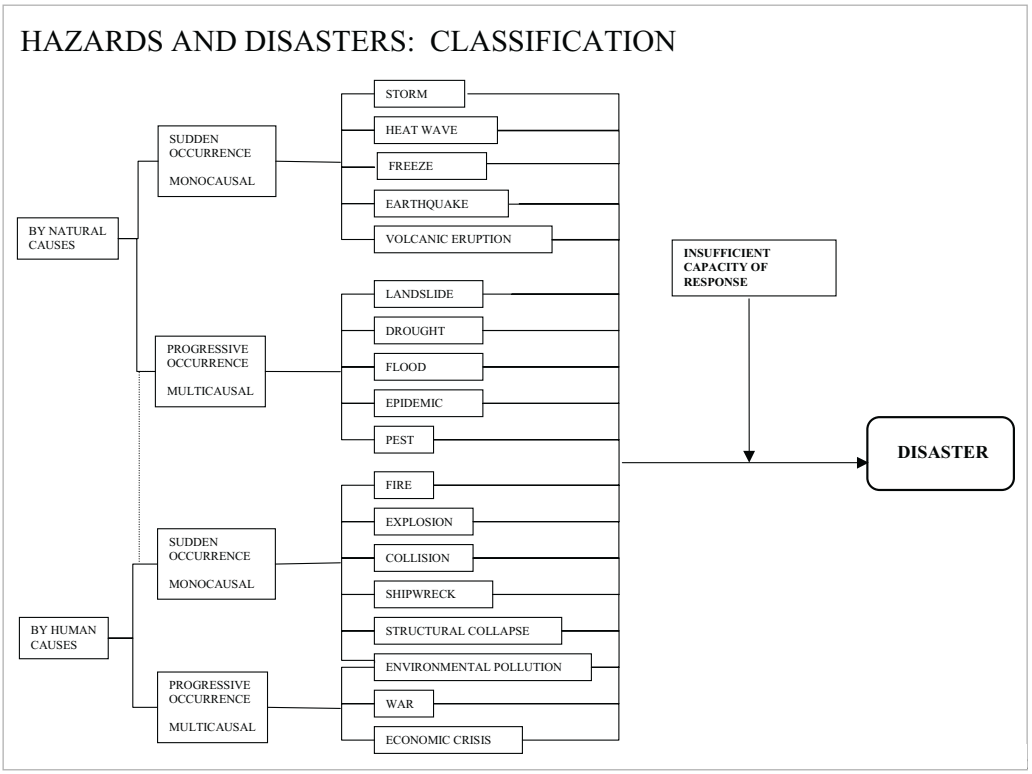
Human intervention also plays a role in the creation of both vulnerabilities and hazards. Human intervention leading to a hazard is termed as an "anthropogenic hazard" and can involve exposure to harmful substances like asbestos fibers, coal dust, or radon. Acid rain, destruction of the ozone layer, and global warming fall into this category as well. Human intervention can further "increase the severity or frequency of a natural disaster." Deforestation, for instance, can cause erosion and landslides, increasing the occurrence or likelihood of a natural disaster and human exposure to it.

Frequency and Magnitude[7]

As mentioned, it is important to understand that natural processes only result in a disaster when humans are adversely affected[8]; frequency and magnitude both influence the extent to which a natural process impacts humans.

The Incorporated Research Institutions for Seismology (IRIS) provides examples of frequency and magnitude. It notes that small earthquakes, usually designated as a magnitude 2 on the Richter scale, occur hundreds of times a day. Moderate earthquakes, typically around a 6 on the Richter scale, happen about 20 times a year. Large earthquakes, reaching above 8 on the Richter scale, occur perhaps once a year.

However, the location in which an earthquake occurs, as well as the density of human population and existing infrastructure, will dictate the severity of its impact on human beings. IRIS discusses Northridge, California, which



GLOSSARY

Disaster—"an occurrence disrupting the normal conditions of existence and causing a level of suffering that exceeds the capacity of adjustment of the affected community"; the insufficient capacity of response to a hazard

Hazard—"a natural or human-made event that threatens to adversely affects human life, property or activity to the extent of causing a disaster"

- **Atmospheric Hazards**—tropical cyclones, severe thunderstorms, and lightening
- **Geologic Hazards**—earthquakes, volcanic eruptions, tsunami, landslides, subsidence, floods, droughts, hurricanes, tornadoes, and asteroid impacts
- **Man-Made Hazards**—industrial accidents (including fire and explosions); chemical, biological, and radiological accidents; transport accidents (including air, maritime, road, and railway); and pollution (including air, maritime, and land)
- **Natural Hazards**—avalanches, earthquakes, drought, floods, forest fires, landslides, plagues, and storms
- **Other Hazards**—insect infestations, disease epidemics, and wildfires

Primary Effects—effects resulting from the hazard itself

Secondary Effects—those which occur from a primary effect

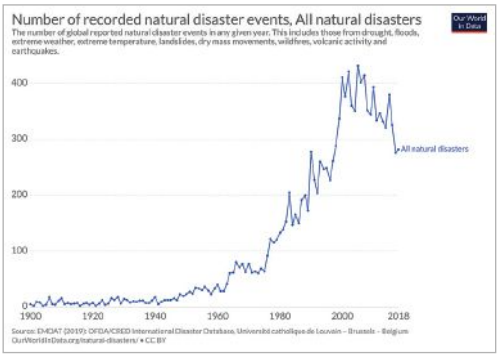
Tertiary Effects—"are long-term effects that are set off as a result of a primary event"

experienced a magnitude 6.7 earthquake in 1994. While this earthquake is considered moderate, "it resulted in over $20 billion in damage."

Disaster, Climate Change, and the Need for Hazard Mitigation

In addition to frequency and magnitude, natural events have the ability to impact humans adversely because of changes in climate patterns. The Whole Building Design Guide (WBDG) maintains, "Buildings in any geographic location are subject to a wide variety of natural phenomena such as windstorms, floods, earthquakes, and other hazards. While the occurrence of these incidents cannot be precisely predicted, their impacts are well understood and can be managed effectively through a comprehensive program of hazard mitigation planning." However, changes in climate patterns can "alter the behavior of hydrometeorological phenomena" increasing the frequency and magnitude of "floods, storms, droughts, and other weather-related disasters" as well as the risk of secondary effects such as wildfires.

According to the World Economic Forum, the most frequently occurring natural events for which humans should prepare are, in order of frequency, flooding, storms, earthquakes, extreme temperatures, landslides, droughts, wildfires, and volcanic activity. Flooding has been the most common disaster with 3,062 floods occurring between 1995 and 2015, which accounts for 43% of all recorded natural disasters.[10] Overall, research indicates that the total number of natural disasters has increased significantly over the past 50 years, making hazard mitigation even more necessary.[11]



PLANNING FOR HAZARDS, AVERTING DISASTERS

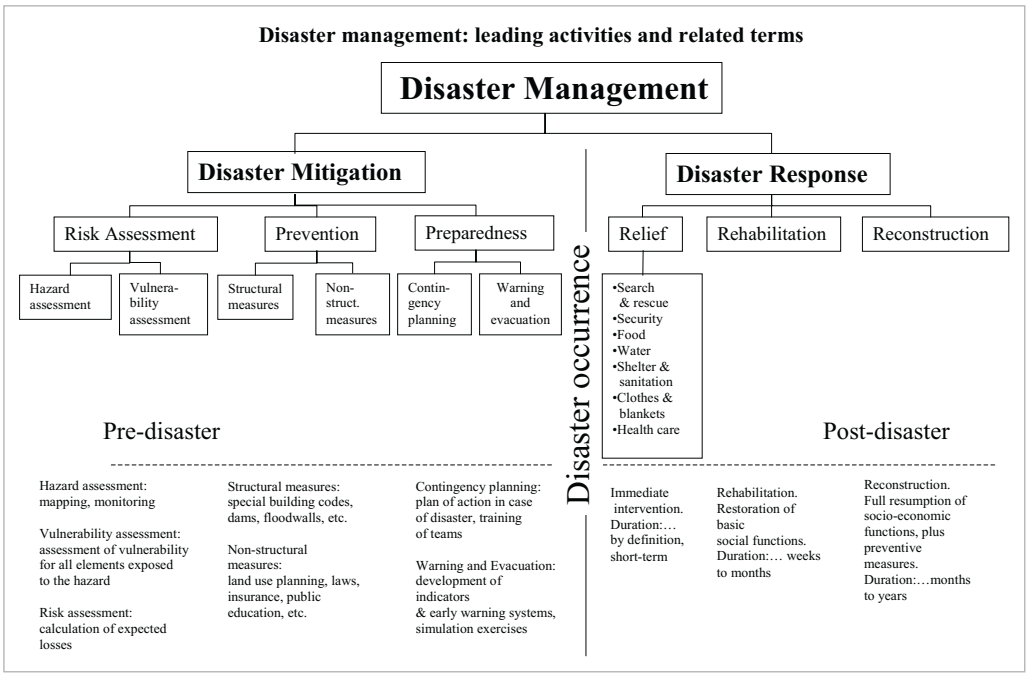
The capacity to plan for hazards effectively is a result of the combination of information, authority, institutions, and partnerships, as well as having the plans, resources, and procedures necessary to enact mitigation techniques.[12]

In *Facing Hazards and Disasters: Understanding Human Dimensions*, the authors note the particular importance of "information effects" when planning for hazards. Information effects can be defined as "those resulting from revised expectations of losses in the future" and are "of central importance to the social significance of disasters." All information effects have the potential to "lead positively to increased vulnerability assessment, hazard mitigation, and emergency preparedness as well as more efficient and effective emergency response and disaster recovery. Whether negative or positive, information effects are important catalysts for increasing or decreasing uncertainty about hazardous conditions before, during, and after disasters." In short, each disaster provides information on how to better mitigate the next.[13]

WHO defines mitigation as "the permanent reduction of the risk of disaster" and divides the concept into two categories:

1. Primary mitigation—"reducing the presence of the hazard; reducing vulnerability"
2. Secondary mitigation—"reducing the effects of the hazard (preparedness)"

"Preparedness" can be defined as the measures taken to "ensure the organized mobilization of personnel, funds, equipment and supplies within a safe environment for effective relief" and is



one of three key components identified by WHO as necessary for disaster mitigation; the other two are risk assessment and prevention.

Overall, "Hazard mitigation includes interventions made in advance of disasters to prevent or reduce the potential for physical harm and social disruption." Hazard mitigation, according to the National Research Council, is comprised of both structural mitigation and nonstructural mitigation. Structural mitigation "involves designing, constructing, maintaining, and renovating physical structures and infrastructures to resist the physical forces of disaster impacts" whereas "nonstructural mitigation approaches include enacting land-use measures that take into account potential disaster impacts; regulating development in high-hazard zones such as hillsides that are prone to landslides and coastal zones subject to storm surge; and even in some cases buying out and relocating communities or parts of communities."[14]

Some hazards such as earthquakes and flash floods occur with no warning. Others such as riverine and coastal flooding, hurricanes, and tornadoes may be predicted in advance with the help of monitoring systems. Earthquakes are potentially the most difficult natural event to mitigate. FEMA claims that this is primarily due to "their complete lack of warning, their rarity, and their possible extreme consequences." However, while earthquakes and their magnitudes are "still, in practical terms, unpredictable," their probability of occurrence is predictable. For instance, it is far more likely that an earthquake will occur in California than in Pennsylvania. Preparation for events such as earthquakes that can impact the structure of a building is a crucial element of the roles of those AEC industry.[15]

BEST PRACTICES AND DISASTER MITIGATION

When planning to mitigate structural damage from natural events, resilience is a major consideration. Building resiliency and the accompanying term "resilient design" emerged from obscurity in the U.S. after the September 11 terrorist attacks in 2001, Hurricane Katrina in 2005, and Hurricane Sandy in 2012. In general between the years 2005 and 2014, the U.S. experienced 212 natural events, second only to China. The monetary losses from these events amounted to $500 billion.[20]

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QUIZ

1. A building collapsing during an earthquake is an example of which of the following?
   a. Primary effect
   b. Secondary effect
   c. Tertiary effect
   d. All of the above

2. Losing a habitat or a river changing its course as a result of a flood qualify as an example of which of the following?
   a. Primary effect
   b. Secondary effect
   c. Tertiary effect
   d. All of the above

3. Which of the following can make a population vulnerable to a hazard?
   a. Poverty and lack of education
   b. A fragile physical environment
   c. Non-existence of early warning systems
   d. All of the above

4. "Reducing the presence of the hazard; reducing vulnerability" defines which of the following terms?
   a. Vulnerability assessment
   b. Primary mitigation
   c. Secondary mitigation
   d. Preparedness

5. Which natural event is potentially the most difficult to mitigate?
   a. Floods
   b. Wildfires
   c. Earthquakes
   d. Tornadoes

6. Between the years 2005 and 2014, the U.S. experienced _____ natural events, second only to China.
   a. 112
   b. 212
   c. 312
   d. 412

7. Which of the following is relevant for any hazardous condition?
   a. Reinforced CMU exterior structural walls
   b. Use of non-rigid connections to attaching interior non-load bearing walls to a structure
   c. Creating an area of refuge
   d. All of the above

8. Elements of critical infrastructure include which of the following?
   a. Power and water
   b. Communications and personnel
   c. Transportation and supplies/materials
   d. All of the above

9. Building collapse is responsible for _____ of the deaths associated with earthquakes.
   a. 25%
   b. 50%
   c. 75%
   d. 100%

10. Expansion joint cover systems are made for which of the following?
    a. Floors and roofs
    b. Interior and exterior walls
    c. Ceilings
    d. All of the above

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ACHIEVING THE UNITED NATIONS' SUSTAINABLE DEVELOPMENT GOALS VIA ARCHITECTURE AND DESIGN

Presented by: covestro

LEARNING OBJECTIVES

1. Understand the United Nation's seventeen sustainable development goals (SDGs)
2. Examine specific sustainable development goals that relate to the architecture and design profession
3. Explore how building product manufacturers can contribute to sustainable design goals
4. Introduce a manufacturer's contribution to the five SDG's that affect the architecture and design industries.

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URBANIZATION OF THE GLOBAL POPULATION

Worldwide, an increasing number of people are moving out of rural areas into cities, leading to greater density and overpopulation of urban areas. This is true in both developed and undeveloped countries. Many people are moving to megacities, defined as having a population over 10 million, such as Tokyo, Japan, Delhi, India, and Shanghai, China, while others are moving to traditional downtowns and their related metro areas that are hubs for industry and business such as New York (finance— also a megacity), San Francisco (technology), and Houston (energy). According to Brett Boyd in his article, *Urbanization and the Mass Movement of People to Cities*, "Approximately 54 percent of people worldwide now live in cities, up from 30 percent in 1950. Sources estimate this will grow to 2/3 of the world population in the next 15 to 30 years. There are currently 29 megacities with populations of over 10 million, up from 2 in 1950 and projected to grow to between 41 and 53 by 2030."[1]

DRIVERS OF URBANIZATION

Many of the drivers of urbanization are the same globally, including increasing automation, innovation, and mechanization of the agricultural sector, which decreases the number of people needed to support the industry. Concentrated wealth, and occupations to support this wealth, draw people to industrial centers, as does the knowledge economy, which requires a large network that is more available in urban centers. There is also a concentration of industry expertise to fewer, larger cities (i.e. New York, San Francisco, and Houston), as well as changing lifestyle preferences, greater opportunity, and new technologies that facilitate and improve the urban living experience.

HOW URBANIZATION WILL AFFECT CITIES

Organizations worldwide, such as the United Nations and US Census Bureau, are trying to determine how this migration pattern will affect cities and how prepared they are for the population growth. All of the people moving to these cities put pressure on the infrastructure, transportation, and sanitation systems, as well as natural resources such as water, trees, and fossil fuels. Residents need safe roads, efficient public transportation, healthy buildings to live, work, and shop in, and adequate consumer goods. This output and use puts a great strain on both the environment and the public. For example, North American infrastructure, largely built after WWII, is aging and has in fact been given a grade of D+ by the American Society of Civil Engineers, who believe the United States requires $3.6 trillion in investment by 2020.[2] This deteriorating infrastructure limits the United States' ability to compete in the global economy and thrive in the future.

Boyd says, "Cities, urban planners, and related public entities also face major challenges to accommodate sustainable growth and incorporate new technologies in an appropriate, cost-efficient, and environmentally sustainable fashion. Some cities will likely over-invest in the wrong technologies and design approaches. Others will underestimate the scale of impending change and fail to plan accordingly, resulting in deteriorating and dangerous cities. Public institutions that can plan from a base of accurate, useful information and learn from one another's successes and mistakes will fare better during this transitory period."

UNITED NATIONS' 17 SUSTAINABLE DEVELOPMENT GOALS (SDGS)

To help cities, urban planners, public institutions, and private entities ride this wave of global population growth and shifting market dynamics, and face the enormous challenges of sustainable growth and

The UN's Sustainable Development Goals are a blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice.

technology integration, the United Nations recently set 17 Sustainable Development Goals. These goals are, "A blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice."[3]

The 17 Sustainable Development Goals are:

- No poverty
- Zero hunger
- Good health and well-being
- Quality education
- Gender equality
- Clean water and sanitation
- Affordable and clean energy
- Decent work and economic growth
- Industry, innovation, and infrastructure
- Reduced inequalities
- Sustainable cities and communities
- Responsible consumption and production
- Climate action
- Life below water
- Life on land
- Peace, justice, and strong institutions
- Partnerships for the goals

In their 2030 Agenda for Sustainable Development, the UN creates a plan of action for people, planet, and prosperity in order to strengthen universal peace in larger freedom. They believe their Sustainable Development Goals are, "Integrated and indivisible and balance the three dimensions of sustainable development: the economic, social and environmental."

The Sustainable Development Goals will stimulate action over the next ten years in areas of critical importance for humanity and the planet in the following ways:

"People
End poverty and hunger, in all their forms and dimensions, and ensure that all human beings can fulfil their potential in dignity and equality and in a healthy environment.

Planet
Protect the planet from degradation, including through sustainable consumption and production, sustainably managing its natural resources and taking urgent action on climate change, so that it can support the needs of the present and future generations.

Prosperity
Ensure that all human beings can enjoy prosperous and fulfilling lives and that economic, social and technological progress occurs in harmony with nature.

Peace
Foster peaceful, just and inclusive societies that are free from fear and violence. There can be no sustainable development without peace and no peace without sustainable development.

GLOSSARY

Megacity
Cities with a population over 10 million

United Nations
An intergovernmental organization tasked with maintaining international peace and security, developing friendly relations among nations, achieving international co-operation, and being a center for harmonizing the actions of nations.[35]

UN Sustainable Development Goals
A blueprint to achieve a better and more sustainable future for all to address the global challenges we face, including those related to poverty, inequality, climate, environmental degradation, prosperity, and peace and justice.[36]

Greenhouse Gas Emissions (GHGs)
Chemical compounds present in Earth's atmosphere that allow direct sunlight to reach the Earth's surface unimpeded, which heats the surface and reradiates infrared energy to the atmosphere. Greenhouse gases absorb this energy, thereby allowing less heat to escape back to space, and 'trapping' it in the lower atmosphere.[37]

Architecture 2030
An organization with a mission to rapidly transform the built environment from the major contributor of greenhouse gas (GHG) emissions to a central part of solving the energy and climate crisis.

Wastewater
Wasterwater comes from residential and commercial sources such as bathing, toilet flushing, laundry, dishwashing, and industry. It may contain hazardous materials and requires special treatment or disposal.[38]

Renewable Energy
Renewable energy is energy from sources that are naturally replenishing but are limited in the amount of energy that is available per unit of time. Sources of renewable energy include solar, wind, geothermal, and nuclear.[39]

Industrialization
The process by which an economy is transformed from primarily agricultural to one based on the manufacturing of goods.[40]

Paris Agreement
The Paris Agreement aims to strengthen the global response to the threat of climate change and the ability of countries to deal with the impacts of climate change.[41]

Together for Sustainability Initiative (TfS)
Initiative to develop and implement a global audit program to assess and improve sustainability practices within the supply chains of the chemical industry.

Partnership
Mobilize a revitalized Global Partnership for Sustainable Development, based on a spirit of strengthened global solidarity, focused in particular on the needs of the poorest and most vulnerable and with the participation of all countries, all stakeholders and all people."

The UN believes the interlinkages and integrated nature of the Sustainable Development Goals are crucially important to profoundly improve the lives of all and will transform our world for the better.[4]

Goal 1: No poverty[5]

Economic growth must be inclusive to provide sustainable jobs and promote equality in order to end poverty, in all its forms, everywhere.

Tactic: Donate what you don't use. 836 million people live in extreme poverty.

Goal 2: Zero hunger[6]

The food and agriculture sector offers key solutions for development, and is central for hunger and poverty eradication.

Tactic: Avoid throwing away food. Over 1/3 of the world's food is wasted.

Goal 3: Good health and well-being[7]

Ensuring healthy lives and promoting the well-being for all at all ages is essential to sustainable development.

Tactic: Vaccinate your family to protect them and improve public health.

Goal 4: Quality education[8]

Obtaining a quality education is the foundation to improving people's lives and sustainable development.

Tactic: Help children in your community read.

Goal 5: Gender equality[9]

Gender equality is not only a fundamental human right, but a necessary foundation for a peaceful, prosperous and sustainable world. This SDG seeks to achieve gender equality and empower all women and girls.

Tactic: Call out sexist language and behavior.

Goal 6: Clean water and sanitation[10]

Clean, accessible water for all is an essential part of the world we want to live in.

Tactic: Avoid wasting water. Water scarcity affects more than 40% of the world's population.

Goal 7: Affordable and clean energy[11]

Energy is central to nearly every major challenge and opportunity. This SDG seeks to ensure access to affordable, reliable, sustainable, and modern energy.

Tactic: Use only energy efficient appliances and light bulbs.

Goal 8: Decent work and economic growth[12]

Sustainable economic growth will require societies to create the conditions that allow people to have quality jobs. This SDG intends to promote inclusive and sustainable economic growth, employment, and decent work for all.

Tactic: Buy from green companies that are equal opportunity employers.

Goal 9: Industry, innovation, and infrastructure[13]

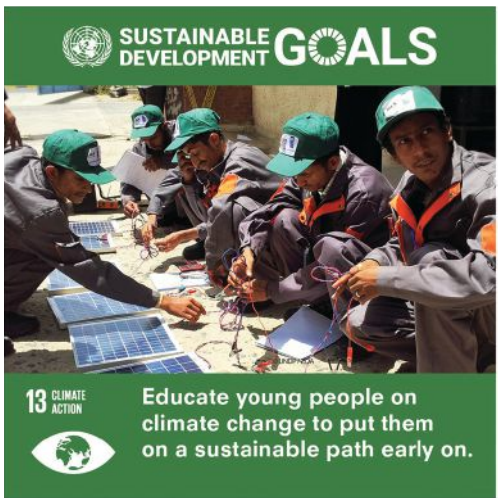
Investments in infrastructure are crucial to achieving sustainable development. We must build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.

Tactic: Think of innovative ways to repurpose old material.

Goal 10: Reduce inequalities[14]

To reduce inequalities within and among countries, policies should be universal in principle, paying attention to the needs of disadvantaged and marginalized populations.

Tactic: Raise your voice against discrimination.



Goal 11: Sustainable cities and communities[15]

This goal aims to make cities inclusive, safe, resilient, and sustainable. There needs to be a future in which cities provide opportunities for all, with access to basic services, energy, housing, transportation, and more.

Tactic: Bike, walk, or use public transportation to keep our cities' air clean.

Goal 12: Responsible consumption and production[16]

This goal aims to ensure sustainable, responsible consumption and production patterns.

Tactic: Recycle paper, plastic, glass, and aluminum.

Goal 13: Climate action[17]

Climate change is a global challenge that affects everyone, everywhere. We must take urgent action to tackle climate change and its impacts.

Tactic: Educate young people on climate change to put them on a sustainable path early.

Goal 14: Life below water[18]

We must conserve and sustainably use the oceans, seas, and marine resources. Careful management of this essential global resource is a key feature of a sustainable future.

Tactic: Avoid plastic bags to keep the oceans safe and clean.

Goal 15: Life on land[19]

Sustainably manage forests, combat desertification, halt and reverse land degradation, halt biodiversity loss.

Tactic: Plant a tree and help protect the environment.

Goal 16: Peace, justice, and strong institutions[20]

This goal seeks to promote just, peaceful, and inclusive societies. This can be accomplished by giving access to justice for all, and building effective, accountable institutions at all levels.

Tactic: Use your right to elect leaders in your country and local community.

Goal 17: Partnerships for the goals[21]

Revitalize the global partnership for sustainable development.

Tactic: Get the SDGs in Action app to learn about the Goals and ways to help achieve them.

This article continues on http://go.hw.net/AR112019-2.
Go online to read the rest of the CEU course, complete the corresponding quiz for credit, and receive your certificate of completion.

QUIZ

1. Megacities are defined as having a population over _____.
   a. 1 million
   b. 5 million
   c. 10 million
   d. 15 million

2. Which of the following is a driver of urbanization?
   a. Increasing automation of the agricultural sector
   b. Concentrated wealth
   c. Knowledge economy
   d. Changing lifestyle preferences
   e. All of the above

3. North American infrastructure, largely built after WWII, has been given a grade of _____ by the American Society of Civil Engineers.
   a. A+
   b. B+
   c. C+
   d. D+

4. Which of the following will stimulate action over the next ten years in areas of critical importance for humanity and the planet while balancing the three dimensions of sustainable development: the economic, social and environmental?
   a. UN Sustainable Development Goals
   b. Paris Climate Agreement
   c. Architecture 2030
   d. Together for Sustainability Initiative

5. Which Sustainable Development Goal is central to nearly every major challenge and opportunity globally?
   a. Goal 6: Clean water and sanitation
   b. Goal 7: Affordable and clean energy
   c. Goal 9: Industry, innovation, and infrastructure
   d. Goal 11: Sustainable cities and communities
   e. Goal 13: Climate action

6. Which Sustainable Development Goal challenges citizens to bike, walk, or use public transportation to keep our cities clean?
   a. Goal 6: Clean water and sanitation
   b. Goal 7: Affordable and clean energy
   c. Goal 9: Industry, innovation, and infrastructure
   d. Goal 11: Sustainable cities and communities
   e. Goal 13: Climate action

7. Water scarcity affects more than ____ % of the world's population.
   a. 10
   b. 20
   c. 30
   d. 40

8. Currently ____ % of wastewater from human activity is released into rivers and oceans without being treated, which leads to water pollution, diarrhoeal diseases and death.
   a. 10
   b. 30
   c. 40
   d. 80

9. To help meet Goal 7: Affordable and clean energy, the A&D community can do which of the following?
   a. Substantially increase water-use efficiency across all sectors
   b. Expand infrastructure and upgrade technology for supplying modern and sustainable energy services for all in developing countries
   c. Ensure access for all to adequate, safe, and affordable housing and basic services and upgrade slums
   d. Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries

10. A special PU resin can be combined with glass fiber fabrics to create new composite materials for wind blades, which can help manufacturers to meet which Sustainable Development Goal?
    a. Goal 6: Clean water and sanitation
    b. Goal 7: Affordable and clean energy
    c. Goal 9: Industry, innovation, and infrastructure
    d. Goal 11: Sustainable cities and communities
    e. Goal 13: Climate action

SPONSOR INFORMATION

SEALING THE ENVELOPE WITH INSULATED METAL PANELS

Presented by: Kingspan

District Warf, Washington DC

LEARNING OBJECTIVES

1. Understand the relationship between the building science concepts of air, water, vapor, and thermal management and how insulated metal panels perform these functions through a single component.
2. Learn the building science properties behind the "perfect" (universal) wall from a performance standpoint.
3. Describe elements of the "perfect" (universal) roof and how insulated metal panels can be used in continuous roof assemblies.
4. Explore best practices for sealing the insulated metal panel envelope in a variety of applications.

CONTINUING EDUCATION

AIA CREDIT: 1 LU/Elective
COURSE NUMBER: AR112019-4

AIA Continuing Education Provider

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The building envelope, with all its technological advancements and design options, is meant to perform two basic functions: be a physical barrier between indoor and outdoor environments and enclose a structure. And yet, there are several factors influencing the building envelope's performance, starting with the physical components like the foundation, wall assembly, roofing system, and penetrations like doors and windows.

Buildings are subjected to intense environmental loads, so physical components must work together to effectively control the flow of heat, air, water, and vapor. External environmental loads like:

- Wind pressure,
- Solar radiation,
- Rain,
- Heat exchange with the outdoors, and
- Vapor exchange with the outdoors

exert pressure on buildings from the outside. At the same time, internal forces like heat and vapor exchange with the indoors put pressure on envelope components. Improving the building envelope is one of the most effective ways of increasing energy efficiency and occupant comfort.[1]

BUILDING ENVELOPE FUNCTIONS[2]

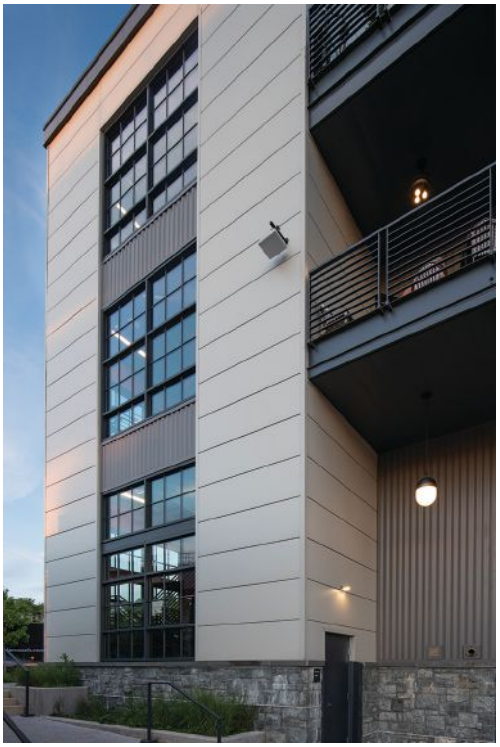
The laws of physics play an integral role in how buildings separate indoors from out. Thermodynamics dictates how water, air, vapor, and heat are controlled. In particular, the Second Law of Thermodynamics states that heat transfer can only occur from the point of higher temperatures to lower ones. Further:

- Air flows from higher pressure to lower pressure,
- Water vapor moves from moist to dry,
- Liquid water moves downward via gravity, and
- Moisture flows from warm to cold.

Thus, designers and builders need to consider the effects of heat and air flow, water vapor, rain, and ground water on the performance and integrity of the building envelope.

Enclosure Control Functions

The building envelope has three primary performance functions: Support, Control, and Finish. Structural components should first support the physical loads imposed by environmental forces like gravity, wind, impact resistance, thermal expansion, and so on.



District Warf, Washington DC

The control layers should effectively manage the flow of heat, air, moisture, light, and sound. This is the layer that is critical to the energy performance of the building enclosure. Finally, the finished envelope needs to provide protection for control and support elements while also taking into consideration interior and exterior aesthetics.

Each performance function needs to adhere to its own set of performance standards, measurement methods, and testing and compliance requirements. For example, the envelope needs to resist water penetration and excessive air flow; components must work together to achieve fire safety ratings; and systems need to ensure that differential and structural movement variations are accounted for.

Different elements are used to control environmental loads acting on buildings. In order of importance, these are:

- Water control layer
  - Controls rain and ground water intrusion, protection from elements
- Air control layer
  - Controls air leakage; more important than vapor control layer due to amount of air-transported moisture
- Vapor control layer
  - Manages movement of vapor (diffusion), even without air movement
  - Relatively newer concern in building design vs. water or air control layers
- Thermal control layer
  - Controls heat transfer, maintains conditioned interior environment
  - Closely related to comfort, operating/ energy costs and sustainability

Insulated metal panels (IMPs) provide all four control layers in a single factory-built component, simplifying installation with fewer transitions and less chance of failure. Compared to traditional insulation methods, which leaves room for cold spots where there is framing instead of insulation, IMPs provide a continuous layer of cladding and insulation that is more energy efficient.

While all control layers are important, in building science what matters first is the water control layer. According to The Perfect Wall, "if you can't keep the rain out don't waste your time on the air. If you can't keep the air out don't waste your time on the vapor." First, a discussion of water control.

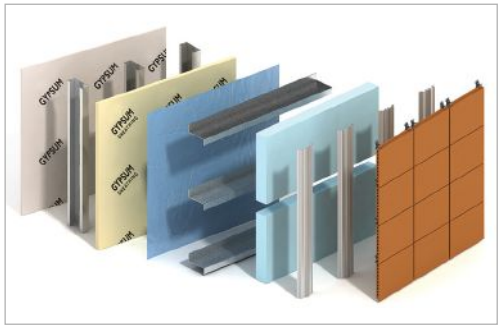
WATER CONTROL STRATEGIES[5, 6]

The most basic requirement of a wall assembly is to keep bulk water out. The water control layer addresses the exterior cladding element and protects against rain water and ground water, not water vapor or condensation—more on that in a later section. Water intrusion has five causes:

- gravity, where water flows downhill
- kinetic energy, or wind-driven water intrusion
- surface tension, when water clings to itself
- capillary action, the ability of water to flow in narrow spaces, even uphill (think trees)
- pressure differentials, where there is higher pressure on the exterior of the wall vs. interior
  - wind-induced
  - hydrostatic

Controlling bulk water can be done in four ways: drained and screened assemblies, mass/storage wall assemblies, perfect barrier assemblies, or by using insulated metal panels. Next, the advantages and disadvantages of each water control strategy will be discussed.

Canal Dock Boathouse, New Haven, CT



Anatomy of a Rainscreen

GLOSSARY

1. Capillary Action: The ability of water to flow in narrow spaces, even uphill

2. Continuous Insulation: Insulation that is continuous across all structural members without thermal bridges other than fasteners (i.e. screws and nails) and service openings.

3. Convective Loops: Occur when wind-driven air penetrates an assembly from the exterior, passes through air permeable insulation, contacts the air barrier, then returns to the exterior; also called wind washing.

4. Hydrostatic Pressure: Pressure exerted by a liquid when it is at rest, due to gravity, and is the strongest force driving rainwater to the building envelope surface.

5. Hygrothermal: Describes the movement of heat and moisture through buildings. *Hygrothermal analysis* predicts how heat and moisture will move through the building envelope and helps prevent potential building damage.

6. K-Value: Also called k-factor, it measures the thermal conductivity of a material or how easily heat passes across it.

7. R-Value: Measures how well a two-dimensional barrier resists heatflow; the higher the R-value, the greater the ability to resist conductive heat transfer.

8. Stack Effect: Also called air buoyancy; the effect of warm air moving upward inside a building and is more common in winter months when the indoor air is warmer than outside air.

9. Thermal Bridging: Occurs when heat flows through the path of least resistance, along a more conductive or poorly insulated material; causes heat loss, occupant discomfort, expansion and contraction beyond expected limits, condensation, damages due to freeze/thaw cycles, and related moisture or mold issues.

10. Universal Wall: Also called the Perfect Wall, it represents the optimum layering of support, control, and finish layers. It works for all buildings in all climate zones and also applies to roofs and floors.

11. Vapor Barrier: Materials that mitigate or eliminate water vapor intrusion; can also function as air barriers and are typically installed on the exterior of the building envelope.

12. Vapor Retarder: Materials used to slow the movement of vapor from one side to the other and are classified three ways according to the level of permeability or impermeability.

Water Control Strategies: Drained and Screened

Rainscreens can either be drained and back-ventilated or pressure equalized. Drained rainscreens are more common. Both types contain rainscreen façade, a water shedding component, and a backup barrier wall assembly. Rainscreens are one of the best building envelopes, but they are expensive to build.

Advantages of drained and screened water control strategies include:

- redundant system (outer rainscreen AND barrier wall)
- does not rely on face seals
- adaptive to many products (brick, tile, ceramic, glass, metal, ACM etc.)
- drainage cavity allows for proper channeling of water and evaporation

However, the disadvantages are that:

- multiple layers are required for proper performance
- layers supplied and installed by different trades
- interfaces between layers must be properly detailed and constructed
- different regions of the country may require different components and assemblies if using cavity insulation vs. exterior insulation

Water Control Strategies: Mass/Storage Walls

Concrete masonry walls are the oldest form of construction and have a proven track record of keeping bulk water out. They are relatively easy to inspect and have excellent water management properties within the field of the wall, and masonry walls can easily absorb excess water, providing a hydric buffer as humidity changes. Examples of mass/storage walls are concrete tilt-up, pre-cast, concrete block, and stone, and they must resist all negative and positive wind loads.

Despite these advantages, mass/storage walls lack redundancy and joints are unprotected from the elements. Excess moisture can be retained within the wall; when that happens, if there is insulation in the wall cavity, the insulation could become moldy over time. Freeze/thaw cycles and exposed seals can lead to failure in the control layer, and solar heating after rainfall can create a strong inward vapor drive.

Moisture build-up and accompanying problems such as mold occur in buildings when the rate of moisture entry exceeds the rate of removal. Mass walls have the capacity to store excess moisture until it can safely evaporate and/or diffuse. This function is particularly helpful when using cavity-based insulation systems. Weep holes, which are drilled at the mortar joint at the bottom of mass walls, can help to control condensation and allow water to drain, but if the wall is built incorrectly they will not work.[8]

Water Control Strategies: Perfect Barrier Walls

A perfect barrier wall is also known as a single-line barrier, perfect system, perfect wall, and zero-tolerance wall system. Single-skin metal panels solid-metal wall cladding, precast concrete panels, and insulated metal wall panels are examples of a perfect barrier wall.[9] Providing water protection by use of a single element, barrier walls may or may not contain separate vapor retarders/barriers and success depends on installation quality, placement and longevity of gaskets/sealants. Cladding must resist all positive and negative wind loads.

Advantages of barrier walls:

- easy to inspect installation
- repairs accessible from exterior of wall assembly
- minimum components, straightforward installation

Disadvantages:

- seal failure leads to water intrusion—no backup system
- seals degrade under atmospheric exposure (UV, wind, rain)
- failure may go undetected, resulting in extensive damage within cavity (mold, mildew)

Barrier walls, as a single line of defense against the elements, often involve complex construction and usually require substantial ongoing maintenance. Even though barrier walls can be cost-effective at the outset, long-term expenses can add up.[10]

Water Control Strategies: Insulated Metal Panels

Insulated Metal Panels (IMPs) function as perfect barrier walls, with several key differences. They are a hybrid between barrier walls and a drained wall assembly. IMPs contain integrated two-stage joinery designed to function like rainscreens. Here's how it works:

- Bullnose deflects rainwater away from exterior joint and protects fastener penetrations
- Bullnose moderates pressure on exterior seal and reduces pressure on exterior joint
- Exterior joint reduces amount of water that can reach interior joint seal
- Factory-built joinery provides for more consistent weathertight fit vs. field assembled
- Joinery has gaskets or non-exposed butyl sealant, both are protected from UV
  - All panel components are non-absorptive, preventing capillary action through panel

IMPs provide exterior insulation, which eliminates the need for cavity insulation. The panels are also non-absorptive, and these two factors combined make hygric storage capacity a moot point. There are no materials in the wall assembly to retain moisture, so moisture build-up never happens. Building trends are moving away from cavity insulation in an effort to reduce heat flow through a building and increase energy efficiency. As IMPs are a continuous insulation element, framing is not exposed and gaps in the building envelope are significantly reduced.

How Insulated Metal Panels Resist Water Infiltration[11]

As a reminder, water intrusion happens in five ways: through gravity, kinetic energy, surface tension, capillary action, or pressure differentials. Barrier systems with water-managed and drained joints function more closely to drained systems than to barrier systems. When a building envelope uses IMPs, water is deflected away due to the panels' design.

This article continues on http://go.hw.net/AR112019-4. Go online to read the rest of the CEU course, complete the corresponding quiz for credit, and receive your certificate of completion.

QUIZ

1. In the Second Law of Thermodynamics, which principle is missing: heat transfer, airflow, liquid water, moisture, and _____.
   a. Wind load
   b. Water vapor
   c. Impact resistance
   d. Solar energy

2. Different elements are used to control environmental loads acting on buildings. In order of importance, these are:
   a. Water, air, vapor, thermal
   b. Air, water, vapor, thermal
   c. Vapor, water, air, thermal
   d. Water, air, thermal, vapor

3. Insulated metal panels are a hybrid between barrier walls and a _____.
   a. Rainscreen
   b. Mass/storage wall
   c. Drained wall assembly
   d. Perfect wall assembly

4. Water intrusion has five causes: gravity, kinetic energy, surface tension, capillary action, and _____.
   a. Holes in the building envelope
   b. Condensation
   c. Heavy rainfall
   d. Pressure differentials

5. _____ happen when wind-driven air penetrates an assembly from the exterior, passes through air permeable insulation, contacts the air barrier, then returns to the exterior.
   a. Convective loops
   b. Air buoyancy
   c. Stack effect
   d. Hydrostatic pressure

6. Proper vapor retarder/barrier design depends on climate zone, insulation system, building use and interior conditions and _____.
   a. The number of envelope penetrations
   b. Project budget
   c. Ventilation
   d. Cladding

7. Thermal insulations are materials with a k-value lower than _____ W/m · K are preferred in building assemblies for their superior ability to resist heat flow.
   a. 0.03 to 0.05
   b. 0.05 to 0.07
   c. 0.07 to 0.09
   d. 0.09 to 0.11

8. In a perfect or universal wall system, the recommended order of layers is:
   a. Cladding, control and support
   b. Support, control, and cladding
   c. Cladding, support, and control
   d. Control, support, and cladding

9. When specifying the best building materials to protect against water intrusion, architects should keep in mind the four D's:
   a. Deterrence, drying, drainage, durability
   b. Drainage, dewpoint, durability, deflection
   c. Design, differentials, drainage, durability
   d. Deflection, drainage, drying, durability

10. Continuous contact between foam and steel facings in insulated metal panels eliminates interstitial condensation, which is when _____.
    a. Residual water stays on the panel facings
    b. Dewpoint is within the panel core
    c. Mold and mildew can occur
    d. Water vapor is contained in the panel core

SPONSOR INFORMATION

Kingspan

Kingspan is a global leader in high performance insulation and building envelope solutions, designed to reduce the carbon footprint of the built environment. Kingspan has five insulated metal panel plants in North America and is one of the largest IMP manufacturers in the world.

QuadCore™ protects against fire, smoke and ordinary design.

Kingspan insulated panels featuring QuadCore™ Technology are designed to make you look good. Inside and out. For starters, the innovative cell formulation inside each panel provides superior fire resistance and unmatched health and wellness certification. Back that up with unrivaled thermal performance, a 30-year thermal warranty and enviable design flexibility, and you'll quickly see how the QuadCore™ portfolio can help bring your design vision to life. Get the full details at **kingspanpanels.com.**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STRATEGIC ELECTRIFICATION, DECARBONIZATION, AND THE ROLE OF ADVANCED HEAT PUMP TECHNOLOGY

Presented by:
MITSUBISHI ELECTRIC
COOLING & HEATING

VRF's outdoor units are compact, quiet and lightweight.

LEARNING OBJECTIVES

1. Explain the concept of strategic electrification and why building decarbonization is one impactful strategy for achieving strategic electrification.
2. Demonstrate how heat pumps help to achieve decarbonization and strategic electrification.
3. Explore VRF advanced heating technology and why it is a promising opportunity for strategic electrification.
4. Analyze efforts by municipalities across the United States to implement strategic electrification.

CONTINUING EDUCATION

AIA CREDIT: 1 LU/HSW
AIA COURSE NUMBER: AR112019-3

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INTRODUCTION

In May of 2017, the last large coal-fired power plant in New England closed, and by 2020, the last of New York's coal plants are set to close. States across the country are implementing policies aimed at carbon reduction. For example, Northeast Energy Efficiency Partnerships (NEEP), a non-profit organization dedicated to accelerating energy efficiency in the Northeast and Mid-Atlantic states, says its "long-term shared goal is to assist the region to reduce carbon emissions 80% by 2050." NEEP notes four key strategies of how to achieve its carbon reduction goal: "dramatically improve the efficiency of energy use; decarbonize the electric grid through the use of distributed as well as large scale renewable energy sources for electricity generation; move as many end uses as possible to renewable electricity; use lower carbon fuels for remaining needs."[1]

NEEP maintains the key drivers behind these strategies, in addition to carbon emissions and reducing dependence on fossil fuels, are health, comfort, safety, and costs. In an effort to benefit consumers, businesses, and the environment, NEEP believes that advanced electric technologies, such as space/water heating; deep energy efficiency, such as thermal improvements; and grid integration, including the flexible use of energy, are all crucial components of reducing carbon emissions through strategic electrification.[2]

Defining Strategic Electrification

NEEP defines strategic electrification as "powering end uses with electricity instead of fossil fuels in a way that increases energy efficiency and reduces pollution, while lowering costs to customers and society, as part of an integrated approach to deep decarbonization."[3] Strategic electrification is also sometimes known as beneficial electrification and offers many opportunities within both the commercial and residential sectors to reduce emissions and energy costs. For instance, strategic electrification can include switching to an electric car or heating system. Strategic electrification occurs when both the end-user

On the exterior of the building, this VRF system requires no unsightly rooftop units and screening.

and the environment benefit and efficiency policies strive to assess the lifecycle energy savings of a product.[4]

The Current State of Strategic Electrification

At the moment, the majority of vehicles and homes rely on the on-demand, on-site burning of fossil fuels for power and heat, and many view using electricity as inefficient; however, the Environmental and Energy Study Institute (EESI) notes several factors that make electrification more viable, both financially and environmentally:

- "Rapid growth in low-cost, zero-emissions power,
- Volatility in fossil fuel prices and availability (especially propane and heating oil),
- Increasing efficiency and performance of electric-powered appliances and vehicles,
- Growing need for electricity load management, and
- Emission reduction goals."[5]

Adopting electrification would necessitate a shift in the viewpoints and business models set forth by utility companies, policymakers, and other invested parties. For example, the EESI recommends that rather than considering the power, heating, and transportation sectors as distinct, energy consumption should be analyzed as a whole across the US economy to incentivize electrification, enabling both financial growth and environmental benefits. The EESI further claims that the electrification of the transportation and commercial and residential building sectors would "double electricity use by 2050" while reducing greenhouse gas emissions by 70%.

New technologies are also making strategic electrification more viable by reducing power demand. For instance, energy efficiency, demand-response technologies, cheap renewable power, and the closing of coal plants are "reducing the carbon intensity of the electric grid," causing electricity to become more environmentally beneficial. Overall, strategic electrification would simultaneously green the grid, increase the sale of electricity, and "link the electric utility model to a clean energy future."[6]

Strategic Electrification and Decarbonization

The major goal of strategic electrification is to identify opportunities provided by new technologies to switch from fossil fuel use to electricity—where it is practical from financial and environmental perspectives. Another goal is "to accelerate long-term market transformation for strategic electrification to displace the use of carbon intensive fuels."[7]

Displacing the use of carbon intensive fuels, or decarbonization, is "the process by which the average amount of carbon in primary energy reduces over a period of time." Green Coast, a non-profit organization whose goal is to connect energy professionals, notes the measures needed to be taken for decarbonization to occur:

- "Reducing the reliance of producing electricity through fossil fuels and adopting clean energy that will decarbonize electricity production
- Ensuring that there is high energy efficiency which in turn helps in reducing the high demand for energy
- Increasing the use of clean energy
- Ensuring that the natural ways of absorbing carbon are active, for example increasing the forest cover."[8]

As these steps are taken, energy production costs and air, water, and soil pollution will all reduce.

According to Carolyn Fortuna, the adoption of a decarbonization strategy that specifically relies on building electrification will ultimately save consumers billions of dollars compared to other carbon reduction strategies. Writing for Clean Technica, Fortuna summarizes three recent white papers written on strategies for building decarbonization. She discusses the rate design for building electrification, noting the complexity but achievability of the process. She claims that by changing long-term building end uses, such as the reliance of heating systems on fossil fuels to clean electricity, decarbonization can occur. Four major design levers that should be taken into account to accomplish this include the following:

- "Adjustable baseline allowances for electrified water heating and other essential home energy uses
- Volumetric rates with meaningful peak to off-peak differentials
- Time differentiated solar export prices
- Seamless compensation for GHG reductions and grid services."[10]

On the whole, building electrification shifts the focus away from conservation and energy use reduction to reducing greenhouse gas emissions. This strategy further promotes the adoption of less carbon-intensive fuels, such as electricity, over oil and propane.

NEEP maintains that in order to achieve long-term decarbonization goals, intensive change must occur in the short-term. For instance, local and state policy changes are needed to assist market development so that barriers to

GLOSSARY

Air-source Heat Pumps (ASHP)—operate by moving heat rather than converting it from fuel; include ductless, ducted, or short-run ducted, split or packaged, and multi-zone or single-zone

Decarbonization—"reduction or removal of carbon dioxide from energy sources"

Green Coast—a non-profit organization whose goal is to connect energy professionals

Green New Deal—New York's response, in part, to the Intergovernmental Panel on Climate Change and the US Global Change Research Project's 4th National Climate Assessment; stipulates 6,000 MW of solar by 2025, 70% renewable electricity by 2030, 9,000 MW of offshore wind by 2035, carbon-free electricity by 2040

Heat Pump Technologies—include ground-source heat pumps (GSHP), air-source heat pumps (ASHP), and commercial ASHP applications with variable refrigerant flow (VRF) technology; these can help achieve decarbonization through strategic electrification; can reduce energy consumption for heating and cooling by as much as 32–40% in a variety of applications and locations

Integrated Energy Efficiency Ratio (IEER) Ratings—allow for different systems to be compared to one another, regardless of the season, as long as the environmental conditions are the same; the higher the IEER rating, the more energy-efficient the system

Northeast Energy Efficiency Partnerships (NEEP)—a non-profit organization dedicated to accelerating energy efficiency in the Northeast and Mid-Atlantic

Strategic Electrification—"powering end uses with electricity instead of fossil fuels in a way that increases energy efficiency and reduces pollution, while lowering costs to customers and society, as part of an integrated approach to deep decarbonization"; sometimes known as beneficial electrification

Variable refrigerant flow (VRF)—used since the 1980s; engineered to use only the precise amount of energy needed to heat or cool a commercial building by dividing a building's interior into zones

VEIC—a non-profit dedicated to reducing the economic and environmental costs of energy use

electrification and new technologies related to electrification can be broken down. Business and economic impacts would also need to be analyzed, and public education would need to occur.[11]

Potential Setbacks

NEEP identifies several potential market barriers to the goals of strategic electrification: awareness, supply chain, economic, technical and infrastructure, and policy and regulatory. A lack of consumer awareness or contractor education; insufficient contractor base, staff training, or competitive supply chain; high upfront costs, inadequate financing and/or return on investment, and capital constraints; low refurbishment rates and inadequate performance data; and fuel switching policies, fossil fuel subsidies, and lack of economy-wide carbon pricing.

To offset these potential barriers, NEEP suggests several strategies, including marketing, outreach, and education; mandates and targets; pricing-based options; and emerging financing and business models. In their white paper, "Rate Design for Beneficial Electrification," authors Cunningham, Ralston, and Wu note that simply providing short-term incentives to encourage electrification will not be enough to sustain long-term change. Instead, they argue that "more dynamic, granular rates and load management will be needed. Advanced grid harmonization rates with active load management can be key to achieving […] long-term GHG reduction goals with the lowest costs possible."

USING HEAT PUMPS TO HELP ACHIEVE DECARBONIZATION THROUGH STRATEGIC ELECTRIFICATION

A geothermal water-source VRF system would save Fairway Independent Mortgage, headquartered in Madison, WI, $0.50–$0.75 per square foot in annual utility costs compared to a traditional hot water VAV rooftop system.

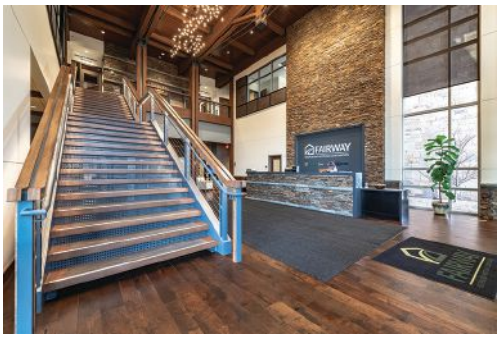
One opportunity to achieve decarbonization through strategic or beneficial electrification in both the commercial and residential buildings sectors is heating. The US Energy Information Administration (EIA) maintains that space heating accounted for 46% of the total consumption of energy in single-family detached homes in 2015, and space and water heating collectively accounted for 62% of household energy consumption in 2015.[13]

The EESI states that in 2015, 36% of households in the US already used electricity as a primary heating fuel versus 10% that used oil or propane. Through the years, the costs of oil and propane have increased, and oil and propane systems also have higher carbon emissions than natural gas. Importantly, "improvements in electric heat pump technology" means that new electric-powered appliances "can heat space and water at efficiencies between 200 and 300 percent, compared with 67 percent for a typical Energy Star gas water heater." The EESI further states that these new appliances are better at operating in colder temperatures, whereas older gas heat pumps are not as effective below 40 degrees Fahrenheit.[14]

NEEP, too, notes that the largest residential energy user is space heating, followed by water heating, and believes that the newest generation of heat pump water heaters (HPWHs) present an opportunity to implement strategic electrification, including through energy and cost savings. NEEP demonstrates that market analysis of the technology shows "that a complete conversion of units 50 gallons and larger from standard electric resistance to energy efficient technology would secure nearly 340 Million kWh in annual electricity savings across the region [Northeast and Mid-Atlantic states], the equivalent of over 41,000 households' annual electricity use. Summer peak demand would be reduced by 30 MW. The 240,000 metric tons of CO2 prevented is equivalent to taking over 50,000 cars off the road for a year."[15]

Heat Pump Technologies

There are multiple heat pump technologies including ground-source heat pumps (GSHP), air-source heat pumps (ASHP), and commercial ASHP applications with variable refrigerant flow (VRF) technology that can help achieve decarbonization through strategic electrification. Marcia Karr, an engineer writing for Washington State University, notes GSHPs "tap a large



Fairway Mortgage selected VRF for its ability to provide an efficient building that maximizes mechanical system performance without compromising architectural design intent.

reservoir of nearly constant-temperature heat (the ground) and they use water as the heat-exchange fluid." She further maintains, however, that new VRF technology "even with air-to-air heat exchangers, can meet or exceed the efficiencies of GSHPs by using multi-speed fans and variable speed compressors" and permits heating and cooling recovery from one zone to another in a building. Amongst numerous other benefits, Karr also states that VRF technology offers "energy savings due to better part-load efficiencies and reducing or eliminating duct losses, when compared to standard air-to-air heat pumps." Overall, Karr concludes that VRF heat pump systems can reduce energy consumption for heating and cooling by as much as 32–40% in a variety of applications and locations.[16] VRF technology will be discussed in greater detail in an upcoming section.

Air-source heat pumps (ASHP), too, are a category of heating and cooling systems that is growing in availability. The US Department of Energy states that ASHPs are capable of delivering "one-and-a-half to three times more heat energy to a home than the electrical energy it consumes." ASHPs operate by moving heat rather than converting it from fuel, which is what a traditional heating system does. Different types of ASHPs include ductless, ducted, or short-run ducted, split or packaged, and multi-zone or single-zone. These systems were, at one time, not intended for use in areas that experienced long periods of subfreezing temperatures; however, newer generations of the technology have enabled its use in a variety of harsh climates.[17]

Heat Pump Market

NEEP notes the downturn in the market for heating and cooling systems in general that occurred in 2005, close to the onset of the housing crash. In 2011, sales, primarily in

cooling systems, began to once again increase. In terms of ASHP installation, NEEP identifies opportunities to transform the residential market by taking advantage of replacement, displacement, and new construction. It defines "replacement" simply as the replacement of old, broken, or existing systems; "displacement" as the addition of a system without removing the old one; and "new construction" as the opportunity to install systems that conform to strategic electrification whether it is because a home does not have access to natural gas, the home is low load, the owners or specifiers are aiming to build a net zero all-electric home with solar electric systems, or they are avoiding meter fees and gas infrastructure costs.[18]

When assessing the market in the Northeast and Mid-Atlantic, NEEP states that in the Northeast, gas is used for space heating in less than half of the homes, and 31% of homes use oil. By contrast, in the Mid-Atlantic region, 58% use gas and only 6% use oil. An additional 12.5% of homes in the Northeast and 25.8% of homes in the Mid-Atlantic use electricity for heating; however, these are primarily electric resistance systems. Heat pumps are only used in 2.3% of Northeast homes and 11.1% of Mid-Atlantic homes.[19] NEEP identifies heat pump candidates as older homes getting an energy retrofit or more energy efficient heating system. Other candidates include homes that currently use electric resistance or oil systems, as a heat pump system would offer increased energy cost savings. The addition of a heat pump could also offer homes without air-conditioning increased comfort in the summer. Comparatively, there is more opportunity to introduce these systems in the Northeast than in the Mid-Atlantic, based on existing systems and costs.[20]

Energy Star estimates that heat pump water heater systems can save a household of four around $350 per year on electric bills and up to $3,750 over the course of the water heater's lifetime. It further claims, "If all residential electric water heaters less than 55 gallons sold in the United States were ENERGY STAR certified HPWHs, the energy cost savings would grow to almost $12 billion each year, and 140 billion pounds of annual greenhouse gas emissions would be prevented, equivalent to the emissions from more than 13 million vehicles."[21]

This article continues on http://go.hw.net/AR112019-3. Go online to read the rest of the CEU course, complete the corresponding quiz for credit, and receive your certificate of completion.

QUIZ

1. NEEP's "long-term shared goal is to assist the [Mid-Atlantic] region to reduce carbon emissions 80% by_____."
   a. 2100 b. 2075
   c. 2050 d. 2025

2. Strategic electrification includes
   a. Switching to an electric car or heating system b. Benefits to the end user
   c. Benefits to the environment d. All of the above

3. The Environmental and Energy Study Institute (EESI) notes several factors that make electrification more viable. These factors include which of the following?
   a. Rapid growth in low-cost, zero-emissions power, and volatility in fossil fuel prices and availability (especially propane and heating oil)
   b. Increasing efficiency and performance of electric-powered appliances and vehicles,
   c. Growing need for electricity load management and emission reduction goals
   d. All of the above

4. NEEP identifies several potential market barriers to the goals of strategic electrification. These barriers include which of the following?
   a. Early adoption, market readiness, and supply chain
   b. Awareness, supply chain, economic, technical and infrastructure, and policy and regulatory
   c. Both A and B
   d. Neither A nor B

5. The US Energy Information Administration (EIA) maintains that space heating accounted for 46% of the total consumption of energy in single-family detached homes in 2015, and space and water heating collectively accounted for _____ of household energy consumption in 2015.
   a. 42% b. 52%
   c. 62% d. 72%

6. New electric-powered appliances "can heat space and water at efficiencies between ____ and ____ percent, compared with 67 percent for a typical Energy Star gas water heater."
   a. 50 and 100 b. 200 and 300
   c. 75 and 150 d. None of the above

7. The largest residential energy user is
   a. Space heating b. Water heating
   c. Lighting d. Refrigerator

8. VRF systems consistently perform at _____ higher efficiency than conventional HVAC systems.
   a. 10% b. 25%
   c. 56% d. 75%

9. Advanced VRF systems can offer substantial heating capacity at minus ____ degrees Fahrenheit.
   a. 5 b. 10
   c. 13 d. 21

10. The Green New Deal calls for _____ clean power by 2040.
    a. 25% b. 50%
    c. 75% d. 100%

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Breadth and Depth

Sarah Whiting is bearing the standard for the Harvard Graduate School of Design at a time of new directions and challenges for the profession.

As the newly appointed dean of the Harvard Graduate School of Design, Sarah Whiting, ASSOC. AIA, will be heavily involved in shaping the next generation of architectural leaders at America's most elite graduate design program. As fall semester was kicking into high gear, we chatted with her about how architectural education is preparing students for practice, and how it can equip future architects in finding design solutions to climate change.

As told to Katherine Flynn

If any generation is experiencing climate change as a reality in their lives, it's the generation that's in school right now. It's a design problem, writ large. It's been naturalized as part of their world view, and I think, as a result, it's been naturalized in the design curriculum.

I think we're moving into a phase where facing climate change, or environmental stewardship, is a way of acknowledging that we can go beyond being responsive and reactive, and be proactive in terms of thinking about how things could change. Landscape and urban planning and [architecture] have to think about climate change—you're not going to design on the water without being aware that a lot of cities on the water are going to lose that land, but you can also think about different materials or different structural possibilities for responding to those conditions. There's an ability to talk at different scales in a way that's productive to all three disciplines.

In terms of the future of practice, there are a series of other electives about practice that have been introduced to the school. The idea that practice is a topic that's an elective, and not a requirement, reflects the field today, but it also reflects students' interest in practice as an intellectual topic, not just an obligation to think about because NAAB [National Architectural Accrediting Board] asks us to.

It also reflects an anxiety that I think has been with students, really, since the economic crisis of 2008, where the vulnerability of the market has made students more nervous about jobs. This generation, not just in our discipline but really across all departments in the university, is anxious about the economy. My generation went to school and figured, "We'll get jobs, we don't have to be career-focused." Students don't feel like that's true anymore. And so partly, I think the school is responding to both intellectual curiosity about new modes of practice and anxiety about what practice is when they finish school.

I think design has always been broad, but I predict its breadth will be more recognized. And so it's our obligation, while that breadth is being well-recognized, to make sure that we also define its depth, because that is for us to define. AIA


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63% of U.S. Architecture Firms Are Not Engaged in International Projects

By Michele Russo

Potential complications from these projects are dissuading firms.

Nearly two-thirds of architecture firms are not practicing internationally, according to firm leaders on AIA's Work-on-the-Boards survey. Of these, 28.5% have no intention to do international work, and while the other 34.7% have no current plans, they might consider it for the right project. Only 10.2% of firm leaders report current projects outside the U.S., while the other 27% either had a recent international project or are planning on international work in the future.

The primary reason that firms will not engage internationally is that they don't want to deal with potential complications from those projects, but others cited they were too busy or that they didn't feel they were qualified. Firms doing international work cite practice diversification as their primary driver.

Source: AIA Work-on-the-Boards Survey, August 2019

AIA Feature

CREDIT: KEITH NEGLEY

Raising the Stakes

Architecture education is facing both great challenges and great opportunities.

By Kim O'Connell

Few moments elicit as much fear and trepidation in architecture school as the studio review or critique—the "crit"—where students' designs are dissected, discussed, and—all too often—demeaned. A 2017 piece in *The Guardian* stated that the architecture crit is often "a nightmare … an emotional and theatrical assault course all architecture students have to get through." Do they, though?

Emotionally draining crits are just one aspect of traditional architecture education currently being pinned to the wall and reviewed. Often, architecture students leave school saddled with huge debts just to enter a profession where the work they are asked to do is far different than what their professors taught, and for far less pay than they might have received in a comparably licensed field such as medicine or law.

As a result, a significant percentage of trained architects leave the profession after a few years or never get licensed. Untold numbers of others, particularly women and people of color, face barriers related to finances, work-life balance, and discrimination that prevent them from entering the profession in the first place. Compounding the problem is the fact that architecture itself faces challenges with regard to competition, automation, and complex environmental issues such as climate change.

AIA and the other collateral architecture organizations (American Institute of Architecture Students, National Architectural Accrediting Board, National Council of Architectural Registration Boards, and Association of Collegiate Schools of Architecture) met in Chicago in July to address a revamp of the accreditation process and a formation of new task forces. What they accomplish in the coming years could have long and wide-ranging impacts on the future of the profession.

Barriers to Entry and Retention

Nate Hudson, AIA, can remember when he first decided to study architecture. He had been a mechanical engineering major at the University of Nevada but had met an inspiring architecture professor at a community college. "There was something captivating about architecture, about doing something in your community that outlives you, and that affects the conditions of mankind," Hudson says. He soon transitioned from university engineering to begin his architecture training at the community college. This eventually led him back to university and to a dual-track career in both teaching and private practice. Founding partner and principal at Reno-based FormGrey studio, Hudson now co-convenes the AIA Strategic Council's working group on architectural education.

But that community-college student pipeline that benefited him is one that is drying up, Hudson says, as undergraduates have felt increasing pressure to attend only large accredited architecture schools. These schools are, of course, more expensive to attend, a self-limiting factor to the economic and demographic diversity of people who choose to attend architecture school.

To Hudson and others working in this arena, there is a fundamental disconnect between what's taught and what's practiced. A design studio in school, they say, is a world apart from a typical day as an entry-level architect plugging away in a cubicle, a small fish in a vast ocean. The academic world is often about individual dreams, whereas practice is more often about collective practicalities. Anecdotal evidence suggests that the chances for a young professional to be successful and profitable as a sole proprietor or small-practice architect are less and less common, so they stay a small fish for a long time as they chip away at student loans. The effects can be demoralizing, squashing talent and contributions from bright and unexpected voices.

"A lot of this has to do with the traditional way we've been educating our students," Hudson says. "I loved the education of architecture, but I think to myself, is it a fantasyland? … If the academy and practice became less siloed and better integrated, we could set students up with the broadest set of tools."

Los Angeles–based designer and educator Peter Zellner agrees. In 2016, Zellner founded the Free School of Architecture as a way to demonstrate out-of-the-box thinking in architectural education. It was essential to Zellner that the collective—which is not a school in any traditional sense, but an opportunity for open discussion and exchange—be tuition-free, to remove the most daunting barrier for many students.

"When we set up the Free School, it wasn't meant to be a replacement for existing institutions," Zellner says. "It was meant to

AIA Feature

CONTINUED

ask some questions in a post-educational environment. I've split my life between teaching, running my own practice, and working in corporate America. I see both the front end of the educational process and the back end where, after graduating, you find sometimes that there isn't a lot of relevance to what is taught and how it applies to the office. I found a lot of my young employees struggling to make sense of what they were taught and what they were being asked to do."

Because the disconnect is sometimes so severe that it is hard to recover from, young professionals might leave the field altogether. Academy and practice are "two different universes—in one you have gravity and the other you don't," Zellner says. "The rule systems are so different and disconnected, the individuals don't understand each other. The student is lost in translation."

As the organization representing students, AIAS is seeing this phenomenon as well. "This organization is about filling the gaps and making sure students are aware of opportunities," says Sarah Curry, ASSOC. AIA, current president of AIAS. "The gaps that I feel exist right now line up with the committees and task forces we've created, such as the Health and Wellness Committee, to make sure students feel emotionally supported."

Curry notes that when architecture school and practice do resemble each other, it's too often not in positive ways. "Late hours, rude crits, and things of that nature—we believe you can still have a great architecture school experience without having to feel so bad," she says. "Those are the toxic behaviors that spill over into firm culture. It is unethical to work outrageous hours without commensurate overtime pay or to be forced to endure workplace harassment. ... Students entering the profession with low expectations and a martyr's mentality can hardly be expected to remain in the field without burning out, much less contribute positively to its advancement and innovation."

Another major lack in the academy, Curry adds, is diversity and inclusion. "We want to move beyond the architecture history seminars that are about the same five dead white architects, which I'm sure everyone can name. Not that they're not relevant, but there are so many more significant people to study as well. We're focusing on highlighting architects of color and other minority architects, and architecture from places we don't often get to hear about."

Curry says that this movement has faced its own criticism, with advocates of the traditional academic approach saying that its challenges (such as the crits) are "character-building." But Curry adds that, overall, practitioners seem positive about building a broader approach to architecture education. "Honestly," Curry adds, "something that happens more frequently, and is almost more dangerous, is where people agree that there are issues, but then there's not a lot of action. They do hear and understand our concerns, but they assume it has nothing to do with them or they don't understand the role they play in perpetuating the culture."

Changing Approaches

Across several fronts, AIA and its partners are changing the narrative around architecture education, raising up new voices and removing barriers to educational success. The Transforming Architectural Education Work Group of the AIA Strategic Council, for example, has been advocating for the creation of a standing committee within AIA to work with schools and other partners to encourage and facilitate a new model of architectural training. At the root of this work is an understanding that future architects have to know more than their predecessors did—about economics, climate science, research, and more—and that their learning should continue throughout their careers.

"The architect has always claimed to be a generalist—but that has expanded exponentially," Hudson says. "We have to know more and more and more things. We have to hold on tight, because change is happening, and it's our responsibility to be quick and agile enough to respond."

One way to increase this agility is the Integrated Path to Architectural Licensure (IPAL), which NCARB created in 2015 to offer an additional pathway for students to move into the field. IPAL allows students to do their internship (Architectural Experience Program) and take the ARE (Architect Registration Examination) concurrently. This interweaves employment opportunities with educational requirements and can jump-start an architecture career, lessening the chance of emotional or financial flameout, advocates say. In 2018, the first architecture students graduated from IPAL programs, and many more are expected to follow.

This year, NAAB overhauled its comprehensive accreditation review process so that it could be more responsive to a changing academic climate. In July, this process culminated in the three-day Accreditation Review Forum 2019 (ARForum19) in Chicago, which brought together the boards of the five collateral organizations to discuss the first draft of the 2020 *Conditions for Accreditation* and 2020 *Procedures for Accreditation*, which are designed to allow for more flexibility, diversity and inclusion, and access to the profession while in school. A subsequent draft is now open for review and comment.

"We scaled back on student criteria, to allow schools to be more innovative in their curricula," says Kevin Flynn, FAIA, current NAAB president. "We also came up with a set of six values that all the collaterals will share." Among these values is an assertion that the education of an architect is a "shared responsibility between academic and practice settings, and is important for the continuous improvement of our field." To this end, Flynn says, he's looking for more sharing and collaboration among the collaterals, so that the traditional wall between school and practice becomes more permeable.

This is an initiative Zellner supports. "One of the things we're seeing now is we have an enormous brain drain in the profession as boomers retire," he says. "I think there would be an opportunity there for continuing education. If you could connect millennials to boomers, architects on both ends would be positively engaged. As an older generation mentors a younger one with the ins and outs of practice, young architects could help retrain older architects in new technologies."

Flynn adds that NAAB has convened a task force looking at both two- and four-year architecture programs to increase support for things like credit transferability, which is often limited and disheartening for students looking to make the leap to a university program. "We see the junior colleges as the way to be a pipeline of talent and reduce the cost and timeframe of education," Flynn says.

Because of new technology and an opportunity to effect change in an increasingly globalized society, the AIAS's Curry still believes that architecture is an essential profession, and that the academy is poised to have an ever-greater toolbox with which to encourage people to enter it.

"The built environments we orbit and inhabit have the power to govern us as much as laws do," she says. "An education in architecture unlocks that power, even if we don't always focus on the corresponding responsibility. When we are not given fish, but taught how to fish, we can apply that critical thinking for the better—and those who make the most of this enabling education are unstoppable." AIA

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Reclaiming Space, Renewing a Community

In Oklahoma City, local leaders come together to build Eastside's future.

By Kathleen M. O'Donnell

CREDIT: HANA WAUGH

Local activist and rapper Jabee Williams (left) and Jeremy Gardner (right) of Gardner Architects teamed up to revitalize the city's Eastside.

Like the residents of many other one-time social and economic centers of African American life, the residents of Oklahoma City's Eastside experienced redlining and segregation throughout the 20th century. In 2016, community members including local developer Sandino L. Thompson and activist and rapper Jabee Williams set out to reignite interest in the historically marginalized part of town. Their idea was to bring business back to the Eastside.

Soon, Pivot Project, an Oklahoma City development company with a socially driven mission, and design firm Gardner Architects were on board. The Gardner and Pivot teams, previous collaborators on challenging projects throughout the city, joined a real estate broker on a car ride through the Eastside, looking for just the right site for a new commercial and social hub. Together with community leaders, they selected an abandoned strip mall on Northeast 23rd Street for what would ultimately become the EastPoint Project.

"What's been interesting is that whole evolution of the idea has really stuck," says Jeremy Gardner, AIA, principal at Gardner Architects, about the dedication the community has shown throughout the process. Early in the project, developers and entrepreneurs drummed up enough excitement to get the city government involved "just by sheer will." He adds, "I'm most proud of the fact that [this project] didn't die on paper."

Interest from potential tenants—including retail entrepreneurs, restaurateurs, and doctors—was strong from the outset, but Gardner explains there were some hurdles along the way. "A lot of the [initial design] solutions were geared towards those particular businesses," he says. "But given the duration of how long this project took to get funding, [get] financed, [get] city approvals—some of those tenants moved on." Thompson, Williams, and Pivot's Jonathan Dodson sought investors and worked to gain buy-in from other stakeholders in the neighborhood, an effort that paid off as the Gardner team got to work.

Envisioning a structure that could accommodate current tenants but would be flexible and versatile enough to adapt to changing needs was a priority for Hana Waugh, ASSOC. AIA, the lead project manager and designer from Gardner. "One thing I've heard some of the community's members hope for with this development is that it would be a springboard," she says. "So, maybe it's the first space that these tenants are able to [occupy] because it's an economical option. And then in the future, they're able to move onto bigger and better things."

With the expertise of Lingo Construction to execute their vision, Gardner pushed through a series of design challenges. "Different veneers and different uses have cannibalized a lot of the structure over time," he says. Gutting and overhauling a strip mall that had such little attention paid to it over the years was a massive undertaking, but one that made room for unique opportunities. The centerpiece of the renewed block of commercial units is a covered breezeway, designed to promote connectivity between a back parking area and the retail fronts.

Gardner is excited that the breezeway will provide various retail opportunities, as well as some social cohesion for tenants. "It allowed us to incorporate even more types of entrepreneurs," he says. "You can get a 500-square-foot tenant and you could get a 3,000-square-foot tenant." After nearly three years of design and construction, those tenants are finally moving in and setting up shop.

Waugh and her colleagues at Gardner, as well as her husband, filmmaker Weston Waugh, recognized they had a story that was worth sharing with a mass audience earlier this year. They entered—and went on to win—the 2019 AIA Film Challenge. Their short film, named *The EastPoint Project*, brings the Northeast 23rd Street development into focus, featuring interviews with Ward 7 city council member Nikki Nice, Gardner, Dodson, Williams, and Thompson, who discuss the project's process, outcomes, and what it represents.

The EastPoint Project is a standard for equitable development that Pivot Project and Gardner Architects hope will continue in Oklahoma City. "We're hoping that this project is a catalyst," Waugh says. "I'm really proud to be a part of something that could be the first of many improvements in a community that will really feel an impact."

The message of grand prize–winning short documentary *The EastPoint Project* is clear and simple: Invest in your community and great things will come. "In addition to bringing in wealth and getting folks to invest where there's really been a lot of disinvestment," says Thompson in the film, "we're also creating opportunities for people who exist, who are here, to be able to persist and be able to sustain themselves." AIA

AIAFuture

CREDIT: RACHEL KAPISAK JONES

Design for a New Generation

Linda Keane thinks that design education with a sustainability bent should be available to every K–12 student.

By Steve Cimino

Linda Keane, AIA, is the co-founder of an architecture studio, an academic who specializes in architecture and environmental design, and a passionate advocate for design education. Her interests collided with the creation of the award-winning education website NEXT.cc, which offers free design learning opportunities for K–12 students, teachers, and families.

Keane and her husband and partner Mark Keane launched the site 11 years ago, and it is now used in 50 states and the District of Columbia and more than 200 countries. Along the way, it's been recognized by the Association of Collegiate Schools of Architecture, American Architectural Foundation, International Union of Architects, and U.S. Green Building Council, which only further inspires Keane's quest to offer design education to children everywhere.

What led to your personal focus on bringing design into K–12 education?

A few things came into play. One, we had children. As they went through public schools, we realized that the idea of creativity—specifically, the way architects and designers practice, cutting across different fields of knowledge—wasn't being taught. Design thinking of that sort wasn't usually offered until college.

I was the founding chair of the architecture program at the School of the Art Institute of Chicago, and curious about design education around the world. We discovered that many other countries do in fact have design programs for children. In the U.S., there were only about 12 high schools with design in the curriculum. That's a very small number when you think of all the schools in this country.

At the same time, we were hosting design workshops for inner-city kids and elementary career programs in architecture, interior architecture, urbanism, and landscape design. We'd gather everyone, have a blast, and then realize we'd never see them again. So we said, "Let's make a website." We could build it and it would be there, 24/7, for anyone who had curiosity and wanted to explore human intention.

In addition, one of our children developed early infantile autism. Working with her, we realized that the digital world presents a huge boost to many children's learning. That's impacted NEXT.cc's "priming and extending" educational approach as well.

How have children responded to the subject matter and your approach?

The kids love it. It changes how they think about collaboration; they learn that ideas aren't something to privatize but to share. Good ideas belong to the whole world. It's important to support kids asking questions and having ideas, testing them out, and learning from other people's successes as well.

That's another thing we emphasize: imagination isn't limited to certain ages, incomes, races, ethnicities, or creeds. It just needs time and space to gestate. Once you turn that switch on, it doesn't turn off.

We often work with middle-school students who don't have access to art or music classes. They are sometimes a little slower to get involved in the beginning, but then everyone is suddenly drawing and modeling. Creativity is a common denominator.

AIAFuture

CONTINUED

How does this all fit with your desire to "green public imagination"?

Greening imagination is a systemic process that needs nurturing in K–12 classes and communities. The best hope for learning to live in more sustainable ways lies in new ways of learning about human ecology and the environment across the curriculum. The experience of the natural world, learning how nature sustains life, nurturing healthy communities, recognizing the implications of the ways we provide for ourselves, and knowing well the places where we live, work, learn, and play are all essential to becoming eco-literate. I have an undergraduate degree in environmental design and studied in England with a landscape architect. Architecture—and whatever [architects] create—is part of larger earth, air, water, and energy systems. That's ancient knowledge, but in the pandemonium of being able to make new things with new materials, sometimes it's forgotten.

NEXT.cc shares the understanding of E.O. Wilson's Consilience [theory] that everything connects. For instance, students learn about the water cycle in school but very few get to meet and understand scientists who try to [mitigate] plastic in the ocean, or entrepreneurs who invent new products to assist water purification and collection in third-world countries. Nor do they have the chance to grasp the social justice implications of water, how it is filtered by nature, how we've conscripted it, and what about that process needs to be improved.

NEXT.cc presents a gentle exploration of the complexities of the world, encouraging human imagination to contribute to ideas to improve life. Together we can look at how things work, and how humans have responded over time, and how we might better respond for the future.

What are your hopes and dreams for NEXT.cc, now and in the future?

Our long-term goal is that architecture and STEAM (Science, Technology, Engineering, Architecture, Math) activities are shared in every K–12 school in America. It doesn't have to happen in a club or in the art department; architecture as a subject can be introduced through science, math, engineering, and health and well-being. The built environment has a place in all K–12 subjects.

More than anything, we work to see a reluctant sixth grader with a bit of boredom who is hesitant to get started, and then 10 minutes later comes up and excitedly asks, "Can I make a second design?" AIA

AIAPerspective

CREDIT: GREG POWERS

Shaping the 21st-Century Architect

The system that creates tomorrow's architects needs to evolve to fit a changing world.

Becoming an architect is one of my proudest accomplishments. My path from undergraduate to licensure to practicing professional is central to the person I am today, and I cherish the experience.

Put simply, being an architect is a defining characteristic of who I am. However, as I look at the changes in society since I became an architect, it is clear to me that the system that creates tomorrow's architects has to evolve to meet the challenges of the 21st century.

Today, the education of an architect requires the development of a growing list of technical skills. Of the sheer volume of information that future architects will have to incorporate into design thinking, perhaps topping the list is climate science. Helping society mitigate and adapt to a changing climate will demand a shift in how we train future architects, as well as how we practice and where, and when we apply our design thinking skills.

I am pleased that in a variety of ways, AIA and its collateral organizations are working together to change the process behind how someone becomes an architect. The overarching goal is to remove the remaining barriers that still obstruct success and stifle the voices of far too many underrepresented groups.

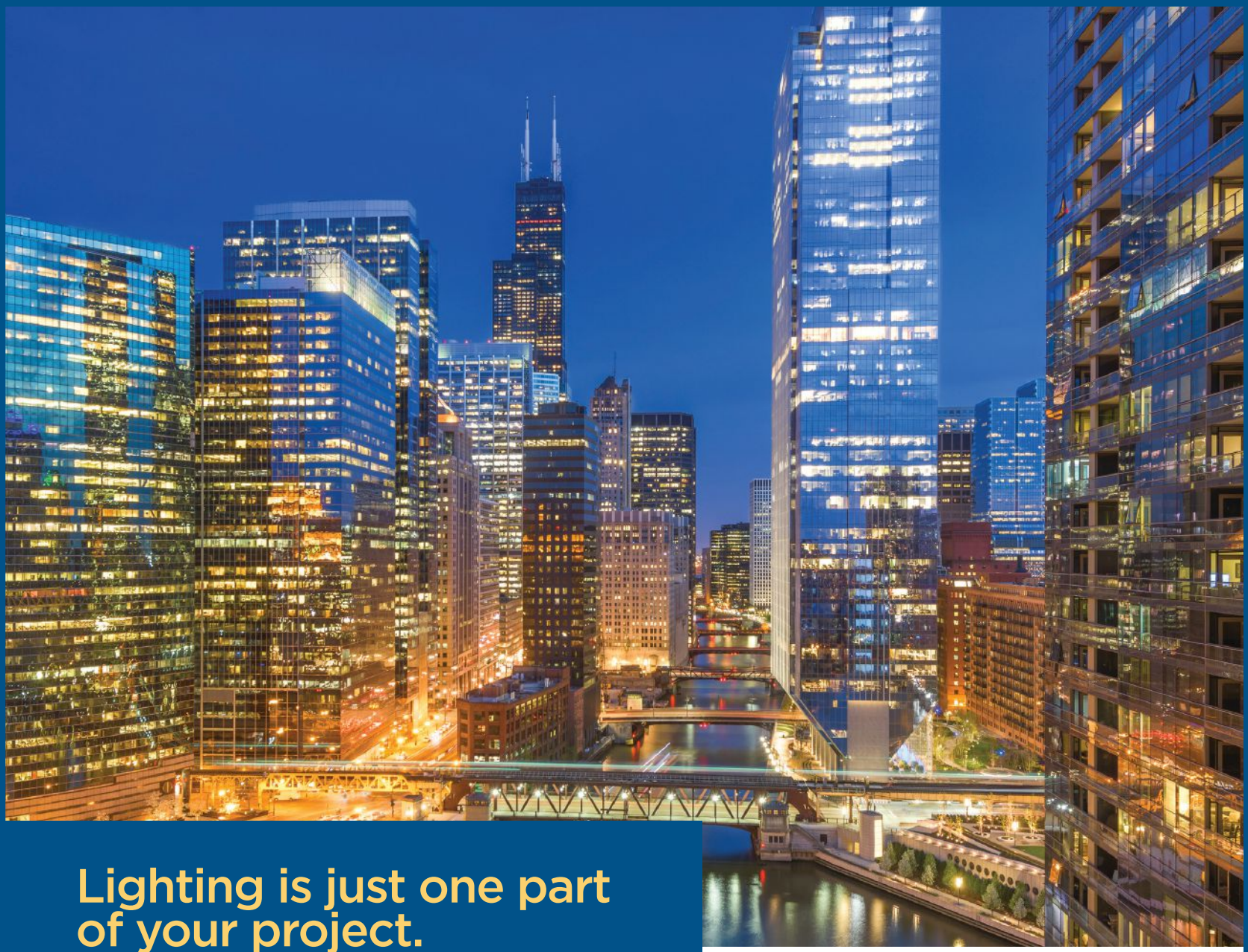
To that end, a few months ago, the leadership of AIA, NCARB, AIAS, ACSA, and NAAB met to discuss ways to work together, and to seize this once-in-a-generation opportunity to modernize our profession. Broadly, our discussions focused on how to adapt to rapid and profound environmental, social, demographic, and economic change. Ideas such as shortening the time it takes to get an architecture degree and focusing the scope of licensure to health, safety, and welfare were discussed. For many, these ideas are controversial today. But that doesn't alter the fact that change will continue, whether we like it or not, which makes modernizing the process of becoming an architect inevitable.

Additionally, the Transforming Architectural Education Working Group of the AIA Strategic Council continues to advocate for the creation of a standing committee within AIA to work with schools and other partners to oversee and implement updates to architecture curricula that address the needs of a rapidly changing society and talent pool.

Change is needed not because the current system is broken, but because the society we serve is vastly different from that of just a few years ago. If we want 21st-century architects to remain at the forefront of creating a more equitable, compassionate, and environmentally responsible built world—and, by extension, society—we need to synthesize a new approach to how someone becomes an architect.

More than two-and-half millennia ago, the Greek philosopher Heraclitus observed, "Everything changes, and nothing stands still." To lead in the future, we must start to change how the profession educates, employs, and rewards, because society isn't standing still. The system we use to create an architect can't either. AIA

William Bates, FAIA, 2019 AIA President



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“The combined effect of the two shows was to make me think that the best way to tell architectural stories is in situ, in the places where architecture happens.”

The Detroit and Chicago Biennials Go Big by Karrie Jacobs

From the start, this year's Chicago Biennial aspired to be different. Yesomi Umolu, the director and curator at the University of Chicago's Logan Center for the Arts, was named the biennial's artistic director—a clear departure from the festival's two previous editions, which were organized by curators closer to the mainstream of architectural theory and practice. Umolu, born in Nigeria and educated in the United Kingdom, began her professional life as an architect, but she found her calling as fine arts curator; she has often been described as a visionary.

Umolu selected Sepake Angiama—a curator based in Europe who has worked on major exhibitions such as "Documenta 14" (held in Kassel, Germany, and Athens, Greece) and St. Petersburg, Russia's "Manifesta 10"—as well as Paulo Tavares, an architect and professor based in Brasilia, Brazil, to join her team. She says they "didn't come into this biennial thinking, 'Hey here's the concept,' or 'Here is what we think about architecture.'" Rather, they had a series of open-ended conversations in cities such as Vancouver, British Columbia; São Paulo; Johannesburg, South Africa; and Chicago, "about what you might term urgencies within architecture and the built environment." So it was no surprise that the exhibition's title "… And Other Such Stories," was at once expansive and vague.

That same expansive spirit seems to have informed another biennial exhibition, one that hasn't gotten as much attention as Chicago's: "Detroit Design 139: Inclusive Futures." The exposition, which ran until Sept. 30 in the Motor City, was mounted by a collective including Bedrock, the development arm of Quicken Loans, the company that has redeveloped much of the city's downtown, as well as the Detroit city government and Design Core, an organization that supports "design-driven" businesses and oversees the city's status as a UNESCO-designated City of Design. The 139 in the title refers to the size of the city in square miles, an indication that the exhibition aimed to cover the entire city and not just the thriving downtown area. Taken together, these two exhibitions pose more questions than they answer about the role architecture plays in society, about how the physical transformations brought about by new architectural thinking affect economic, political, and environmental realities.

A Different Animal

The central exhibition of the Chicago Biennial, which runs through Jan. 5, is staged near Millennium Park in the Chicago Cultural Center, a big hunk of Beaux Arts swagger that was originally built as the city's first public library and boasts the world's largest Tiffany dome. It proved to be a sometimes enthralling, sometimes befuddling, and occasionally maddening experience. The first thing I encountered was something called "How Together," which its creators, Berlin-based ConstructLab, describe as an "agora" that "explores gathering as a political act." When I visited on a sleepy Thursday afternoon, no one was gathering on the crude, colorful tiered seating, made from 2x4s and a miscellany of cushioning materials. But the installation made it clear that this was not a conventional exposition of architecture, all renderings and models, or even the kind of show (increasingly common) in which architecture is positioned as a force for social good. This was an altogether different animal.

The "How Together" display at the Chicago Biennial

But what kind of animal, exactly? Subsequent galleries sometimes revealed displays of great aesthetic ingenuity, but also staggering informational density. Consider the installation by Santiago, Chile–based architectural theorists Alejandra Celedón and Nicolás Stutzin that was intended to probe the connection between land speculation in their hometown and the free-market philosophy espoused by economists from the University of Chicago. A lengthy disquisition on the impact that philosophy had on Santiago's urban layout was printed on piles of poster-like pamphlets. But the most compelling thing in the room was a plywood structure, about the size and shape of a dumpster—it was supposed to make the gallery look like a construction site—with mirrored interior walls and, projected on its floor, a film of Santiago shot from the air. An accompanying voice-over, I later learned, explained how "financial, legal, and social forces" transformed the city during Augusto Pinochet's regime, but it was borderline inaudible. So I just took pleasure in the bird's-eye view of cityscape made infinite by the surrounding mirrors.

And so it went, for much of the exhibition; there were moments where the information on the walls of the gallery was so abundant that it was off-putting. A Brazilian activist group called MSTC, for example, filled a gallery with stories of a highly organized

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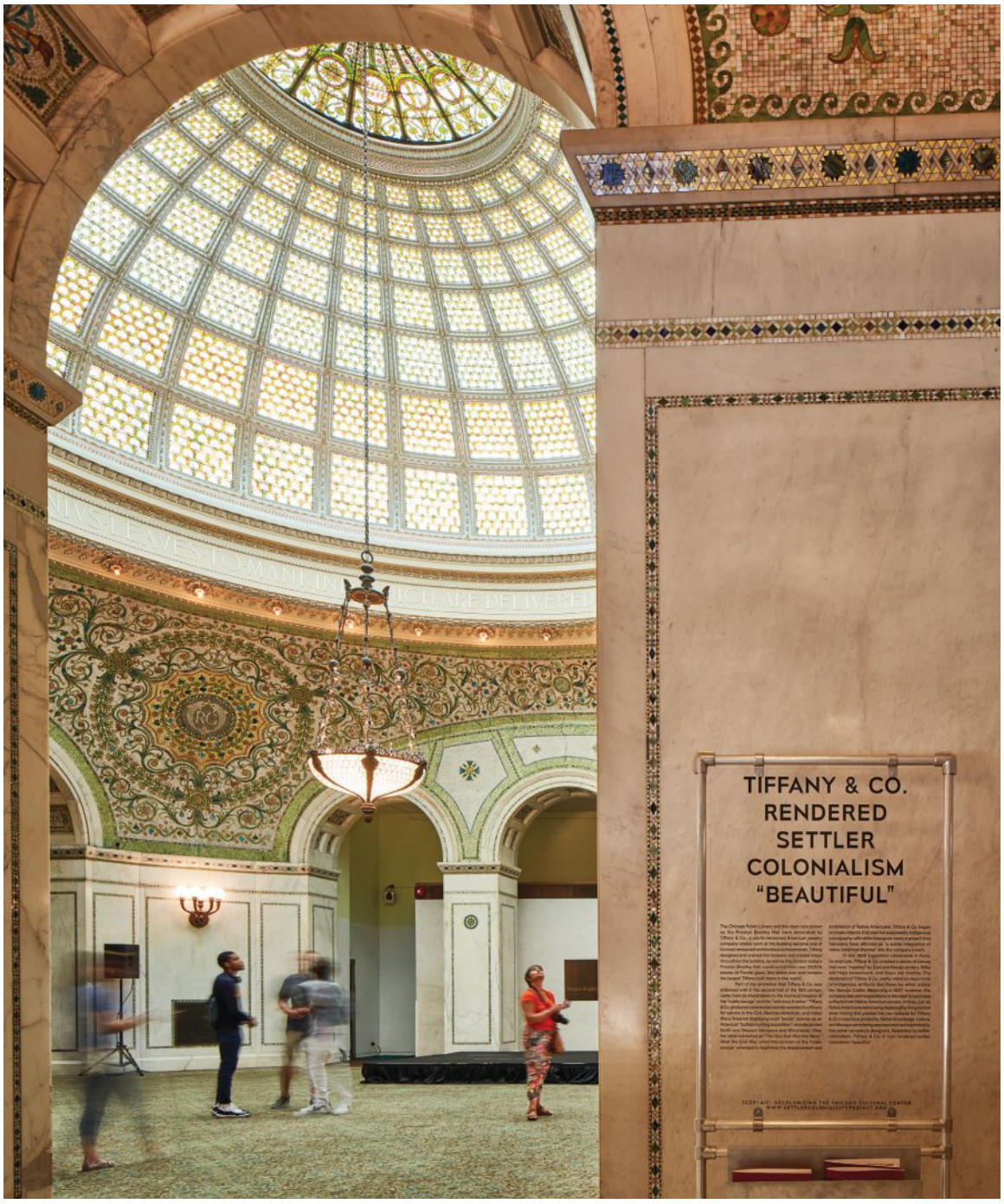

The Tiffany dome in the Chicago Cultural Center, with wall text from the Settler Colonial City Project

strategy of squatting—namely, housing people in São Paulo's many unoccupied downtown buildings. They laid out the history of this endeavor on a massive three-tiered timeline tracing the city's urbanization, shifting political landscape, and social movements from the mid-19th century to the present. The coursework from an entire semester appeared to have been mounted on the gallery wall. As Umolu later told me, the curators didn't try to presuppose the nature of the biennial's audience "or their capacity to digest information." Indeed they did not; some editing would have been nice.

Other portions of the exhibition were much more visceral: Watching London-based artist Do Ho Suh's film of Alison and Peter Smithson's now-demolished Robin Hood Gardens apartment complex in London,

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in which the camera appears to float between floors and through walls, gave me a voyeuristic thrill. I was fascinated by a massive high-resolution photo mural by Chicago artist Maria Gaspar, which essentially re-creates one wall of the Cook County Jail. I had mixed emotions about a running series of signs throughout the exhibition by a group called the Settler Colonial City Project, which highlighted how land and resources were stolen from the region's Native Americans—I felt more badgered than enlightened—but I couldn't help but be moved by the words arrayed across the tall east-facing windows of a fourth-floor gallery: "YOU ARE LOOKING AT UNCEDED LAND." Nearby wall text tells the story of how the Odawa, Ojibwe, and Potawatomi lost their land in an 1833 treaty and, in the wake of the Chicago Fire of 1871, unsuccessfully attempted to regain a foothold in the neighborhood.

There are some banner moments for architecture proper, including a life-size floor plan of a 507-square-foot affordable housing prototype intended for a family of five in São Paulo. The concept—that the display itself matches the exact footprint of the apartment in question—was unusually direct and lucid. But architecture is not the hero of this biennial. Rather, the architectural toolkit is portrayed as a defensive weapon that, at best, can be deployed to subvert the mistakes of a previous generation of architects. Primarily, this is a show about a world where best intentions go awry or worst intentions prevail, where sewage, garbage, fossil fuels, and mining waste overwhelm the systems designed to contain them … if those systems exist at all. Which is to say, it's an unvarnished look at our current moment, not the sanitized version often depicted in architectural discourse.

The most compelling experiences I had in Chicago were visiting sites of systematic failure. For instance, I traveled to the city's west side to the future home of the National Public Housing Museum. The museum will someday take up residence in the last remaining fragment of the Jane Addams Homes, a 1938 public housing project that shared an oversized block with

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three other now-demolished projects collectively known as the ABLA Homes.

I found the future museum, a three-story brick building, its windows boarded up, sitting at the edge of yet another superblock that was otherwise vacant. The biennial exhibition located there, a sound installation by a Johannesburg-based collective called Keleketla! Library, was turned off in anticipation of a rainstorm, but I met the museum's oral historian, Shakira Johnson, sitting at a table outside. She explained that mixed-use housing was supposed to be built here, but never was. It slowly dawned on me that this was the site of a 2001 design competition sponsored by the Chicago Housing Authority. The winning proposal, by Boston-based Brian Healy Architects, called for 25,000 units of densely configured low-rise housing built to painstaking specifications, a rebuke to the "depressing masses that turned their backs on the street as well as to each other," as the firm described the project on its website. At the time, I thought the idea was world-changing. But the project was upended by the 2008 recession, and today there's nothing but grass.

The local design cognoscenti had told me there was one thing I shouldn't miss: the Anthony Overton Elementary School, located in the south Chicago neighborhood of Bronzeville. Designed by Perkins and Will and completed in 1962, it was closed in 2013, one of 50 schools shuttered for budgetary reasons across the city. The National Trust for Historic Preservation has deemed it "locally significant" because its design "represents a modern and progressive approach to education reform." Built to serve the children of the Robert Taylor Homes (demolished in 2007), the school once represented the optimism of its moment.

Now it's owned by a community development organization and, for the biennial, was the site for a series of projects involving neighborhood kids developed by practices from Istanbul; Bucharest, Romania; and a local group, Borderless Studio, that works to reanimate closed schools. The main attraction at Overton was a sound installation by Zorka Wollny, a Polish artist who divides her time between Kraków and Berlin. She recorded the voices of children talking, arguing, and playing, and piped those sounds into the school's darkened hallways using a funky-looking network of speakers and cables. The effect was uncanny, like a haunted house, and inside the shuttered school it seemed like a complete disavowal of the idea that architecture can change the world.

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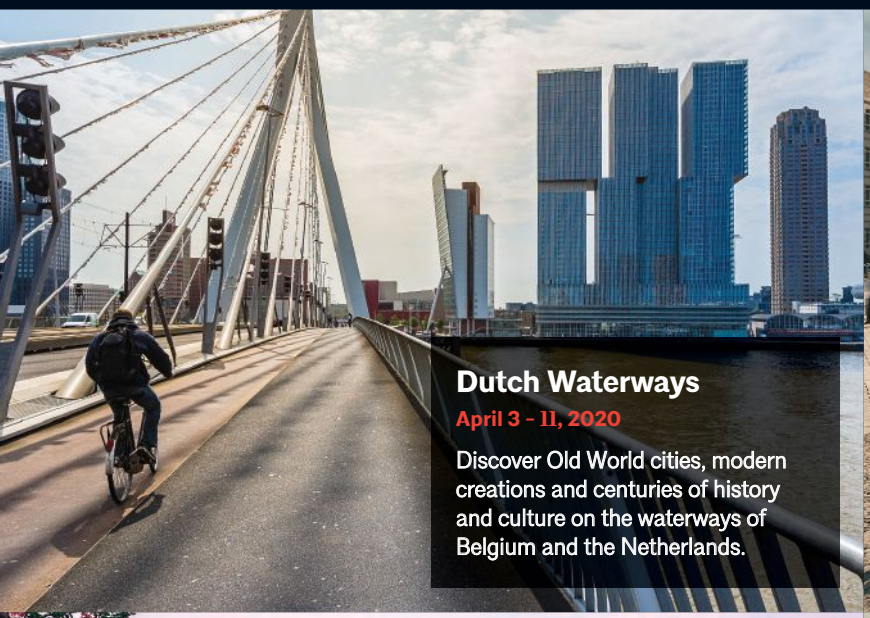

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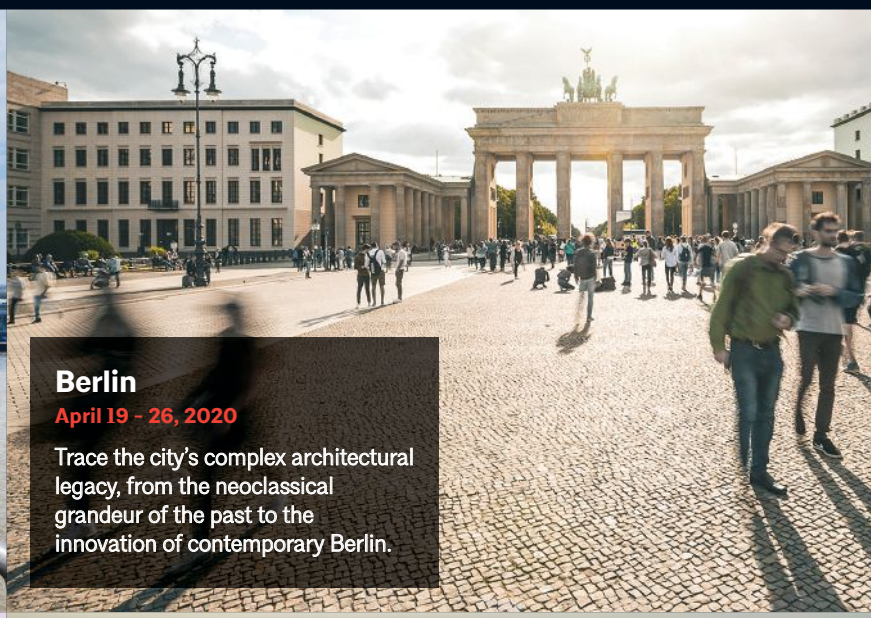

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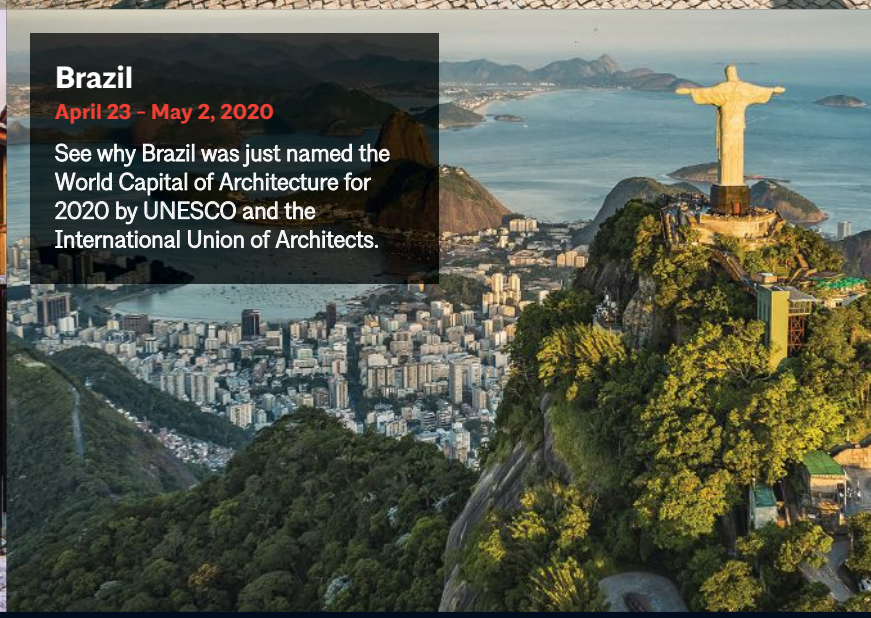

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A New City Emerging

The second edition of "Detroit Design 139" (the first was in 2017), represents a significant improvement over the last architecture exhibition that I saw Detroit, which was back in 2012. That one, a modest grassroots precursor to the current show, was hung in a former Cadillac showroom now owned by Wayne State University. Local firms had displayed a lot of ambitious projects, but all of them were planned or conceptual, rather than built. In this exhibition, many of the 70 projects on display were already constructed or had completion dates—everything from a luxury hotel to a major new waterfront park, from a day care center to an addition (for tile production) to a historic pottery

"Detroit Design 139" exhibits on display at 1001 Woodward

firm, and all sorts of mixed-use developments. Most of the exhibition was in the form of tightly formatted posters, with renderings, diagrams, and one repeated refrain: How is this project inclusive?

While the primary exhibition was on the ground floor of 1001 Woodward, one of many downtown office buildings owned by Bedrock, there were three satellite exhibitions in outlying neighborhoods—Fitzgerald, Old Redford, and Morningside—areas that the city has been making a significant effort to revive. Each had a smaller assortment of the same projects that were on display downtown, chosen for their relevance to the area. I visited the Fitzgerald satellite, housed in Neighborhood HomeBase, an old storefront repurposed as a center for "community gathering, design, and engagement," which itself was one of the projects on display. On the day I visited, the storefront was tended by a neighborhood resident, Stephanie Harbin, who explained that she's the facility's "space ambassador," meaning if you need to book a room for a community gathering, she's there to help.

COURTESY DETROIT DESIGN 139

Ella Fitzgerald Park, designed on a series of vacant lots

Harbin was less interested in talking about the exhibition than about some of the recent changes in the neighborhood, like the conversion of a series of lots, left vacant when abandoned houses were demolished, into Ella Fitzgerald Park. The park is a modest affair, with playgrounds, a basketball court, and an abstract mural in the adjacent street, to help slow traffic. It's one component of a larger plan designed by landscape architects Spackman Mossop Michaels (based in Detroit, New Orleans, and Sydney, Australia) in which abandoned houses are restored and vacant lots are transformed into wildflower meadows; a greenway will soon wend its way through former backyards. The project, featured in the festival, is one of many conceived under Detroit's innovative director of Planning and Development, Maurice Cox, who recently was lured away to become the commissioner of the same department in Chicago. Harbin was clearly pleased to play a role in her neighborhood's revival. "I hope it keeps on rolling," she told me.

Whether I was downtown or in one of the outlying neighborhoods, seeing the transformations large and small was far more gratifying than eyeing them on a gallery wall. What I really wanted was "Detroit 139" available in guidebook form, so I could spend a day touring, seeing a new city begin to emerge.

In both Detroit and Chicago, my most powerful experiences happened far from the main exhibitions. The combined effect of the two shows was to make me think that the best way to tell architectural stories is in situ, in the places where architecture happens (or fails to happen). By the end of my trip, I wound up with a variation of the 1960s maxim in my head: If you're not part of the solution, you're part of the problem. In "Detroit 139," if you buy the message of inclusiveness, then architecture can help solve the city's problems. At the Chicago Biennial, meanwhile, the problems seemed more intractable and solutions harder to come by. The lesson—one I'm guessing was intended by the curators in Chicago but not the organizers in Detroit—is that architecture is only as good as the society that makes it. It's only as transformational as we allow it to be.

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TEXT BY ELIZABETH EVITTS DICKINSON
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Lake | Flato
is
BEST
IN SHOW

2018 was a banner year for Lake|Flato Architects. The 108-person firm, based in San Antonio and Austin, won a COTE Top Ten Award for the Georgia Tech Krone Engineered Biosystems Building (see page 114 for this year's COTE winners) and an AIA/ALA Library Building Award for the Austin Central Library. Founders Ted Flato, FAIA, and David Lake, FAIA, also received the O'Neil Ford Medal for Design Achievement from the Texas Society of Architects. That award recognized the firm's 35 years of bringing regionally sensitive Modernism and sustainable design to the state, and it felt particularly poignant given that the architects first met at Ford's firm before starting their own studio in 1984. "He was our mentor and he taught us well," Lake says. From the start, "our principle passion has been to merge the built environment with the natural environment, and the contextual and cultural environments as well."

Opposite, Top Row:
Partners Greg Papay, FAIA, Matt Morris, FAIA, Andrew Herdeg, FAIA, and Bob Harris, FAIA
Opposite, Bottom Row:
Partners David Lake, FAIA, and Ted Flato, FAIA

Associate Partners Jonathan Smith, AIA, Todd Wascher, AIA, JoBeth Thomas, Brandi Rickels, AIA, Steve Raike, AIA, and Ryan Jones, AIA

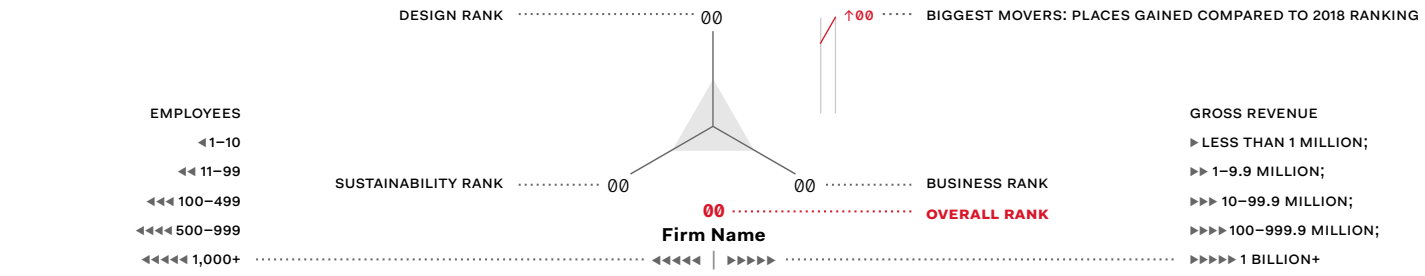
Associate Partners Joseph Benjamin, AIA, Robert Trinidad, Tenna Florian, AIA, Matt Wallace, AIA, and Bill Aylor, AIA

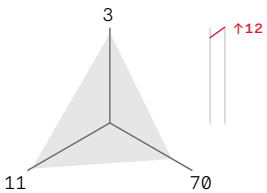
All of which helps explain how Lake|Flato claimed the Number One spot overall in this year's ARCHITECT 50. The firm especially excelled in the sustainability and design categories. "Gorgeous projects, inflected by a western U.S. regionalism," the design judges wrote about the firm's portfolio. "Each feels rooted in its place." That sensitivity to place also impressed the sustainability judges, particularly in regard to the Marine Education Center at the Gulf Coast Research Laboratory, completed last year. Located along the Mississippi coast, the center's previous buildings were destroyed by Hurricane Katrina, and the site was hit again in 2017 by Hurricane Nate. The design team spent months consulting with biologists and site ecologists to find the location least damaging to nature yet most protected from natural disaster. The judges lauded the "ecologically sensitive scheme that considered the holistic impact of the project upon place." The center is expected to consume 46% less energy than the national average for a similar collection of buildings.

Lake|Flato projects begin with an integrated design charrette that includes owners and users, as well as interested participants and citizens. "We set metrics for building performance, building resiliency, and regenerative principles at the start, and it creates goal posts for us to aspire to in the design," Lake says. "We listen to the potential users. We listen to the land. We really want the best ideas and we have been incredibly fortunate to have owners who share our aspirations."

That relationship with owners cultivates a rare commitment to post-occupancy work. Lake|Flato has signed on to the AIA 2030 Commitment, and "the only way to confirm that our buildings are meeting that high bar is post-occupancy," Lake says. The firm maintains a residential energy monitoring program that tracks performance of its projects, and it coaches occupants on how to best use their buildings after handing over the keys.

The firm's founders credit their outstanding year in part to a healthy studio culture, supported by strong employee benefits and reflected by the low employee turnover in 2018 of just 4%. Today, Lake and Flato continue to take cues from O'Neil Ford. "What I'm loving is mentoring the future leaders and partners of this studio, who are incredibly talented," Lake says. "We get great joy in watching them progress and evolve."





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Lake|Flato Architects
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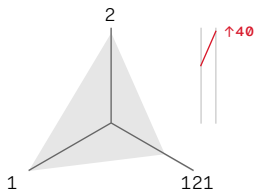

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BNIM
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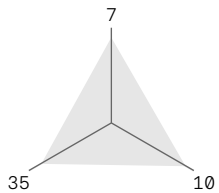

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Hastings
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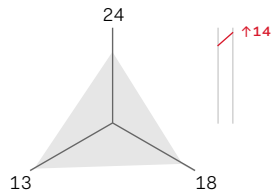

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Adrian Smith + Gordon Gill Architecture
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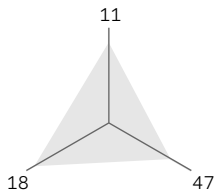

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Skidmore, Owings & Merrill
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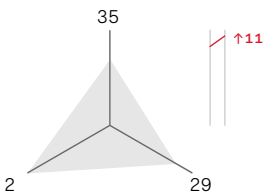

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The Miller Hull Partnership
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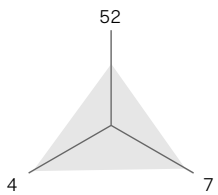

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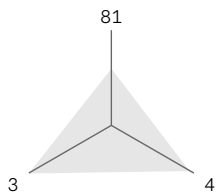

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WRNS Studio
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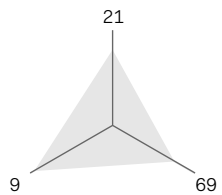

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Perkins and Will
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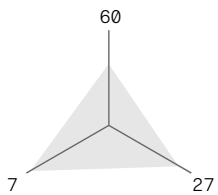

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Touloukian Touloukian
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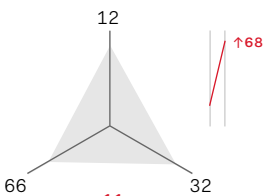

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Olson Kundig
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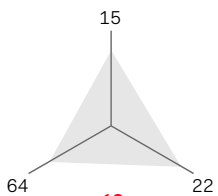

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Gensler
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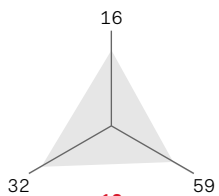

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LMN Architects
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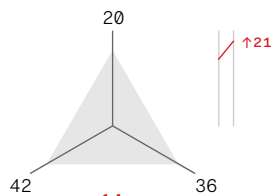

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Leers Weinzapfel Associates
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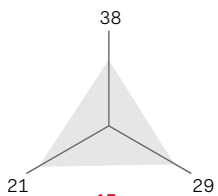

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ZGF Architects
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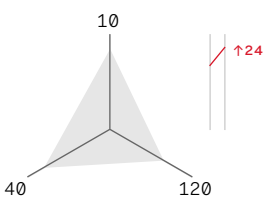

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Eskew+Dumez+Ripple
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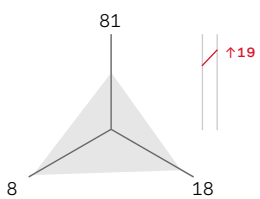

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Bruner/Cott & Associates
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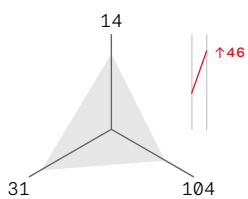

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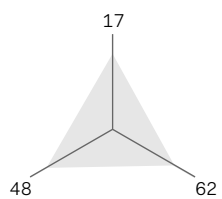

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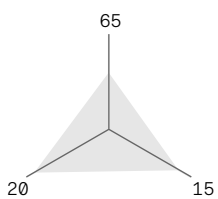

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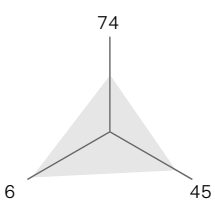

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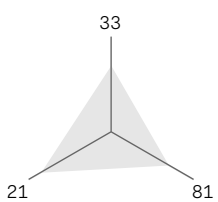

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DLR Group
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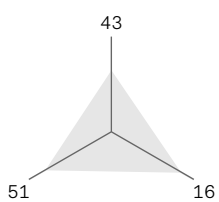

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Steinberg Hart
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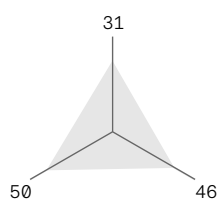

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HGA Architects and Engineers
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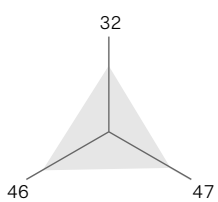
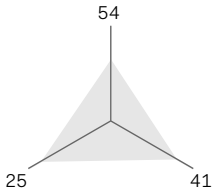


25
Payette
◂◂◂ | ▸▸▸

BIGGEST MOVERS IN % WOMEN DESIGNERS	2017	2018	% CHANGE
EwingCole	20.0	45.0	100+
Adrian Smith + Gordon Gill Architecture	30.0	42.0	40.0
RATIO Architects	27.3	35.2	28.8
WRNS Studio	34.0	43.0	26.5
Solomon Cordwell Buenz	32.0	40.0	25.0
Shepley Bulfinch	48.0	59.0	22.9
Ballinger	32.0	39.0	21.9
Opsis Architecture	39.0	46.0	17.9
SmithGroup	39.0	45.3	16.2
CO Architects	40.0	46.0	15.0

BIGGEST MOVERS IN % MINORITY DESIGNERS	2017	2018	% CHANGE
Hastings	2.0	8.4	100+
The S/L/A/M Collaborative	7.0	12.0	71.4
LMN Architects	15.0	25.0	66.7
SRG Partnership	9.0	15.0	66.7
BNIM	7.5	12.0	60.0
BAR Architects	22.0	35.0	59.1
MSR Design	6.5	9.3	43.1
Hord Coplan Macht	14.8	21.0	41.9
Shepley Bulfinch	20.0	27.0	35.0
GGLO	18.0	23.5	30.6



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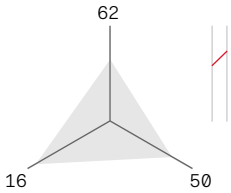

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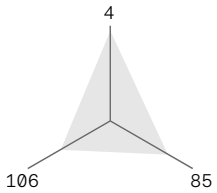

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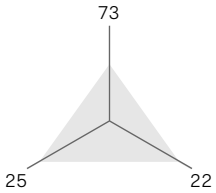
MASS Design Group



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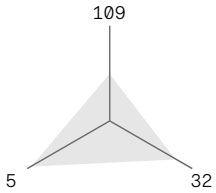

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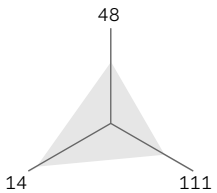

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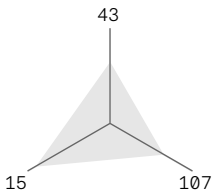

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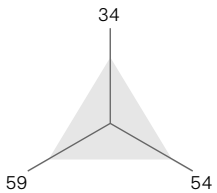
SRG Partnership



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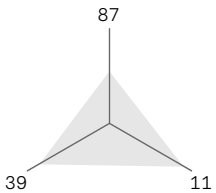
William Rawn Associates, Architects



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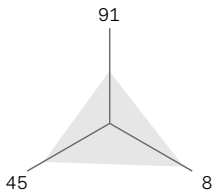

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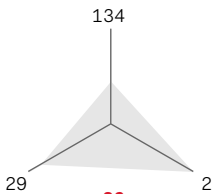

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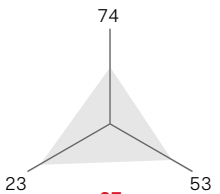

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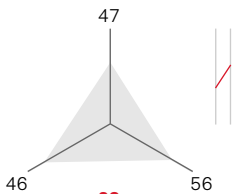

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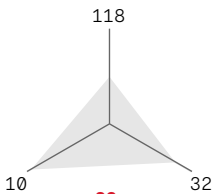

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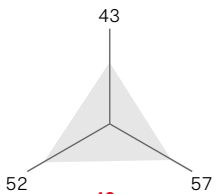

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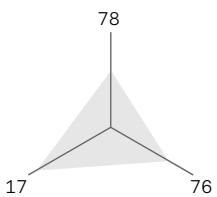

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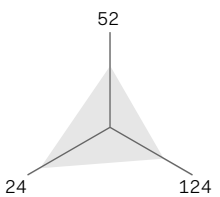

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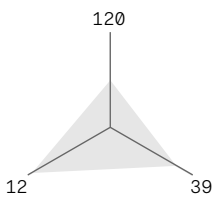

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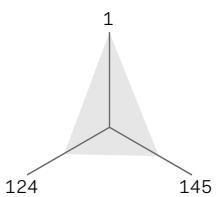
Opsis Architecture



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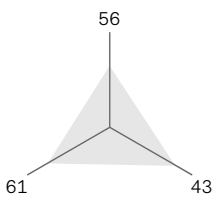
Trahan Architects



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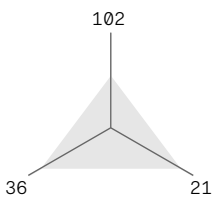
HKS



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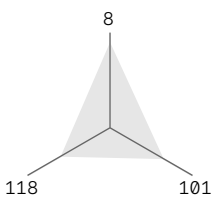

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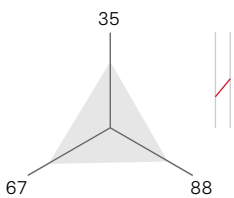

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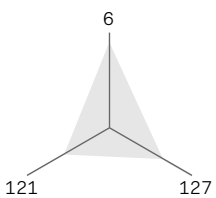
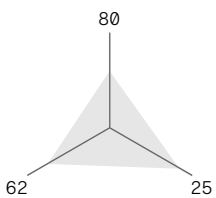
Arrowstreet



49
Lorcan O'Herlihy Architects



50
David Baker Architects

1

Trahan Architects

is

BEST

IN DESIGN

If you had to describe the work of New Orleans–based Trahan Architects according to only one essential element, it would be materiality. Take the Alliance Theatre in Atlanta, where Trahan partnered with sculptor Matthias Pliessnig on the overhaul of a historic 650-seat auditorium. The interior of undulating ribbons fabricated from steam-bent white oak inspired a "wow" from the design judges, who lauded the firm's "dramatic, sumptuous, and well-detailed" projects that offer "beautiful, compelling spaces to dwell within." The firm's portfolio helped Trahan earn the Number One spot for Design in this year's ARCHITECT 50.

The idea for the Alliance's design came after an African American member of the community recalled how the theater, which opened in 1968, once had segregated seating. "It was critical to address the issue of equality and diversity, and so we challenged ourselves to shape a space where the lower level and the balcony level could integrate into one unified community," says the founder of the 35-person firm, Trey Trahan, FAIA.

Transforming complex conceptual ideas into realized physical spaces is no simple task, but Trahan Architects excels at this alchemy. "Sometimes our focus is on the artistry and on shaping things that are beautiful, but at other times the focus is on marrying technology and our commitment to ecology," Trahan says. With Alliance, which won a 2019 R+D Award (see our July 2019 issue), "we found, through the use of technology, that we could very cost-effectively build these shaped pieces consistent with the placement of each strand in the digital model."

Material, Trahan says, is critical to that process. "Buildings should become more harmonious with their context over time and the environmental conditions should result in a patination that is rich and touches us in an emotional way," he says. "We're attempting to work from both a cognitive and emotional place." At the Conservation Foundation Headquarters in New Orleans, for example, their design couples a cast-in-place concrete box with a weathered steel sculpture wall that creates a tranquil and contemplative respite within the bustle of the city's central business district. That process extends to their robust pro-bono work for clients like Hubbard Street Dance in Chicago. Last year, Trahan helped the company with site evaluations for a new building while completing a concept design for a temporary space.

"It's beyond buildings, right?" says Trahan. "It's about arriving at a place where you believe that architecture can create or result in an attitude of kindness. … Architecture has a voice in that."

1 Trahan Architects
2 BNIM
3 Lake|Flato Architects
4 MASS Design Group
5 El Dorado Architects
6 Lorcan O'Herlihy Architects
7 Hastings
8 NADAAA
9 nArchitects
10 Eskew+Dumez+Ripple
11 Skidmore, Owings & Merrill
12 Olson Kundig
13 Dake Wells Architecture
14 Richärd+Bauer Architecture
15 Gensler
16 LMN Architects
17 CannonDesign
18 Substance Architecture
19 Montalba Architects
20 Leers Weinzapfel Associates
21 Perkins and Will
22 De Leon & Primmer Architecture Workshop
23 Kevin Daly Architects
24 Adrian Smith + Gordon Gill Architecture
25 John Ronan Architects
26 Helix Architecture + Design
26 Höweler + Yoon Architecture
28 Marlon Blackwell Architects
29 Works Progress Architecture
30 CetraRuddy
31 HGA Architects and Engineers
32 Payette
33 DLR Group
34 William Rawn Associates, Architects
35 The Miller Hull Partnership
35 Arrowstreet
37 Ross Barney Architects
38 ZGF Architects
39 Holst Architecture
40 Solomon Cordwell Buenz
41 Elkus Manfredi Architects
42 Neumann Monson Architects
43 Steinberg Hart
43 SRG Partnership
43 Stantec
46 Mode Associates
47 Bora Architects
48 Hacker
48 ODA New York
50 Quinn Evans Architects
50 OfficeUntitled

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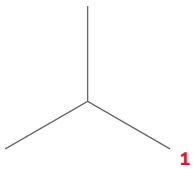

1

Marmol Radziner

is

BEST

IN BUSINESS

Some years, the proverbial ship comes in, and projects that languished on the horizon finally land all at once. That was the case in 2018 for Los Angeles–based Marmol Radziner, which earned the top spot in business in this year's ARCHITECT 50. The 160-person firm enjoyed a 34% increase in net revenue over 2017, and boasted the highest net-revenue-per-employee figure of all the survey participants. "Some of it truly is timing," says managing partner Leo Marmol, FAIA. "Various projects fell into place by chance at the same time last year."

Like most firms, "we see fluctuation in annual revenues because of the normal ebb and flow of the profession," Marmol adds, but the firm's growth "speaks to the unique nature of our office. We have a whole variety of revenue streams from a business perspective."

Founded in 1989 as a design-build firm with an emphasis as a "master builder," Marmol Radziner touts itself as a single-source shop offering everything from architectural drawings and construction documents to prefab, custom cabinetry, fixtures, and furniture. Employees work across multidisciplinary teams of architects, landscape designers, interior designers, furniture designers, and construction crews. Projects in 2018 included a 64-story mixed-use tower in downtown Los Angeles (still in progress), a Four Seasons resort in Puerto Rico, and multiple private houses. "We had a number of residential construction projects where we were both architect and builder and some were very large scale," says design partner Ron Radziner, FAIA, including the 9,300-square-foot stone-and-wood Bella Vista Residence in Montecito, Calif., completed last year. Tucked into a bluff with ocean views and a landscape of native oaks, the house represents the firm's signature Modernist-meets-landscape style.

As a sign of its expanding reach, Marmol Radziner opened a New York office in 2018 to service a growing number of East Coast residential and commercial clients, including restaurants for Sushi Nozawa Group, boutiques for Vince and Oliver Peoples, and the New York corporate headquarters for Italian eyewear company Luxottica. "We have always had a strong emphasis on office management," Marmol says. "We have a COO that heads up the financial management structure and he has a talented and committed team that keeps all of the accounting managed very smoothly."

1 Marmol Radziner
2 EHDD
3 Duda|Paine Architects
4 WRNS Studio
5 Butler Armsden Architects
6 Works Progress Architecture
7 HDR Architecture
8 Clark Nexsen
9 ELS Architecture and Urban Design
10 Hastings
11 Mahlum Architects
12 Blair + Mui Dowd Architects
13 RBB Architects
14 CO Architects
15 Leddy Maytum Stacy Architects
16 Steinberg Hart
16 Carrier Johnson + Culture
18 Bruner/Cott & Associates
18 Adrian Smith + Gordon Gill Architecture
18 PBK
21 Page
22 Ayers Saint Gross
22 Gensler
24 Mark Cavagnero Associates
25 David Baker Architects
26 Goettsch Partners
27 Touloukian Touloukian
28 Flansburgh Architects
29 The Miller Hull Partnership
29 ZGF Architects
31 Ann Beha Architects
32 SmithGroup
32 HOK
32 Olson Kundig
35 Hord Coplan Macht
36 Leers Weinzapfel Associates
36 Kobi Karp
38 Spectorgroup
39 Opsis Architecture
39 HMC Architects
41 EYP
42 BAR Architects
43 Kirksey
43 HKS
45 Mithun
46 HGA Architects and Engineers
47 Skidmore, Owings & Merrill
47 Payette
49 Studios Architecture
50 LPA

Mott Library
Mott Community College
Architect: Buehrer Group Architecture and Engineering Inc.
Product: Endure Woodgrain Engineered Polymer Canopy Ceiling

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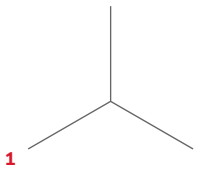

1

BNIM

is

BEST

IN SUSTAINABILITY

BNIM, which earned top honors in the sustainability category this year, has long been a pioneer of environmentally ambitious design. Founded in Kansas City, Mo., in the 1970s, and now with 86 employees across three offices, the firm was built on a commitment to transform the way buildings serve people and nature. "I went to school during the first energy crises in the 1970s and came out fired up about making buildings more efficient," says Steve McDowell, FAIA, the firm's director of design. By 1989, McDowell was among a group of AIA members to present a resolution at that year's convention called the Critical Climate Rescue, which helped spur the creation of COTE, the USGBC, and LEED. BNIM would go on to develop the Living Building concept of design, and be among the first to earn LEED Platinum for one of its projects.

Last year, the firm, which has signed on to AIA's 2030 Commitment, demonstrated a robust commitment to energy modeling and began using Tally, a software application (designed by Philadelphia-based KieranTimberlake) that analyzes how design decisions influence the life cycle of a building, including outputs such as carbon. After years of tracking performance to see how their models stood up to real-life scenarios, BNIM standardized their measurements in 2018 by incorporating ARC, a digital platform for tracking building performance, and Energy Star Portfolio Manager into some of their post-occupancy services. They also have a research partnership with the Salk Institute to test the effects of daylight on human health. Last year, they coalesced their ambitions for green building into a 2020 Sustainability Action Plan, which includes the goal of identifying strategies for disaster planning when considering a project site.

The ARCHITECT 50 sustainability judges were particularly struck by the firm's Asilong Christian High School in Kenya, a COTE Top Ten winner (featured on page 140) that they deemed "a wonderful project." Its triple bottom-line design responded to climate, community, and education needs in a remote area. Harnessing the abundance of solar energy, the building operation requires no carbon-based fuels, and local labor was trained in brickmaking and construction and contributed to the completed project.

The green ethos has become so baked in at BNIM that the word "sustainability" isn't bandied about as it once was. "It's so much a part of who we are and how we work, it's almost redundant to use that word. We are truly focused on outcomes," McDowell says. "Is our work making people healthier? Is our work contributing to a more vital and regenerative ecological system? Is our work helping organizations to function better? Is our work connecting people to nature? All those things mean sustainability. We don't have sustainability workshops like we used to 20 years ago because our design workshops are sustainability workshops."

1 BNIM
2 The Miller Hull Partnership
3 WRNS Studio
4 HDR Architecture
5 SmithGroup
6 Mithun
7 Touloukian Touloukian
8 Bruner/Cott & Associates
9 Perkins and Will
10 HOK
11 Lake|Flato Architects
12 Opsis Architecture
13 Adrian Smith + Gordon Gill Architecture
14 Hacker
15 SRG Partnership
16 LPA
17 Hennebery Eddy Architects
18 Skidmore, Owings & Merrill
18 GWWO Architects
20 Leddy Maytum Stacy Architects
21 DLR Group
21 ZGF Architects
23 Sasaki
24 Archimania
25 EYP
25 Ayers Saint Gross
27 Ballinger
28 Dattner Architects
29 EHDD
30 Kaplan Thompson Architects
31 Richärd+Bauer Architecture
32 LMN Architects
33 ELS Architecture and Urban Design
34 CBT Architects
35 Hastings
36 Fergus Garber Young Architects
36 Page
38 Behnisch Architekten
39 Mahlum Architects
40 Eskew+Dumez+Ripple
41 Kirksey
42 Leers Weinzapfel Associates
42 Weber Thompson
44 ZeroEnergy Design
45 Clark Nexsen
46 Payette
46 Bora Architects
48 CannonDesign
49 Studio Ma
50 HGA Architects and Engineers

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METHODOLOGY

ARCHITECT advertised the ARCHITECT 50 program in print and online, and also sent direct invitations to firms that either requested entry forms or that had participated in previous years. In all, 182 firms qualified. Data was from the 2018 fiscal year and was self-reported. Projects completed or in progress during the calendar year were included. Data was checked for consistency, and outliers were fact-checked. Karlin Research, a third-party research firm based in New York City, compiled the ranking and assured the confidentiality of the data. The ARCHITECT 50 ranking is based on scores in three separate categories: design, sustainability, and business. To see which data points were used to generate scores in each category, see below.

DESIGN

14% Licensure, as measured by the percentage of designers licensed in their respective fields, the average percentage increase in salary or bonus paid upon licensure, and how the firm mentors young designers

7% Pro bono work, as measured by participation in Public Architecture's 1+ program, the percentage of billable hours dedicated to pro bono, and the scope of the pro bono work

4% Design awards, including awards issued by ARCHITECT and prominent institutions such as the AIA and the ASLA

3% Research, as measured by the percentage of profits invested in it and its scope and significance

72% A design portfolio, scored individually by the following three judges. Their scores were combined to create an overall score.

Lawrence Scarpa, FAIA, co-founded Los Angeles–based Brooks and Scarpa, which won the 2014 Smithsonian Cooper-Hewitt National Design Award. He has taught at numerous institutions and currently is on the faculty at the University of Southern California.

Dan Wood, FAIA, co-founded New York–based WORKac with Amale Andraos in 2003. He has taught extensively, most recently at MIT and the University of Toronto, where he held the 2017 Frank Gehry International Visiting Chair in Architectural Design.

Jennifer Newsom, AIA, is a co-founder and principal of Dream the Combine, based in Minneapolis. The firm's installation, Hide & Seek, was winner of the 2018 MoMA PS1 Young Architects Program.

BUSINESS

49% Net revenue per employee

12% Profitability (positive change in net revenue from 2017)

24% Business practices, including the percentage of women and minority designers and principals, the firm's approach to diversifying its staff, the percentage of new full-time positions, and voluntary staff turnover rate

15% Employee benefits, including ARE benefits, stock options, and the value and scope of other fringe benefits

SUSTAINABILITY

18% 2030 Commitment: Participation in AIA's 2030 Commitment program, submittal of a report of predicted energy use of active projects to AIA in 2018, percentage of predicted energy use intensity reduction and predicted lighting power density reduction from the baseline reported, and whether those two submitted percentages represented an improvement over the numbers submitted in 2017

18% Energy and water metrics: Percentage of the total square footage of projects that were in design during 2018 that met or exceeded the 2030 energy target (70% better than a baseline building as measured by the 2003 Commercial Building Energy Consumption Survey or the 2001 Residential Energy Consumption Survey) and percentage of the total gross square footage of interior design projects that were in design during 2018 that met or exceeded the 2030 target (25% improvement in lighting power density—LPD—as measured by the baseline established by ASHRAE 90.1 v2007); percentage of the total square footage of projects that were in design during 2018 that achieved a 20% reduction or greater in regulated potable water use than the standards of the U.S. Energy Policy Act of 1992; that incorporated simulated energy modeling to determine the energy use impacts of the project, and the percentage of those projects that used modeling during the conceptual or schematic design phase of the project; that used daylight simulation modeling to reduce energy consumption by electric lighting or enhance occupant health or comfort; that used life-cycle assessments as a tool for reducing the embodied carbon footprint of a project or that took into account embodied carbon when making material selections; for completed projects with sufficient energy data available, the percentage for which firms gathered data to see if they were meeting the project goals and/or predicted performance; and finally, a firm's approach toward resilient design, the use of material ingredients reporting to avoid chemicals of concern when sourcing materials, the approach to reducing embodied carbon in a project, and the scope of post-occupancy work

6% Employee certifications: The percentage of a firm's design employees with Living Future, Passive House, WELL, Green Globes, Green Roof Professional, or LEED AP or Green Associate credentials (and the specialty LEED credentials represented at the firm), as well as the percentage increase in salary given to employees who achieve LEED AP accreditation

20% Building certifications: Points awarded on a sliding scale for projects that in 2018 were registered or certified for LEED, Living Building Challenge, Green Globes, Net Zero, Green Guide for Health Care, Energy Star, Passive House, and other leading certifications

38% A score for the green project that best demonstrated a firm's commitment to sustainability and how it is an inherent part of the design process in three areas: energy, materials, and site ecology. Projects were scored individually by the following two judges, and their scores were combined to create an overall score.

Margaret Montgomery, FAIA, LEED AP BD+C, WELL AP, is a principal and global sustainable practice leader for NBBJ, a global design firm based in Seattle. She leads initiatives and projects that are focused low-energy, high-performance design. She has served on the board of AIA Seattle and co-chaired its What Makes It Green program.

Jean Carroon, FAIA, a LEED Fellow, is principal at Goody Clancy, a Boston-based firm. The 2019 president of the Boston Society of Architects, her practice focuses on the creative reuse of existing places and buildings to shape a resilient world. Her book *Sustainable Preservation: Greening Existing Buildings* was published by John Wiley & Sons in 2010.

The weight assigned to each data point was formulated after consulting with industry experts. Using the weights, scores were calculated and then normalized so the top-scoring firm in each of the three categories would equal 100. The overall ranking was created by adding together the normalized scores from the three categories. Those scores were also then normalized, with the top firm given an overall total of 100.

Each firm's performance was calculated relative to the performance of other firms. The firm with an overall score of 100, for example, did not necessarily top out on every indicator and category; it accumulated the highest composite score. Any ties in the overall list were broken based on which firm achieved the better design ranking.

EQUITY DATA

The charts on page 105 are based on firm responses to the questions: *What percentage of your firm's principals, architects, interns, and design staff are women? What percentage of your firm's principals, architects, interns, and design staff are racial or ethnic minorities?* List limited to firms with 50 or more employees. All participating firms were included, not just firms that were ranked in the Top 50.

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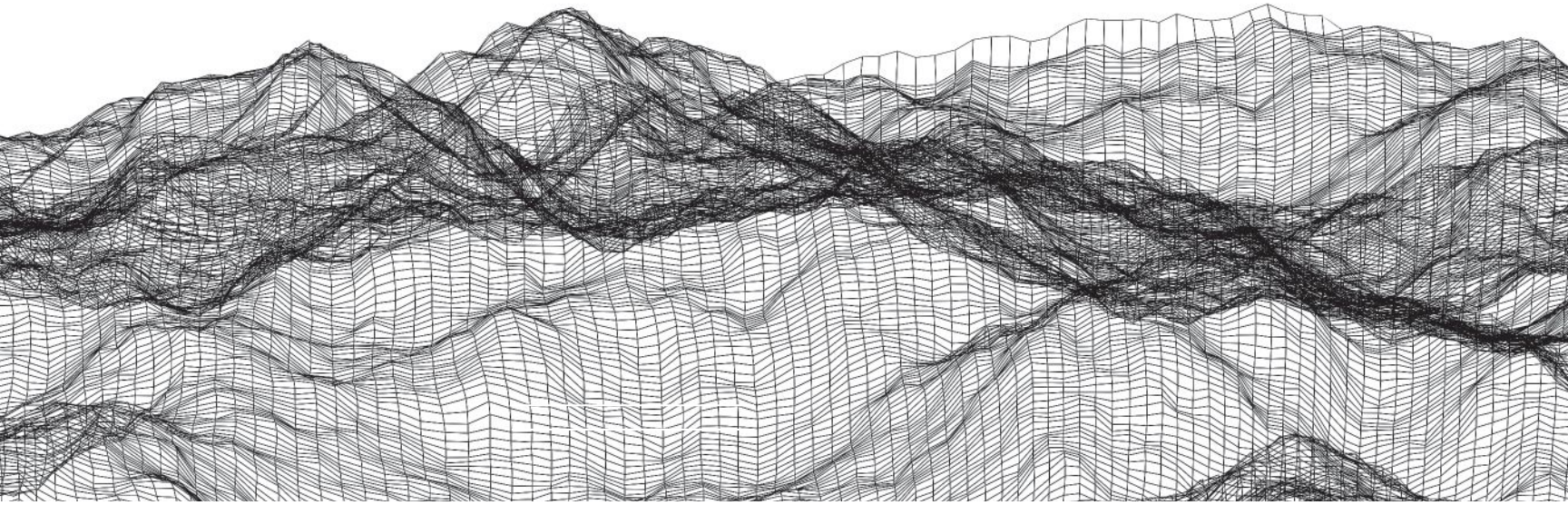

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COTE TOP TEN

INTEGRATIVE
COMMUNITY
ECOLOGY
WATER
ECONOMY
ENERGY
WELLNESS
RESOURCES
CHANGE
DISCOVERY

The AIA COTE Top Ten projects represent the pinnacle of green architecture. The criteria for judging them form a holistic approach to sustainability and design that everyone can emulate.

2019

INTRODUCTION BY KATIE GERFEN
PROJECT DESCRIPTIONS BY
EDWARD KEEGAN, AIA, AND CLAY RISEN

In his Sept. 20 testimony before the House Committee on Energy and Commerce, 2018 AIA president Carl Elefante, FAIA, stated: "The threat posed by climate change to our homes, cities, nation, and the planet require[s] that we fundamentally reexamine how we develop and adapt the built world." The climate is in crisis. And with 75% of electricity and 28% of the natural gas in the United States used by buildings—and 39% of global greenhouse gases emitted by them—it is a threat that architects cannot afford to ignore.

It is also one they are singularly equipped to help change. Just two weeks before Elefante spoke on behalf of AIA on Capitol Hill in Washington, D.C., the Institute's board of directors ratified a resolution to position the industry to do just that. The resolution calls for three actions: "declare an urgent climate imperative for carbon reduction; transform the day-to-day practice of architects to achieve a zero-carbon, equitable, resilient and healthy built environment; and leverage support of our peers, clients, policy makers, and the public at large."

The appetite in the architectural community for such actions is great: The resolution, which was introduced by Betsy del Monte, FAIA, and co-signed by 50 other members of AIA's Committee on the Environment (COTE), was introduced at the business meeting at this summer's Conference on Architecture in Las Vegas, where it received 4,860 votes in its favor and only 312 against. (Twenty-eight members abstained.) "We thought it was very important to include this idea that we really have to transform day-to-day practice for all architects to achieve zero carbon and an equitable, resilient, healthy built environment," says Marsha Maytum, FAIA, of San Francisco–based Leddy Maytum Stacy Architects, who serves as the 2019 COTE chair and was one of the co-signers.

The ratification by the board in September coincides with what the Institute calls the "Big Move Toward Environmental Stewardship." It calls for the development of a Climate Action Plan in 2020, as well as continuing to encourage firms to join the AIA 2030 Commitment to reduce the carbon footprint of new projects and renovations over the next decade.

AIA has also adopted the COTE Top Ten Measures—the 10 criteria (listed opposite) used to evaluate the annual COTE Top Ten Awards—as the Framework for Design Excellence going forward. These principles focus on creating holistically sustainable projects that reduce energy and water use, integrate design and sustainable systems, and foster the wellness of building users. (For more information on each of the 10 measures, visit the COTE knowledge community page at bit.ly/AIACOTE).

"The framework based upon the Cote Top Ten measures is a really holistic way to think about the entire design process, and provides a way for each architect, community, and client to look at all of the measures, adapt them to what is most important in their communities, and comprehensively look at design excellence in its fullest form," Maytum says.

To help the industry make energy and carbon reduction a focus in everyday practice, AIA will continue to develop tools for its membership. But there are already several available to help people become familiar with the framework and to offer tips on how to achieve performance goals. The COTE Top Ten Toolkit, released online in December 2018 (see bit.ly/TopTenToolkit) breaks out each of the 10 measures, offers examples from past winners of the awards program, and provides high-impact strategies of the "if you can only do one thing" variety. The Toolkit has been demonstrated in workshops across the country over the past year, and has already received 15,000 views to its website, according to Toolkit contributor and COTE board member Tate Walker, AIA, of OPN Architects in Madison, Wis.

The Toolkit isn't just beneficial to architects: In his practice, Walker is also introducing it to clients, who have adopted it and the measures into their own standards for sustainability. The state of Wisconsin's Division of Facilities Development and Management, for example, is in the process of revamping its sustainability guidelines, but in the interim is offering the Toolkit as a suggested resource for all projects. "It works with clients, and it works within firms to raise a level of knowledge, and to help to support a culture of high-performance design," Walker says.

The Toolkit is complemented by the Design Datamap—a searchable, visual database of all past COTE Top Ten–winning projects (see bit.ly/DesignDatamap)—that allows users to search by region, climate, zone, typology, size, and other filters to find case studies that can inform their own work.

Indeed, the COTE Top Ten Awards program is one of the best resources for architects looking to transform their design practices: It has been showcasing 10 of the most sustainable projects each year for more than 20 years. In the following pages we dive into the latest winners, in each case spotlighting a different one of the 10 measures. Altogether, these projects provide a higher benchmark, one that every architect should aim to emulate, even surpass—and in very short order—if the world is to reach energy and carbon neutrality. Architects must continue to lead the search for environmental solutions, and can make a profound contribution toward the mitigation of climate change.

> *For full project credits, metrics, and materials and sources information, visit bit.ly/2019COTETopTen.*

INTEGRATION
COMMUNITY
ECOLOGY
WATER
ECONOMY
–
WELLNESS
RESOURCES
CHANGE
DISCOVERY

Frick Environmental Center
Pittsburgh
Bohlin Cywinski Jackson

COTE

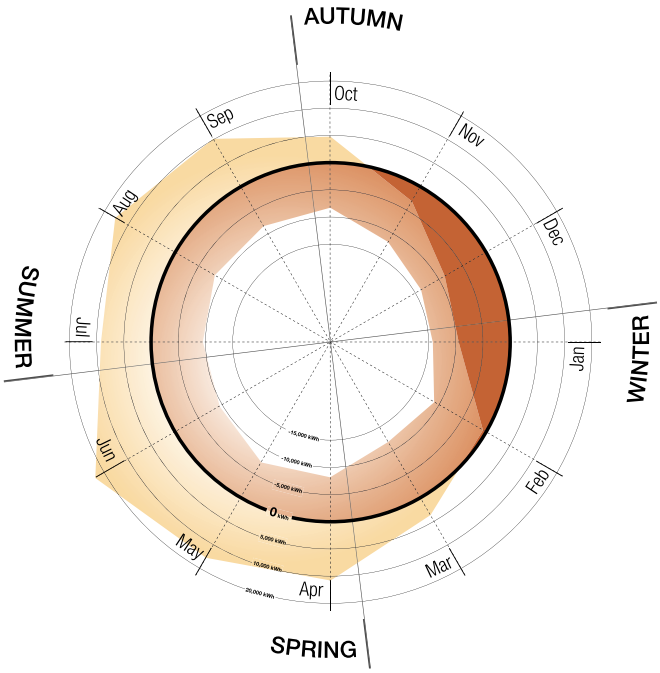
TOP

TEN

PLUS

CHRISTIAN PHILLIPS

Energy Use Diagram



Use
Net (surplus)

327,912 kWh total collected
237,623 kWh total used

90,289 kWh total net (surplus)

Center interior, with views out to tree canopy

By delicately balancing passive and active systems, this environmental center teaches the public about sustainable design through its net-positive energy and carbon design.

Frick Park—the 644-acre green space nestled among the hilly neighborhoods east of downtown Pittsburgh—has long acted as an oasis in the dense industrial city, but has always lacked a gateway. In 2011, the city of Pittsburgh and the Pittsburgh Parks Conservancy invited Wilkes-Barre, Pa.–based Bohlin Cywinski Jackson (BCJ) to design a new environmental center to act as a locus for the park's education and advocacy efforts and to teach visitors about energy-efficient design. "The mission was to make sustainability a part of the park experience," says senior associate Patricia Culley, AIA. "We wanted the building to be a platform to make nature itself a part of that mission."

The three-story center, which is free to the public, occupies the same footprint as the park's former education center, to minimize ecological disruption. Located on the side of a hill, visitors enter at the top floor and immediately find themselves amid the treetops of the surrounding forest.

The building relies on a number of passive heating and cooling strategies, beginning with a high-performance, highly insulated exterior wall clad in black locust—a locally sourced wood that does not require sealant or staining. "We tried to be creative with the systems we were going to use," Culley says. "First, that meant designing a good envelope, and then looking at systems that are super-efficient."

The firm also incorporated a number of passive strategies, like roof overhangs, natural ventilation, and a red light/green light system that lets occupants know the best time to open windows. Photovoltaic shading, located in the parking lot, provides much of the energy. The center's predicted net energy use intensity (EUI) was just 2 kBtus per square foot per year—60% below average for similar structures, and the actual net EUI came in at -0.7 kBtus per square foot per year—an energy surplus, which is sent to the grid.

For all the energy savings, water is also an essential part of the center's sustainability agenda. Low-flow fixtures and minimal irrigation reduce demand, but the architects wanted to do more—not just to save water, but to show visitors how it sustains a place like Frick Park. "The water story is a huge component in this site," says senior associate Robert Aumer, AIA.

After decades of neglect, the site had experienced significant erosion, which the designers addressed by adding 7,000 plants, including 200 new native trees. With careful landscaping to reduce the hillside grade, the BCJ team was able to restore a significant amount of the site's luster with minimal artificial irrigation.

The center sits astride two watersheds, and the architects were careful to make sure that stormwater falling on the building was diverted evenly. Rain that falls on the north side is captured in a 15,000-gallon underground cistern, and is used for flushing toilets and other nonpotable needs. In fact, Aumer says, while local laws prevent the use of rainwater for drinking, the site has enough capacity to meet potable water demand as well, should the laws change.

Rain falling on the south side plays a very different role: Water flows off the roof in a sheer curtain, called the Rain Veil, which is visible from inside the center. The runoff then passes through the Rain Ravine, an installation by artist Stacy Levy that mimics the sandstone-lined creek beds found in the park, giving visitors an up-close view of the region's water ecology.

BCJ was conscious of making the building's systems, for water and energy alike, easy to use for staff and visitors. "So many times we've seen this—you deliver a sophisticated system that the maintenance crew refuses to operate," Culley says. "We're proud that our building is simple to maintain." —C.R.

ENERGY

Mandatory Metrics

Predicted Consumed EUI: 30 kBtus per square foot per year
Predicted Net EUI: 2 kBtus per square foot per year
Predicted Net Carbon Emissions: 6 pounds per square foot per year
Predicted Reduction from National Average EUI for Building Type: 60%
Predicted Lighting Power Density: 0.7 W/sq ft

Encouraged Metrics

Actual Consumed EUI (Site EUI): 23 kBtus per square foot per year
Actual Net EUI: -0.7 kBtu per square foot per year
Actual Net Carbon Emissions: -0.18 pound per square foot per year
Actual Reduction from National Average EUI for Building Type: 101%

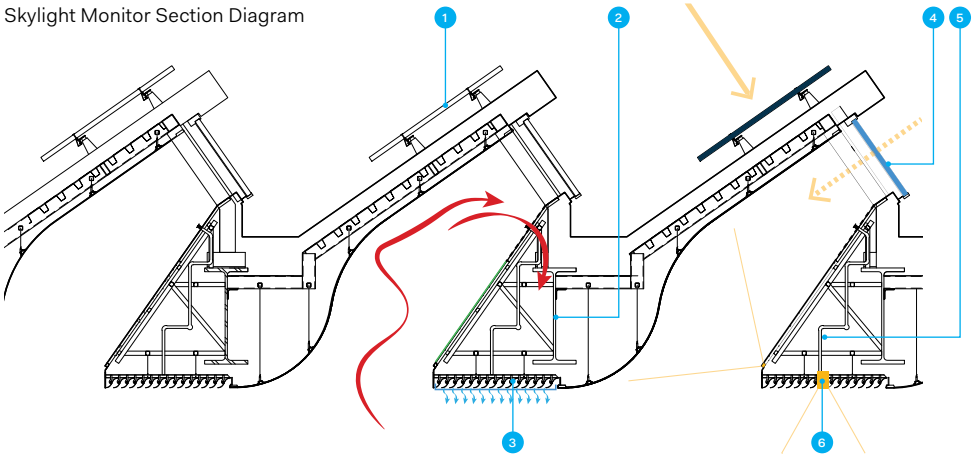
Project Attributes

Architect: Bohlin Cywinski Jackson
Owner: Pittsburgh Parks Conservancy
Location: Pittsburgh
Project Site: Previously developed land
Building Program Type(s): Education—General; Office—10,000 square feet; Public Assembly—General
Year of Design Completion: 2014
Year of Substantial Project Completion: 2016
Gross Conditioned Floor Area: 16,440 square feet
Gross Unconditioned Floor Area: 2,000 square feet
Number of Stories: Three
Project Climate Zone: ASHRAE 5A
Annual Hours of Operation: 2,660
Site Area: 182,952 square feet
Project Site Context/Setting: Urban
Cost of Construction, Excluding Furnishings: $13.75 million
Number of Residents, Occupants, and Visitors: 75,000

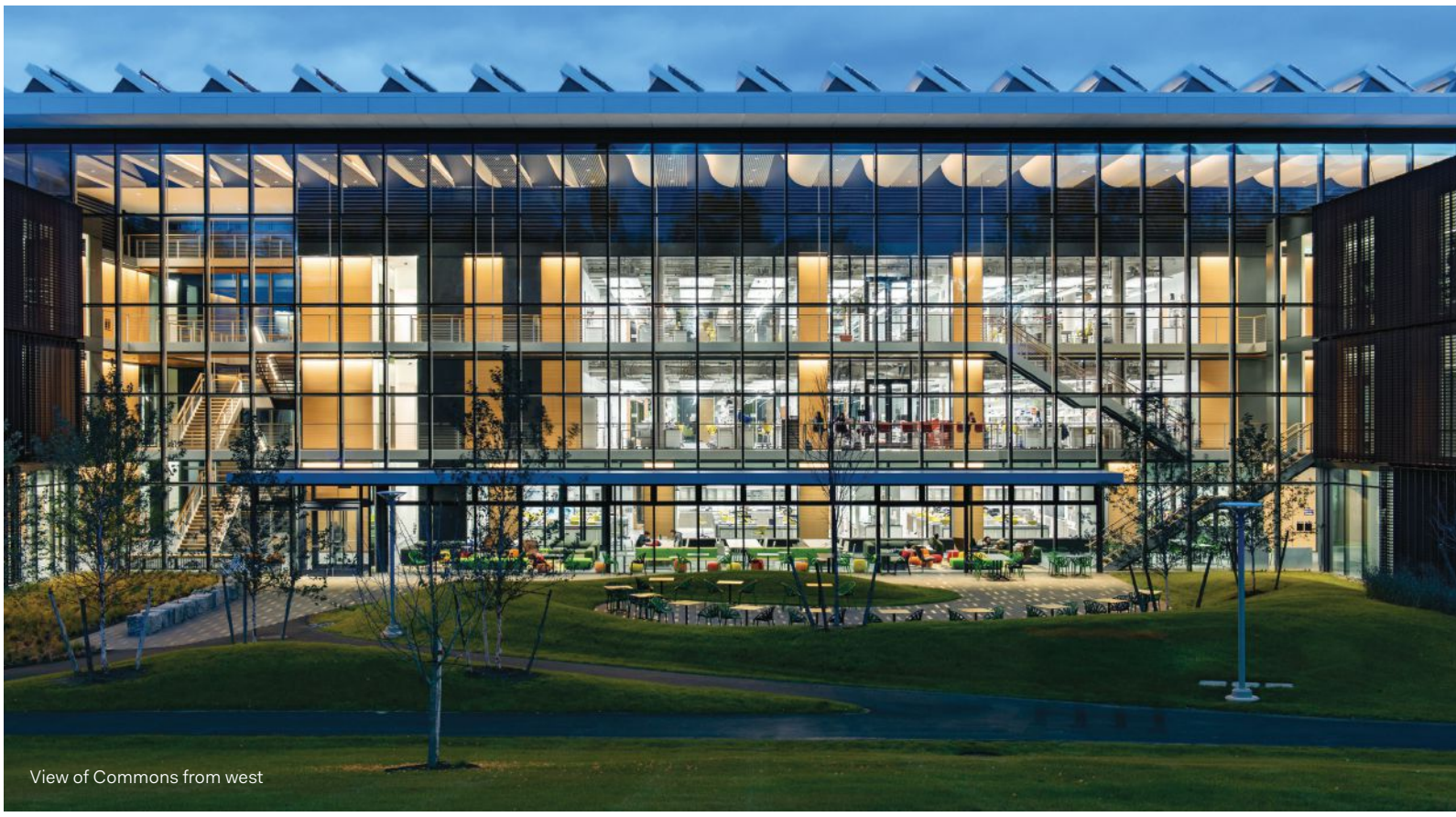
DENMARSH PHOTOGRAPHY

Amherst College New Science Center
Amherst, Mass.
Payette

Skylight Monitor Section Diagram



1. Photovoltaic panel
2. Structural beam
3. Radiant cooling panel
4. Skylight
5. Fire protection system
6. Integrated lighting



View of Commons from west

By integrating systems and taking a holistic approach to sustainable design, this lab building achieved an EUI 76% lower than the national average for the building type.

At first, Amherst College, located in western Massachusetts, just wanted a new home for its science labs. Then it heard about Dartmouth. Amherst's New Hampshire rival had recently completed its own life sciences center, which, despite being full of energy-intensive laboratories, had an EUI of just 99 kBtus per square foot per year—significantly below the average for its building type.

"Amherst came to us and said, 'We have to beat Dartmouth,'" says Jeff Abramson, AIA, a senior associate at Payette, the Boston-based practice hired to design the school's New Science Center. The firm, which has developed a reputation for delivering high-performance, sustainable academic research facilities, accepted the challenge—knowing full well that a deep integration of systems was the only way to meet it.

In a typical lab building, air circulation is the biggest energy demand, so the first step was to reduce the amount of air required. That meant using high-efficiency chilled beams to cool non-laboratory spaces, and a cascade circulation system that recycles air from the offices and common areas into the labs, where it is vented out. Before leaving the building, the air passes through a convection heat recovery system, which draws energy out of the exhaust for use elsewhere. The firm also employed high-efficiency fume hoods in the labs, each of which can be shut off when not in use.

Because of the building's north–south orientation, Payette also had to address the fact that its longest wall—400 feet long, to be exact—was exposed to direct afternoon sunlight. But the firm had already decided that the wall needed to be almost all glass to allow natural lighting into the center's laboratories. The firm installed high-performance triple-glazing with two low-E coatings, one to deflect exterior light, the other to reflect and retain internal heat. Inside the windows run retractable shades; when lowered, they create a solar chimney—the air between the window and the shades absorbs external heat, which rises to a rooftop monitor and radiant convective panels.

In other parts of the building, Payette kept glass to a minimum: Much of the exteriors are brick or steel, which are thermally separate from the internal walls, further reducing demand on the HVAC system. "A lot of detailing went into making sure we had a very high-performance skin," Abramson says.

Payette paid equal attention to the building's water consumption—both as a sustainability strategy and as a pedagogical tool. "Unlike in the West, New England isn't as sensitive to water," says principal Michael Hinchcliffe, AIA. "We tried to use this project to raise awareness of water issues."

The building directs rainwater from the roof to a central reservoir on campus, where it is used in the university's cooling towers—saving up to a million gallons of water a year. A water feature in the building showcases water capture levels to occupants.

Raising awareness also meant making the building overtly biophilic, starting by connecting it to the college's new greenway—a series of gardens, common spaces, and paths that tie together the eastern side of campus. Also, the center is shaped like a letter E, and Payette placed rain gardens between its three arms.

Those gardens have quickly become oases for students and wildlife. "You go in there and suddenly you're in your own world," says Robert J. Schaeffner, FAIA, the principal in charge of the project.

In the end, by making incremental, integrated moves that work together to create a holistic approach, the science center smashed Dartmouth's very respectable energy-use rating by eight points, achieving an EUI of 91 kBtus per square foot per year—a stunning 76% below the baseline for this building type, according to Schaeffner. "We find that as long as you set a clear number as a target, it's easy for us to achieve it," he says. —C.R.

_ INTEGRATION

Mandatory Metrics

From the Architects: The Amherst College New Science Center provides state-of-the-art facilities and a flexible space to support the college's science programs through the next century while reducing energy usage by 76% compared with a typical research building. It is organized around "the Commons," a dramatic multistory atrium. A roof that floats above unifies the building, and skylight monitors integrate architectural and mechanical elements that provide an overall comfort conditioning solution: chilled beams, radiant slabs, acoustic baffles, and a photovoltaic array.

Project Attributes
Architect: Payette
Owner: Amherst College
Location: Amherst, Mass.
Project Site: Brownfield
Building Program Type(s): Education—College/University (campus-level); Laboratory
Year of Design Completion: 2015
Year of Substantial Project Completion: 2018
Gross Conditioned Floor Area: 251,000 square feet
Gross Unconditioned Floor Area: Zero
Number of Stories: Six
Project Climate Zone: ASHRAE 5A
Annual Hours of Operation: 8,760
Site Area: 522,922 square feet
Project Site Context/Setting: Rural
Cost of Construction, Excluding Furnishings: N/A
Number of Residents, Occupants, and Visitors: 1,380

CHUCK CHOI

Lakeside Senior Apartments
Oakland, Calif.
David Baker Architects

Axonometric Diagram Showing Sustainable Strategies

Top: Exterior View of Lakeside Senior Apartments from southwest

Above: Ground-floor community room, which opens to central courtyard

This affordable senior housing complex weaves sustainable social spaces throughout to increase the wellness of its residents and fight the sense of isolation that too often bedevils older people.

San Francisco–based David Baker Architects (DBA) doesn't start each project with a predetermined sustainability goal. "We want to do the most sustainable, affordable housing we can possibly afford," says principal Daniel Simons, FAIA. This ethos drove the firm's approach to the LEED Platinum–certified Lakeside Senior Apartments, which provides 92 affordable units for low-income, special-needs, and formerly homeless senior citizens on a sloped site just a half block from Lake Merritt in Oakland, Calif.

The city's predominant street grid is rotated about 45 degrees from north–south and Lakeside Senior Apartments' L-shaped site encompasses the southern half of a block, with two parallel five-story apartment wings that enclose a protected courtyard. This central green space is protected by a glass fence but still engages the street, and it sets the tone for a series of daylit public spaces throughout the complex that encourage social interaction among the residents. A fifth-floor kitchen and dining and community rooms open onto a rooftop garden where residents can grow vegetables. A smaller outdoor terrace is located on the southeast corner of the fourth floor, and more intimate interior spaces punctuate each of the building's corridors, including at the center of a bridge that connects the two apartment blocks. "We're trying to create many opportunities for informal connections between neighbors to fight isolation, [which is a] big issue with seniors," Simons says.

Maximizing daylight while still achieving a tight building envelope that can be heated and cooled efficiently—DBA predicts a 70.5% reduction from the average EUI for the building type—required thoughtful orientation and shading of openings. Along the southeast façade, on 2nd Avenue, apartments open onto long decks that provide ample individual outdoor space while also creating recesses that shade interiors from solar heat gain. The windows on this southeast face that are not protected by those decks feature sunshades made from perforated sheet metal. The façades facing East 15th Street along the southwestern edge of the block are primarily opaque, with narrow vertical slit windows protected by fins that prevent sunlight from heating the interiors. On the northwest side—facing Lake Merritt—shading isn't necessary, and units get a little bit more square footage.

To supplement the shading strategies, DBA deployed heat recovery ventilators (HRVs), which have proved critical to providing balanced mechanical services while saving energy and minimizing tenants' utility bills. "Seniors are very concerned about heating and cooling and have different personal set points," Simons says, "so it's important to give them good thermal control." The systems have required a bit of a learning curve, as tenants didn't initially understand how the HRVs' fans work. "Tenant education is critical," Simons observes, which is true for achieving many sustainable goals, especially on a tight budget.

DBA exploited the site's slope to give access to underground parking from grade at the north end of the building. The garage accommodates 60 cars—a high number for the project, but it also serves another senior apartment building across the street that previously used this site for surface parking. Now, instead of blacktop, 30% of the site supports vegetation, mostly native or climate-appropriate, where the previous parking lot, with its impervious surface, supported none. Raised planters and permeable paving allow 80% of rainwater to be managed on-site.

David Baker Architects has received many awards for sustainability, especially for relatively low budget projects such as the Lakeside Senior Apartments, but the firm's approach is incremental, and the welfare of the inhabitants is key. The benefits of their solutions grow with each iteration. "All of these little decisions add up to an overall more sustainable building," Simons says. And good design is always a fully integrated component. —E.K.

_ WELLNESS

Mandatory Metrics

Percentage of Floor Area With Direct Views of the Outdoors: 100
Percentage of Floor Area or Percentage of Occupant Workstations Within 30 Feet of Operable Windows: Zero
Percentage of Floor Area Achieving Adequate Light Levels Without the Use of Artificial Lighting: 24% receive more than 300 lux at 3 p.m. on March 21
Is this project a workplace? No

Project Attributes

Architect: David Baker Architects
Owner: Satellite Affordable Housing Associates (SAHA)
Location: Oakland, Calif.
Project Site: Previously developed land
Building Program Type(s): Residential—Multifamily, five or more units
Year of Design Completion: 2013
Year of Substantial Project Completion: 2014
Gross Conditioned Floor Area: 69,528 square feet
Gross Unconditioned Floor Area: 17,394 square feet
Number of Stories: Five
Project Climate Zone: Title 24 CA Climate Zone 03
Annual Hours of Operation: 8,760
Site Area: 28,947 square feet
Project Site Context/Setting: Urban
Cost of Construction, Excluding Furnishings: $25.3 million
Number of Residents, Occupants, and Visitors: 125

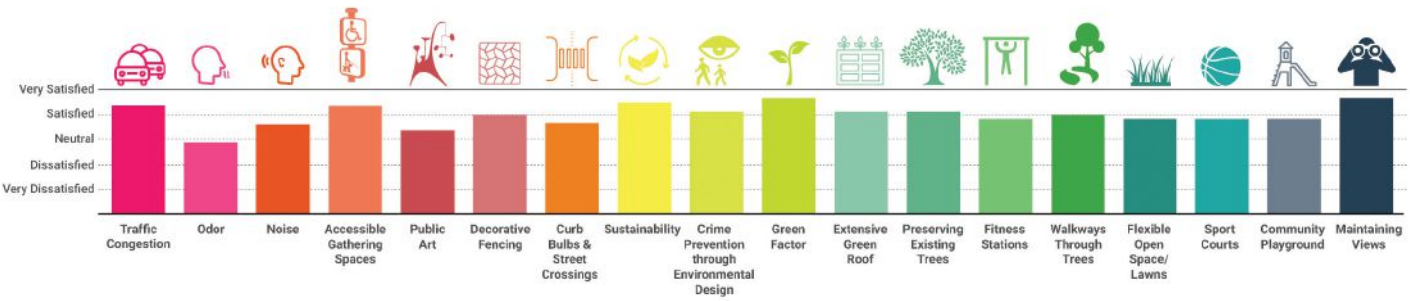
BRUCE DAMONTE

INTEGRATION
COMMUNITY
ECOLOGY
WATER
ECONOMY
ENERGY
WELLNESS
RESOURCES
CHANGE
_

North Transfer Station
Seattle
Mahlum Architects

BENJAMIN BENSCHNEIDER

Average Post-Occupancy Study Score Diagram



Previous Spread: Truck entering the North Transfer Station

Left: Aerial view from north

Bottom Left and Right: Park areas designed by HBB Landscape Architecture at the eastern end of the site

The success of this trash-processing station in a residential neighborhood shows that with a thoughtful discovery process, design can make even the most noxious building typology a boon.

Seattle's North Transfer Station might reasonably be mistaken as a factory for electric cars or some other high-tech production facility. But the low-lying translucent glass and concrete structure actually houses a dump, right between two residential neighborhoods and less than 100 yards from the shore of Lake Union.

Much of the discovery process centered on how to make the new facility sustainable and how to make it a good neighbor. "The old station was just a dump," Mahlum Architects design partner Anne Schopf, FAIA, says. The trash came into an open-air concrete structure and was transferred to trains to be hauled away. "We reengineered the process," she says. It's part of Seattle's ambitious initiative to divert 75% of the city's waste stream to recycling or composting by 2022.

To mitigate impact on the surrounding houses, the top of the complex was capped at 78 feet above sea level, which matches the highest point of the site at its northeast corner. This allowed the houses above the facility to retain expansive views of the lake and downtown Seattle.

Mahlum broke the complex into three distinct buildings: a two-story warehouse-like structure for waste processing, a two-story administrative building attached to the east side of the main structure, and a 10,000-square-foot recycling building bermed into the east end of the property. Trash arrives from the south side of the building via trucks that enter and exit from beneath the administration building along the east side of the main structure. The 63,246-square-foot "tipping" floor, where trash is spilled out and sorted, features 200-foot-long clear-span trusses, a translucent clerestory, and skylights that provide the workspace with 97% natural daylight. An added benefit, Schopf says, is the fact that "odor and noise can be much better [controlled] by having it contained in a warehouse." Following sorting and processing, the trash is transferred through openings in the floor into waste haulers on the lower level.

Concrete was a given to withstand the abuse that the building needs to take, but in order to be a good neighbor, the architects deployed standard concrete formwork inserts to create a faceted pattern on the façades. That's topped with translucent panels that surround the tipping floor—softening what could have been a large and ominous presence in the residential neighborhood.

Greenery atop both the recycling building and the administration building are part of view corridors for streets to the north. The designers increased the vegetation-supporting area of the site from 20% for the old dump to 26% now, but the biggest improvement was the consolidation of these areas as public amenities, including a new pocket park with play equipment.

The complex produces 68% fewer CO_2 emissions than similar buildings. A rooftop 159.4-kilowatt photovoltaic array provides 10% of the facility's power needs, and its size can be doubled in the future.

Not only is the new North Transfer Station better integrated into the neighborhood, its capacity has doubled while mitigating noise and nuisance by placing dump activities indoors, and removing waste haulers from queuing on neighborhood streets.

"If we're going to create sustainable, walkable, and compact communities, we need to figure out how to integrate infrastructure in a way that is livable," Schopf says. The North Transfer Station—and its commitment to answering community needs—is an object lesson in how to do this beautifully with even the most noxious functions. —E.K.

_ DISCOVERY

Mandatory Metrics

Post-Occupancy Evaluation Summary (from the Architects): A community satisfaction survey, consisting of questions on both the design process and the final outcome, was issued to the Wallingford and Fremont communities in December 2018 with an 8% response rate. A score of 5 represents Very Satisfied, 3 represents a Neutral opinion, and 1 is Very Dissatisfied. Ten of the 18 design criteria received a weighted average score of 4 or above. Traffic congestion was previously a huge problem for the neighborhood; a weighted average score of 4.30 indicates the success of strategies to eliminate idling cars backing up into the neighborhood. Notably, several criteria received only Very Satisfied and Satisfied rankings: Maintaining Views, Green Factor, Reduction of Traffic Impacts and Congestion, Sustainability, CPTED Design, Fencing, and the Preservation of Existing Trees. Areas for improvement are in Odor and Noise mitigation, two of the toughest challenges. Implementation of additional mitigation strategies in these two areas are ongoing.

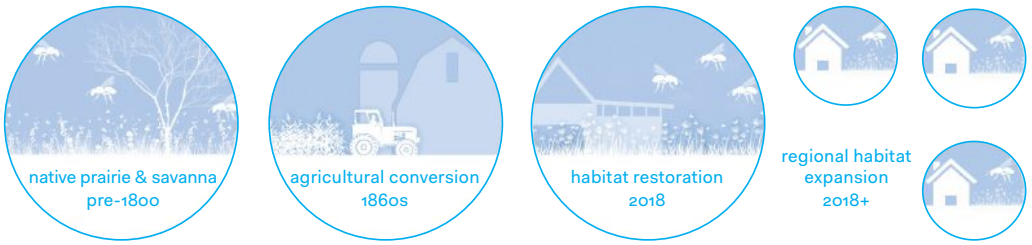
Project Attributes

Architect: Mahlum Architects
Owner: City of Seattle
Location: Seattle
Project Site: Previously developed land
Building Program Type(s): Office—10,000 square feet; Other
Year of Design Completion: 2014
Year of Substantial Project Completion: 2016
Gross Conditioned Floor Area: 8,499 square feet
Gross Unconditioned Floor Area: 163,600 square feet
Number of Stories: Two
Project Climate Zone: ASHRAE 4C
Annual Hours of Operation: 3,328
Site Area: 217,800 square feet
Project Site Context/Setting: Urban
Cost of Construction, Excluding Furnishings: $75.8 million
Number of Residents, Occupants, and Visitors: 105,413

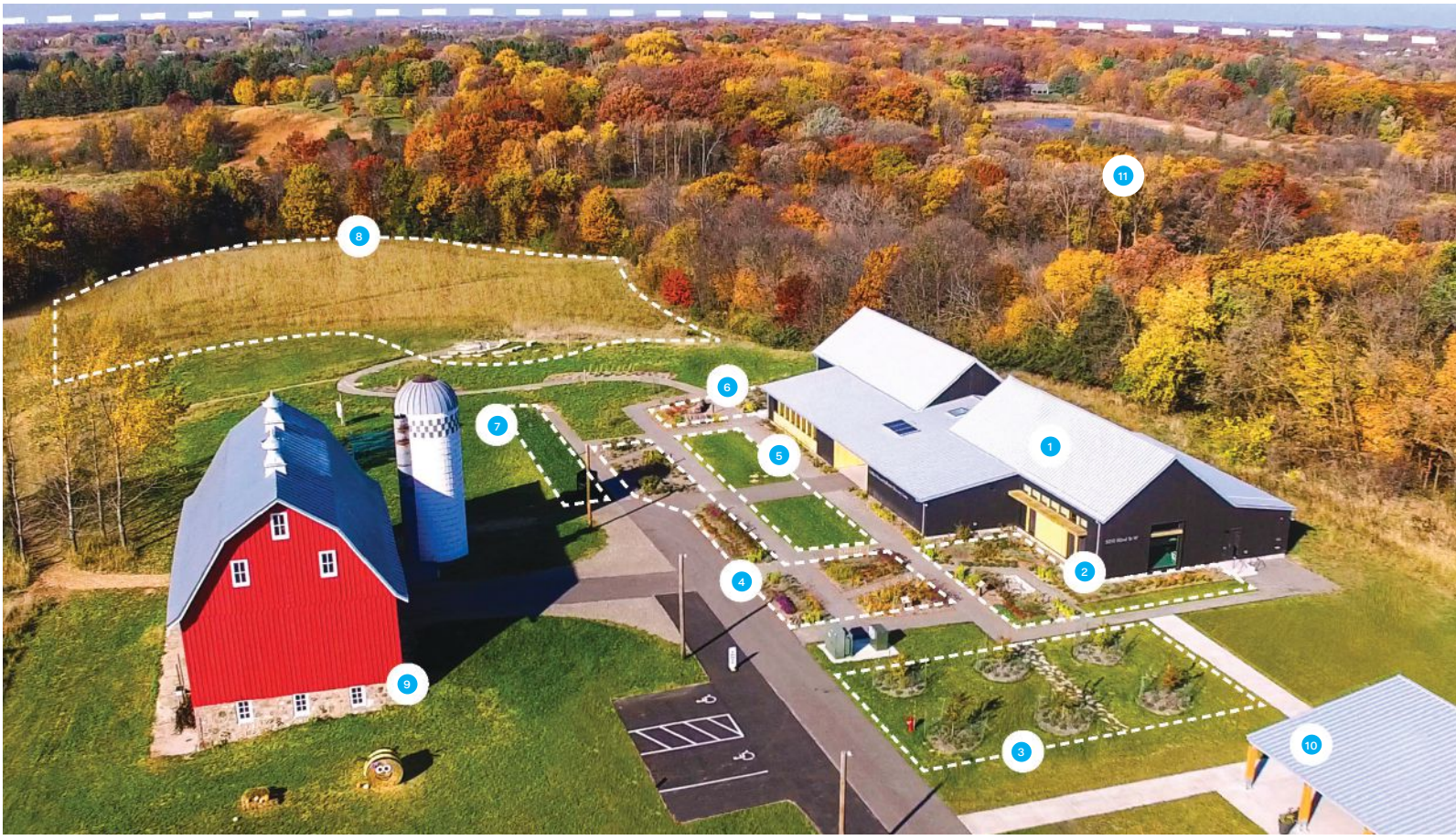
TOP: TIME RICE; BOTTOM: DAVE KRONSTAD

Tashjian Bee and Pollinator Discovery Center
Chaska, Minn.
MSR Design

Site Plan and Local Ecology Timeline



1. Pollinator center
2. Pollinator garden
3. Orchard
4. Demonstration gardens
5. Gathering lawn
6. Nesting habitat feature gardens
7. Bee lawn
8. Restored prairie
9. Red barn
10. Outdoor classroom
11. 2-mile foraging range



This habitat for pollinators shows how effective management of an ecosystem can improve conditions for local species, even if that habitat is smaller than what existed before.

Located on the 1,100-acre grounds of the Minnesota Landscape Arboretum, less than 20 miles southwest of Minneapolis, the Tashjian Bee and Pollinator Discovery Center forms the nucleus of a new area centered around food production and sustainable land-management strategies. With the University of Minnesota as the client, "we had a very supportive user for a sustainable project," says MSR Design founding principal emeritus Tom Meyer, FAIA.

The locally based firm began by developing a master plan for the property: a former farm that had lain fallow for some time. There were some inherent advantages in achieving the project's sustainability goals. For instance, all rainwater can be managed easily on-site. But there were also considerable disadvantages. In its preexisting condition, 96% of the land supported vegetation, but much of that was dominated by invasive species, and it supported little biodiversity. MSR's plan reduced the percentage of land that supports vegetation to 64%. New landscaping is designed to transition the site back to native species and increase the effectiveness of the remaining habitats.

Part of the reduction in vegetation can be accounted for by a modest 7,530-square-foot center that MSR designed to incorporate exhibition space, a multipurpose learning lab, a demonstration apiary, and a honey extraction room that provides public education on pollinators and their role in sustainable ecosystems. The center's configuration encourages interaction between its functions, and the interiors open onto demonstration pollinator gardens, beehives, and future food production plots.

The new building defers to the only existing on-site structure: a 120-year-old red barn. "We wanted the barn to remain at the center of the campus as a historic icon," Meyer says. Thus, the new structure, while larger in size, is lower in height; its two-tone natural finishes are intentionally more muted than the barn's traditional red. The center's primary structure is long and gable-roofed and runs east–west on the site, but it's split in the center to diminish the effect of its overall mass; the south entry, which faces the barn, is topped with a low shed roof.

Inside are "large rooms without any interior structure," says associate Eric Amel, AIA. A simple wood-framed, glulam truss system—sheathed in structural insulated panels—maximizes insulation while creating a soaring space that looks out to the prairie at either end. The designers doubled the number of necessary trusses—they occur every 4 feet—to create a better rhythm, a sturdier structure, and a clear reference to the framing in the historic barn.

The Discovery Center's metal roof reprises that of the barn, while the exterior Accoya wood cladding is rendered in natural and *shou sugi ban* finishes that alternate yellow and black on the surface of the building. The siding is geared toward the bees in more than coloring: traditional exterior varnish is harmful to pollinators. On the interior, "we tried to hide any plastic and PVC," Amel says, as they're also harmful to the bee population—a sensitivity that extends to the design of the gardens, lawns, orchard, and restored prairie as well.

Using time-tested passive strategies, including a well-insulated envelope, radiant heating and cooling systems, a geothermal field, and photovoltaics, resulted in a 71% EUI reduction from the national average for the building type. A sanitary drain field helps with water conservation and obviated the need for a half-mile-long connection to the municipal sewer system.

In recent years, MSR has embraced COTE criteria as their primary approach to sustainability. "We've set a performance goal for the firm to have all our projects approach regenerative levels by 2026," Meyer says. But it's not only about energy, as the focus on local ecologies in this project demonstrates. Without fail, he says, "design is always front and center." —E.K.

_ ECOLOGY

Mandatory Metrics

Percentage of the Site Area Designed to Support Vegetation: 64
Percentage of Site Area Supporting Vegetation Before Project Began: 96
(Before the project began, the site was dominated by invasive species—including reed canary and aggressive brome grasses—and supported little biodiversity. Transitioning the site back to a suite of native species enhanced biodiversity and offered increased habitat capacity.)
Percentage of Landscaped Areas Covered by Native or Climate Appropriate Plants Supporting Native or Migratory Animals: 50

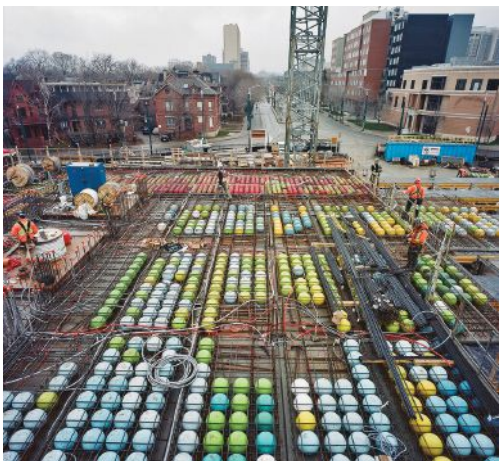
Project Attributes

Architect: MSR Design
Owner: University of Minnesota | Minnesota Landscape Arboretum
Location: Chaska, Minn.
Project Site: Previously developed land
Building Program Type(s): Education—General
Year of Design Completion: 2016
Year of Substantial Project Completion: 2016
Gross Conditioned Floor Area: 7,530 square feet
Gross Unconditioned Floor Area: Zero
Number of Stories: One
Project Climate Zone: ASHRAE 6A
Annual Hours of Operation: 2,236
Site Area: 121,210 square feet
Project Site Context/Setting: Rural
Cost of Construction, Excluding Furnishings: $3.25 million
Number of Residents, Occupants, and Visitors: 30,000

INTEGRATION
COMMUNITY
ECOLOGY
WATER
ECONOMY
ENERGY
WELLNESS
–
CHANGE
DISCOVERY

Daniels Building at One Spadina Crescent
Toronto
NADAAA with Adamson Associates Architects and ERA Architects

NIC LEHOUX

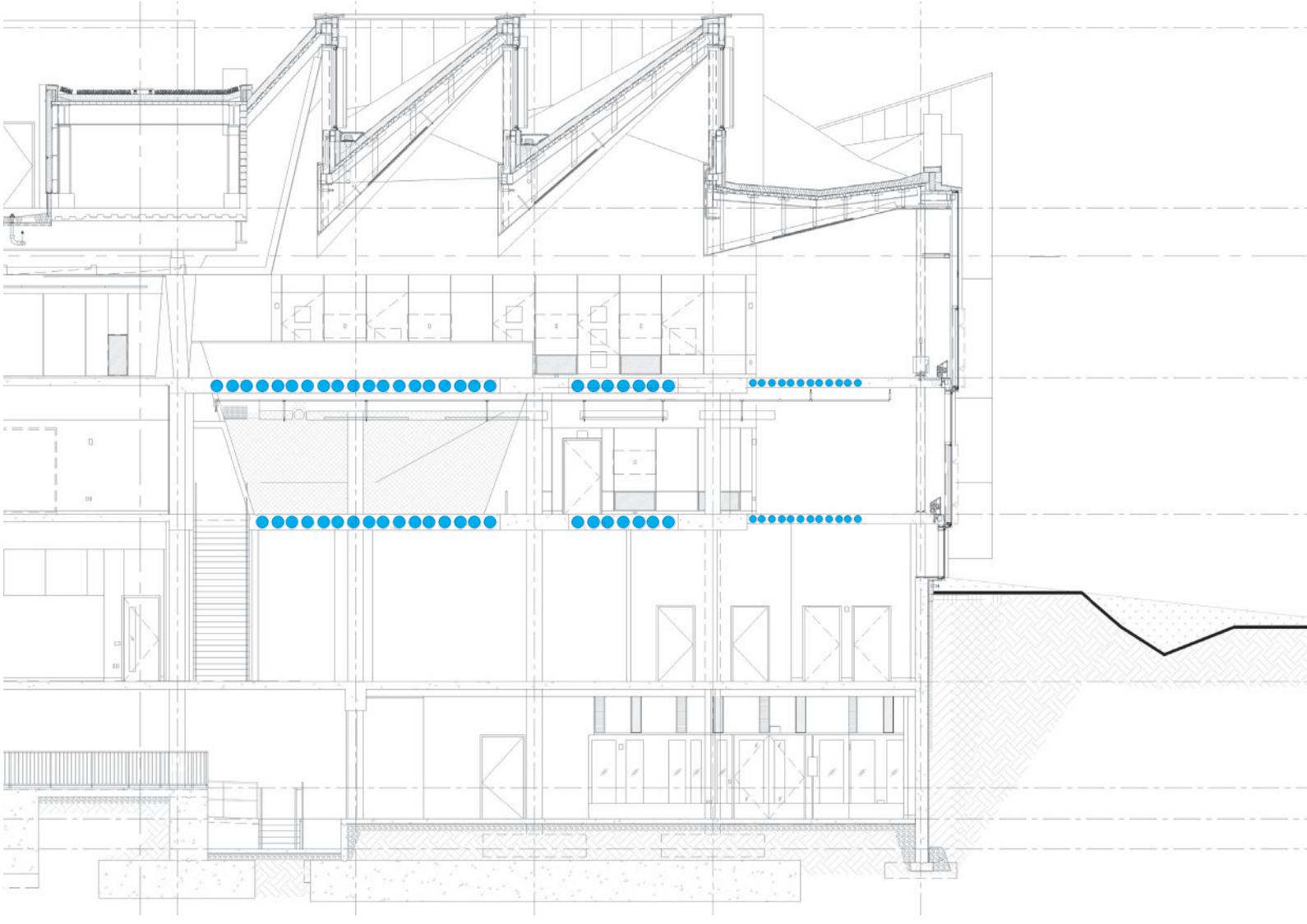


Previous Spread: North façade

Far Left: The addition, at left, and the restored historic façade, at right

Left: Recycled plastic spheres held in place before the concrete is poured to form void slabs

Addition Section, Showing Void Slabs



An architecture school addition shows how careful material choices can augment even that most sustainable of design strategies: building reuse.

The imposing Gothic structure at the center of Spadina Crescent, an island in a circular intersection near downtown Toronto, has played many roles in its nearly 150-year history: At different times it has been a theological college, a military hospital, and an eye bank. It was nearly demolished in the 1960s, and for decades after suffered from neglect—despite being owned by the University of Toronto. Finally, in 2013, the university announced that it would rehabilitate and expand the building to make a new home for its John H. Daniels Faculty of Architecture, Landscape, and Design, hiring Boston-based firm NADAAA to lead the effort, with local firm Adamson Associates Architects as the executive architect.

From the beginning, the firms saw the brief in three parts: make the building sustainable, make it a teaching tool for design students, and knit it back into the surrounding community. The overarching goal was to leverage the existing building's resources wherever possible, while minimizing the impact of new materials.

The revamped building is two pieces stuck together—the original, U-shaped Gothic pile and the sleek-lined addition, which nestles inside the U. ERA Architects, a local firm that specializes in historic preservation, assisted in the rehabilitation of the original structure, which involved installing a modern HVAC system and high-performance windows. The architects played to the building's advantages, including its high ceilings and abundant natural light: "As much as possible, we wanted to maintain those existing features," says Andrew Pruss, a principal at ERA.

NADAAA relied heavily on the original structure's substantial south-facing thermal mass for the addition: "Because the existing building is U-shaped, is serves as insulation that holds the addition in place," says principal Nader Tehrani. "It gives us a very conservative loss of energy." The firm also took inspiration from the high volumes and large windows of the original building for the three-story addition—especially on the top floor. The first two floors are encased in a concrete frame, but the roof is supported by a pair of steel scissor trusses, which create broad, light-filled spaces; the floor and roof slabs are precast void slabs, which have recycled plastic spheres set inside, and use 30% less concrete than traditional slabs.

The addition gains further energy savings by limiting the amount of glazing on the east and west façades. In fact, taken together, the entire structure has a net EUI of only 62 kBtus per square foot per year—40% less than comparable academic buildings.

Given that site is surrounded on all sides by a busy traffic circle, pedestrians once took their lives in their own hands just trying to get to the building. "It was very disconnected from campus and the surrounding neighborhoods," says Marc Ryan, a principal and co-founder of Public Work, which oversaw the landscape renovation for the project. "Part of our agenda was reconnecting it." That meant, first of all, expanding sidewalks and pathways—including a pedestrian walkway between the old building and the addition—so that people can pass through the site. It also meant creating different green spaces around the building, including an expansive lawn on the south side and an 18-foot-tall rise covered in native plant species to the north. "The landscape is a major player in the overall design," says Richard Lee, an associate at NADAAA. "The landscape and the building often seem to be playing off one another." A 365-cubic-meter (96,422-gallon) cistern under the green allows the site to achieve a 100% stormwater retention rate. Several of the pathways are surfaced in a permeable bonded gravel—the sort of innovation intended to showcase the role of new technologies in sustainable design.

The entire building, in fact, offers large and small lessons for the students—from the adaptive reuse of a neglected property to the latest technologies that help minimize the use of resources in construction. "The idea of a pedagogical building is that it's a space for teaching, but also a didactic instrument," Tehrani says. "The whole building is an tool for them to pursue their research." —C.R.

_ RESOURCES

Mandatory Metrics

CO_2 Intensity: 58.74 pounds per square foot

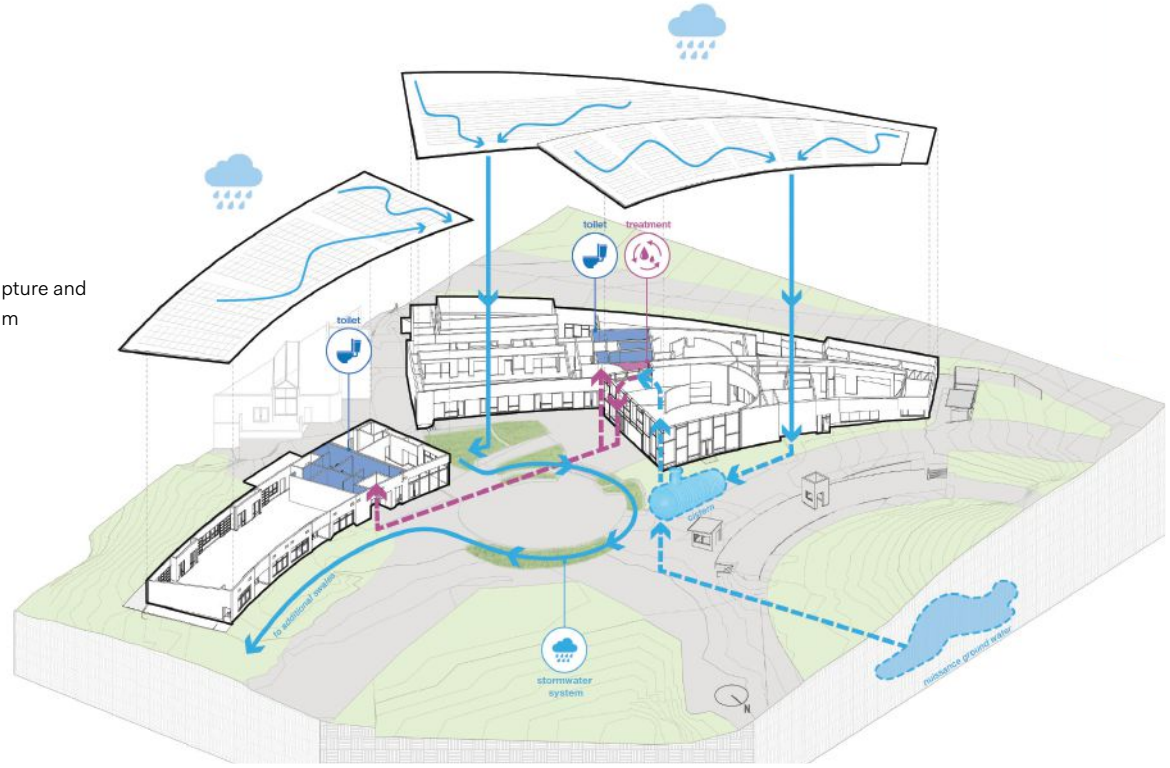
Estimated Carbon Emissions Associated with Building Construction: 74 pounds per square foot

Project Attributes

Architect: NADAAA with Adamson Associates Architects and ERA Architects
Owner: The University of Toronto/The Daniels Faculty of Architecture, Landscape, and Design
Location: Toronto
Project Site: Historic structure or district
Building Program Type(s): Education—College/University (campus-level)
Year of Design Completion: 2017
Year of Substantial Project Completion: 2017
Gross Conditioned Floor Area: 155,000 square feet
Gross Unconditioned Floor Area: Zero
Number of Stories: Four
Project Climate Zone: ASHRAE 6
Annual Hours of Operation: 8,200
Site Area: 123,150 square feet
Project Site Context/Setting: Urban
Cost of Construction, Excluding Furnishings: $51.9 million
Number of Residents, Occupants, and Visitors: 10,000

TOP LEFT: NIC LEHOUX; TOP RIGHT: PETER MACCALLUM, COURTESY THE DANIELS FACULTY

Oregon Zoo Education Center
Portland, Ore.
Opsis Architecture



Rainwater Capture and Reuse Diagram

Plaza with exhibit wing at center and classroom wing at left

By providing 56% of needed potable water through on-site water management (and other green bona fides) this education center teaches visitors as much about sustainability as it does about flora and fauna.

From the beginning, says Opsis Architecture founding partner Alec Holser, AIA, the program for the Oregon Zoo Education Center informed the design team's approach: "Its mission is all about education, so the building became a platform for delivering a message around climate change, habitat preservation, and other issues."

That meant making the center—which is actually two buildings, an exhibit wing and a classroom wing—as sustainable as possible. One obvious place to look for efficiencies in Portland, which has an annual rainfall of 43 inches, or 11 inches above the national average, is water. Fully 75% of the rainwater that falls on the site is managed, either by directing it through a series of rain gardens and bioswales, or—if it falls on the roof of the classroom building—by funneling it into a 10,000-gallon cistern that is topped off by water from an underutilized aquifer beneath the zoo. As a result, rainwater supplies 56% of the water consumed on-site—largely for use in the building's toilets, which double as the primary restroom facility on the west side of the zoo.

_ WATER

Mandatory Metrics

Predicted Annual Consumption of Potable Water for All Uses, Excluding Process Water: 322 kgal/yr (indoor water use), 56% reduction from federal standards
Is Potable Water Used for Irrigation? Yes
Predicted Peak Monthly Consumption of Potable Water for Outdoor (Irrigation) Purposes: 0.17 gallons/sq ft

Encouraged Metrics

Actual Annual Consumption of Potable Water for All Uses: 208,186 gallons
Percentage of Water Consumed On-Site that Comes from Rainwater Capture: 58
Is Graywater or Blackwater Captured for Reuse? No
Percentage of Rainwater that Can Be Managed On-site: 75
Water Quality for Any Stormwater Leaving the Site: 84% of total suspended solids removed from stormwater runoff

Project Attributes

Architect: Opsis Architecture
Owner: Metro
Location: Portland, Ore.
Project Site: Previously developed land
Building Program Type(s): Education—General
Year of Design Completion: 2016
Year of Substantial Project Completion: 2017
Gross Conditioned Floor Area: 19,000 square feet
Gross Unconditioned Floor Area: Zero
Number of Stories: One
Project Climate Zone: ASHRAE 4C
Annual Hours of Operation: 2,920
Site Area: 83,000 square feet
Project Site Context/Setting: Suburban
Cost of Construction, Excluding Furnishings: $18.7 million
Number of Residents, Occupants, and Visitors: 1.6 million

But reducing water consumption is only part of the equation for a truly sustainable structure. To minimize energy use, the center utilizes an air-source heat pump with variable refrigerant flow technology, which allows for localized heating and cooling. Classrooms are fitted with garage-door-like windows, so that in the summer the facility can take advantage of natural ventilation (a red light/green light display next to each window tells users when it is appropriate to open them).

As a result of these strategies—and others such as rooftop photovoltaic cells—Opsis expects the building to be carbon positive, keeping 1.9 pounds of carbon per square foot out of the atmosphere every year.

Opsis didn't stop at making the building sustainable, they also embraced the mandate to make it didactic. "The zoo decided the center's theme is 'small things matter,'" Holser says. So the architects asked themselves: "What are the things we can demonstrate through this building?"

Before getting into any specific features, Opsis wanted to make sure the building didn't project a pessimistic message about the planet's varied environmental threats. "Some of these challenges today are so overwhelming," Holser says. "And because of that, it needs to be a receptive, welcoming, joyful building." Opsis achieved that by blurring the lines between inside and outside—spiraling the two buildings (and an adjacent train station that provides visitors with access to other areas of the zoo) around a central plaza. The arrangement has the effect of encouraging visitors to explore different corners of the facility. Children will find a variety of permanent and rotating exhibits, from nature demonstrations to an insect zoo. For adults, especially those with green thumbs, the Wildlife Garden, an ongoing demonstration project, teaches sustainable lawn and garden skills they can apply at home.

Another outdoor feature, the Turtle Lab, lets visitors watch baby western pond turtles from birth to maturity, after which the animals are released into their natural habitat—a program that demonstrates the zoo's role in promoting the region's threatened species. Helping to direct all this is a full-time official from the U.S. Fish and Wildlife Service—in fact, the Oregon Zoo is one of the only zoos in the country to have one.

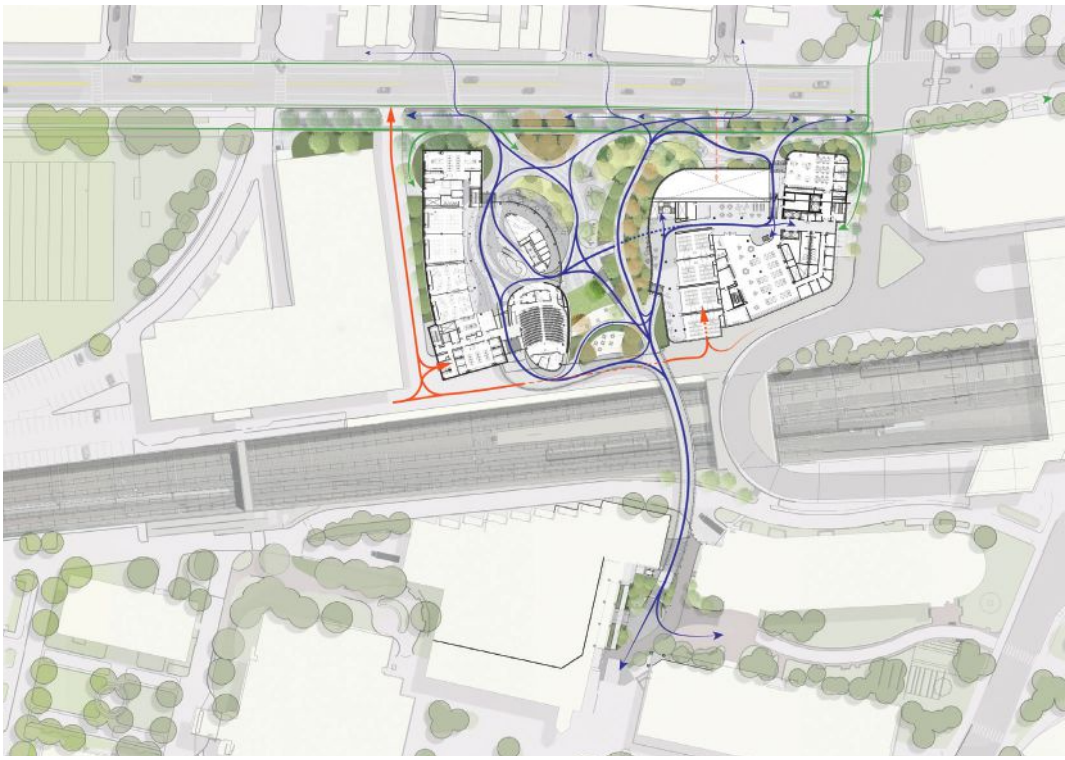
Above all, Holser says, Opsis strove to encourage visitor curiosity and learning by making the center's sustainable design strategies—like the solar panels on the roof of the train station or the rain gardens that filter stormwater—visible to the public. "When they can see it, that encourages people to ask, 'What's that about?'" Minor details, perhaps—but like the center's mantra states, small things matter. —C.R.

Interdisciplinary Science and Engineering Complex
Boston
Payette

COURTESY PAYETTE

Campus Plan

Site Plan Showing Circulation



Previous Spread: View from northwest showing pedestrian bridge over rail line that connects Boston's Fenway and Roxbury neighborhoods

Below: Interior glass walls visually connect labs to circulation and breakout spaces, and to central atrium

A new lab building at Northeastern University proves that sustainability isn't just about energy, it's also about connecting the community through improved transit access and public pathways across the site.

For much of its 121-year history, Northeastern University has been a commuter school, drawing most of its students from the Boston area. But as its profile has risen in recent decades, so has its need for new campus facilities—above all, the sort of first-class labs that mark a nationally ranked research university. Part of that transition is the school's new Interdisciplinary Science and Engineering Complex, located on a brownfield site—a former parking lot—across one of the city's main rail corridors from the campus.

From the beginning, the university wanted a landmark building—not just a home for scientists researching everything from robotics to biophotonics, but a structure that linked together different parts of campus and made a bold statement about the school's future. Payette, the Boston-based firm that won an open competition to design the center, answered that call by designing a broad, low-rising bridge of a building. Open to the public, it serves as both a gateway to the main campus and a link between two Boston neighborhoods, Fenway and Roxbury. It also facilitates access via walking, biking, or mass transit, upon which 89% of building occupants rely.

_ COMMUNITY

Mandatory Metrics

Community Engagement: Stakeholders were involved throughout most of the process
Walk Score: 91

Encouraged Metrics

Estimated Occupants Who Commute via Alternative Transportation (Biking, Walking, Mass Transit): 89%
Estimated Annual Carbon Emissions Associated with the Transportation of Those Coming to or Returning from the Building: 17.1 metric tons

Project Attributes

Architect: Payette
Owner: Northeastern University
Location: Boston
Project Site: Brownfield
Building Program Type(s): Laboratory
Year of Design Completion: 2016
Year of Substantial Project Completion: 2017
Gross Conditioned Floor Area: 236,240 square feet
Gross Unconditioned Floor Area: 10,000 square feet
Number of Stories: Seven
Project Climate Zone: ASHRAE 5A
Annual Hours of Operation: 8,760
Site Area: 122,031 square feet
Project Site Context/Setting: Urban
Cost of Construction, Excluding Furnishings: $165 million
Number of Residents, Occupants, and Visitors: 1,302

While connections to the campus and to the community are critical, Payette wanted to design something even more significant: a truly, holistically sustainable research building."We didn't want to just make a pretty building," says Wesley Schwartz, AIA, the project architect. "If it was going to look exciting, it would have to be more than skin deep."

Early on, the firm recognized that air handling is one of the chief energy demands of a lab building like the Interdisciplinary Science and Engineering Complex. For safety reasons, the air circulated in the labs had to then be vented; it couldn't be recycled elsewhere in the building. So Payette devised a system to use recirculated air as much as possible before it reaches the labs: Fresh air is pumped into perimeter offices, then out into a spacious atrium. The sunlight that enters the atrium through a massive skylight heats the air; as it rises, it is then delivered to the labs before being exhausted. "The atrium is literally the lungs of the building," says Payette president Kevin B. Sullivan, FAIA. "It's a fusion of design and performance."

The system also works to capture and reuse as much heat as possible: A solar wall along the southern side of the top floor captures heat in winter, while a high-efficiency heat recovery system extracts energy before the air is vented out of the laboratories. As a result of these and other strategies—like a vertically oriented brise-soleil that the firm calls a "solar veil"—the complex achieves a 70% reduction in metered energy use against the average for similar research facilities. "These types of buildings use lots of energy," says lead principal Robert J. Schaeffner, FAIA. "So if you can be strategic about energy use, you can have a profound impact on the environment."

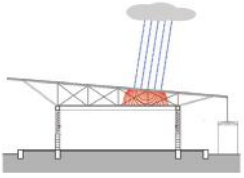
The building also captures 99% of the rainwater coming off its roof, which it uses for restroom facilities—meeting 57% of its flushing demand. Guided by the city's strict requirements for stormwater retention, the site uses rain gardens and bioswales to irrigate native plants—in effect mimicking the wetlands that once covered much of southwestern Boston.

Payette collected massive amounts of data to inform its design. Using parametric modeling and custom compositing software, the design team generated scores of options for details as granular as the width of the slats that make up the solar veil and the circulation capacity of access routes. The firm then fed that data to its engineering partner, Arup, to integrate it into the overall modeling for the building, which in turn shaped the design team's decision making. "That way, we can say we were making informed decisions based on something more than just what we liked," Schwartz says. —C.R.

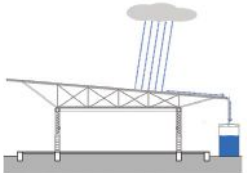
WARREN JAGGER

Asilong Christian High School
Asilong, West Pokot, Kenya
BNIM

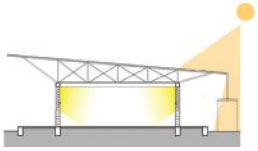
Acoustic Mitigation



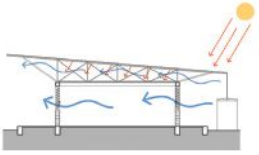
Rainwater Capture



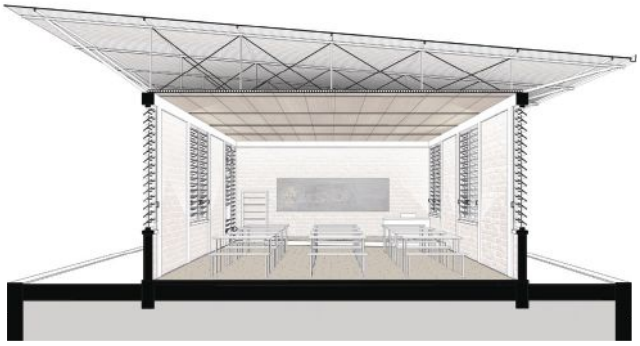
Daylight Study



Ventilation Flow



Classroom Building Section



Vernacular Precedent

Vernacular Precedent

Classroom buildings at Asilong Christian High School

TK CREDIT

Listening to locals and training them to work as craftspeople during construction ensures that this net-zero school campus will enact lasting change, not just on individual students, but on the region as a whole.

There's a bit of irony to be found in the metrics for the Asilong Christian High School: "Walk Score is not supported in this community," reports Kansas City, Mo.–based BNIM, which designed the campus of single-story structures on a greenfield site in Asilong, Kenya. The irony lies in the fact that walking is the primary means of transportation in the area where the project is located, more than 230 miles northwest of the nation's capital, Nairobi.

For the past decade, BNIM principal Laura Lesniewski, AIA, and associate principal Samuel De Jong, AIA, have been making yearly trips to the region, where sustainability is a given: "There's no municipal infrastructure whatsoever," Lesniewski says, "so net zero is what it is." A lack of available utilities didn't affect the goals for the project; instead, it inspired the team to set a high bar in bringing change to the community. "[Nearby] towns like Kapenguria and Kitale are on the grid," De Jong says, noting that the team wanted to ensure that all the Asilong Christian High School students—there will eventually be 320 of them—had facilities that would offer "the same education that students are getting in larger towns."

To start with, that meant generating energy via a 2-kilowatt solar array that powers electronic teaching aids such as laptops, tablets, and e-readers, as well as lighting for evening hours.

The next hurdle was water: "We did some early climate data research," Lesniewski says, but "we learned more from talking with the local people than from any available online data." What they found is that access to clean water in the area is diminishing: The eastern edge of the campus is a now-dry river bed; upstream development and changing climate patterns, including extreme heat and drought, have rendered water management a critical problem. BNIM's design includes an on-site well with a solar-powered pump, which provides all necessary potable water. On-site gardens provide vegetables for meals prepared at the school, and native plantings mitigate erosion.

For the structures, the quality of local materials and construction techniques was a concern, Lesniewski says, but "we didn't want to divorce ourselves from that. We tried to improve the quality of the [local] bricks because it is a very natural material to use." Both bricks and concrete for the new structures were prepared on-site. "We're building off familiar techniques, but refining them to make them safer, give the buildings more longevity, and make them respond better to the climate," De Jong says.

It's common for civic buildings in the region to utilize wattle-and-daub construction with a metal roof, which informed the design of the new buildings: BNIM's 24-foot-wide structures are spanned by lightweight metal trusses that support shallowly sloped shed roofs. Walls consist of a concrete frame on 7-foot centers, which are filled by brick or wicker screens. The brick infill was formed using a confined masonry technique: The bricks were laid first, and the concrete poured around them to provide a more solid, integrated structure.

Raising the roof plane created a separation between classroom ceilings and the corrugated metal spans that allow ample cross-ventilation. Many local structures with metal roofs can't be used when it rains, as the sound of water hitting the roof renders the spaces acoustically inviable. Here, locally sourced woven papyrus on the ceilings mitigates the noise. Steel components—the rebar, lightweight trusses, and metal roofing—came from Kitale, about three hours away. "They bring it in pieces and it's welded on-site to reduce transportation costs and as an opportunity to train people in welding," De Jong says.

The school's influence is meant to be far wider than just its local community in the northwest corner of Kenya. "This [can be] a model for stronger, more durable, and robust structures that could be used around the country," Lesniewski says. —E.K.

_ CHANGE

Mandatory Metrics

Percentage of Project Floor Area, if Any, that Represents Adapting Existing Buildings: Zero

Anticipated Number of Days the Project Can Maintain Function Without Utility Power: Indefinitely

Encouraged Metrics

Percentage of Power Needs Supportable by On-Site Power Generation: 133

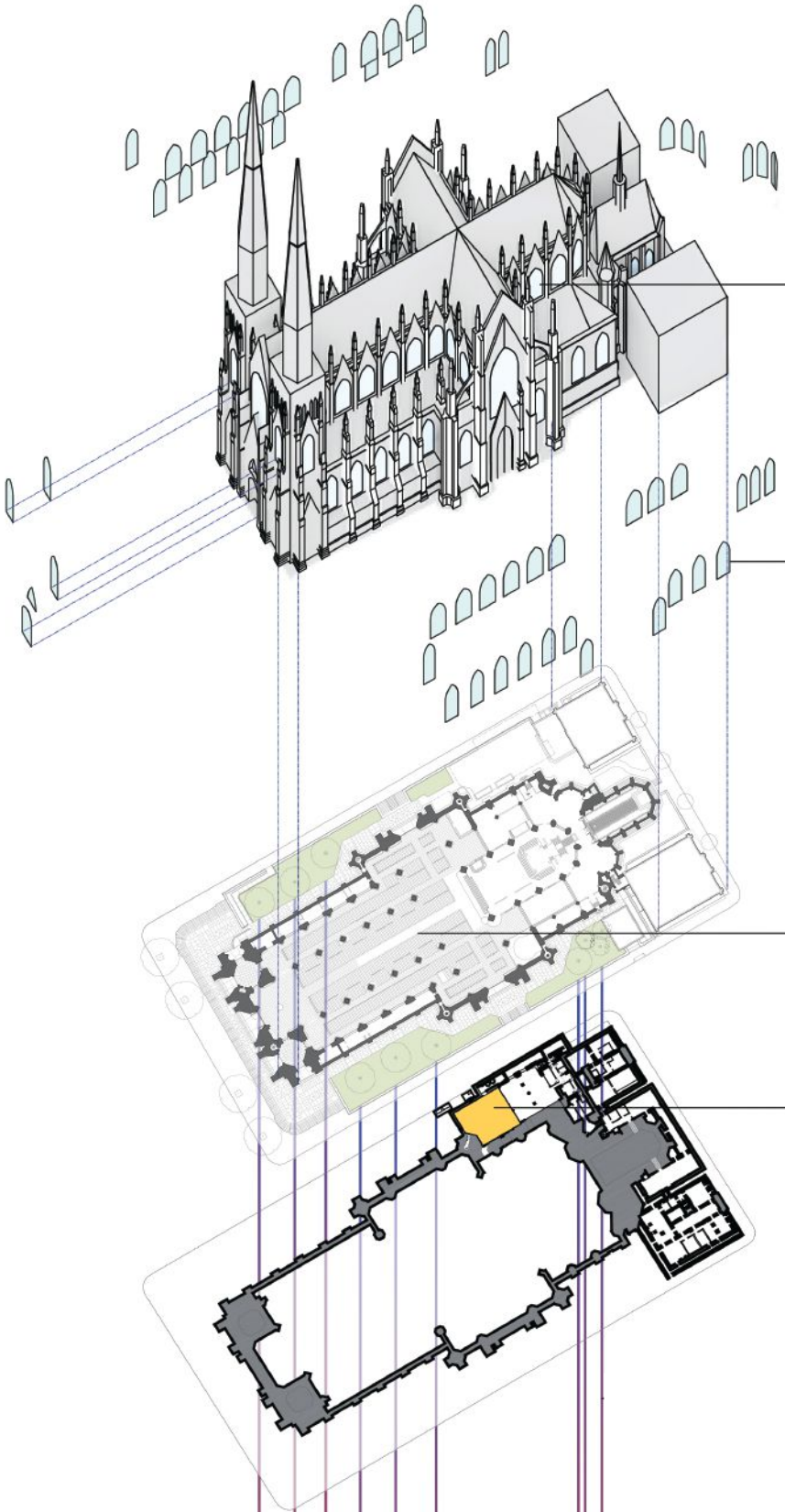
Project Attributes

Architect: BNIM
Owner: Asilong Christian High School
Location: Asilong, West Pokot, Kenya
Project Site: Greenfield (previously undeveloped land)
Building Program Type(s): Education—K–12 School
Year of Design Completion: 2018
Year of Substantial Project Completion: 2018
Gross Conditioned Floor Area: Zero
Gross Unconditioned Floor Area: 13,782 square feet
Number of Stories: One
Project Climate Zone: 2B—International Climate Zone Conversion Chart
Annual Hours of Operation: 1,560
Site Area: 887,429 square feet
Project Site Context/Setting: Rural
Cost of Construction, Excluding Furnishings: $300,386
Number of Residents, Occupants, and Visitors: 61

COURTESY BNIM

St. Patrick's Cathedral
New York
Murphy Burnham & Buttrick Architects

Axonometric Showing
Sustainable Systems



A series of largely incremental interventions demonstrates that even the most sacrosanct of historic structures can benefit from a sustainable overhaul.

A Gothic Revival cathedral in midtown Manhattan hardly seems a candidate for a COTE award, but a more-than-decade-long restoration of the James Renwick Jr.–designed St. Patrick's Cathedral by New York–based Murphy Burnham & Buttrick Architects (MBB) transformed the 19th-century structure into a 21st-century sustainable design success story. The outcome seems almost miraculous: combining better insulation and other renewable strategies to reduce annual operating costs, increase the number of visitors, and still respect the integrity of a historic landmark.

As one might expect of the Catholic Church—a client with a 2,000-year history—the restoration required an extended period of time: MBB began working at the cathedral in 2007, developing a needs assessment for the late Cardinal Edward Egan, who retired in 2009. Restoration work began in earnest in 2011, and led to the renewal of every surface and system within the immense structure.

While the cathedral is the centerpiece of the Roman Catholic Archdiocese of New York (and, by extension, is often considered the center of American Catholicism), MBB's approach wasn't entirely orthodox: "We had this historic building, and we had to figure out what we could do to make it more energy efficient," says MBB principal Jeff Murphy, FAIA. "It wasn't methodical in the sense that we knew the steps we had to take." In other words, the architects had to invent the process as they went along. They began by researching the history of the structure, and learned that it originally incorporated features that would today be considered sustainable.

When Renwick started designing the building in 1853, for instance, his original sketches showed two grooves in the tracery that suggested it was designed for both protective glazing and the existing stained glass. "A lot of the stained glass was so damaged that there were sizable holes that were letting outside air in," Murphy recalls. So, the restoration fixed those broken pieces and installed protective glazing, which greatly enhancing the thermal performance of the windows.

The main doors on Fifth Avenue posed a considerable problem for the integrity of the building envelope. Data showed that 30% fewer people came into the cathedral when these doors were closed, which led the church to adopt a literal open-door policy. "They were basically heating the outside in the winter and cooling the outside in the summer," Murphy says. MBB designed new glass doors that provide a necessary thermal break while maintaining open sight lines that attract more than 5 million visitors each year.

To generate power, the architects and engineers decided to add 10 geothermal wells, drilled as deep as 2,200 feet into Manhattan's schist. Fortunately, gardens on both the north and south side of the structure allowed this work to take place immediately adjacent to the footprint of the building, rather than beneath it. After the heavy construction was completed, the gardens were updated to include new native plantings. Updates to the mechanical system also needed to respect the building's historic fabric. "[Our MEP group was] very clever in helping us utilize existing infrastructure," Murphy says. "There were radiators for the steam heating system behind the pews and against the walls and they were able to fit most of the fan coil units we needed in these existing boxes." Beyond extending the useful life of a building whose massive structure embodies a significant amount of carbon, the many incremental changes resulted in a remarkable 29% reduction in both annual energy usage and the associated operating cost.

Originally consecrated in 1879, St. Patrick's Cathedral had last been renovated in 1949, making MBB's project a once-in-several-generations opportunity. "We touched every surface, inside and out," Murphy says. "We replaced every system—rewiring and replumbing the place." The effort shows—and, where appropriate, doesn't. As a result, the cathedral will remain a viable place of worship, inspiration, and refuge for decades to come. —E.K.

_ ECONOMY

Mandatory Metrics

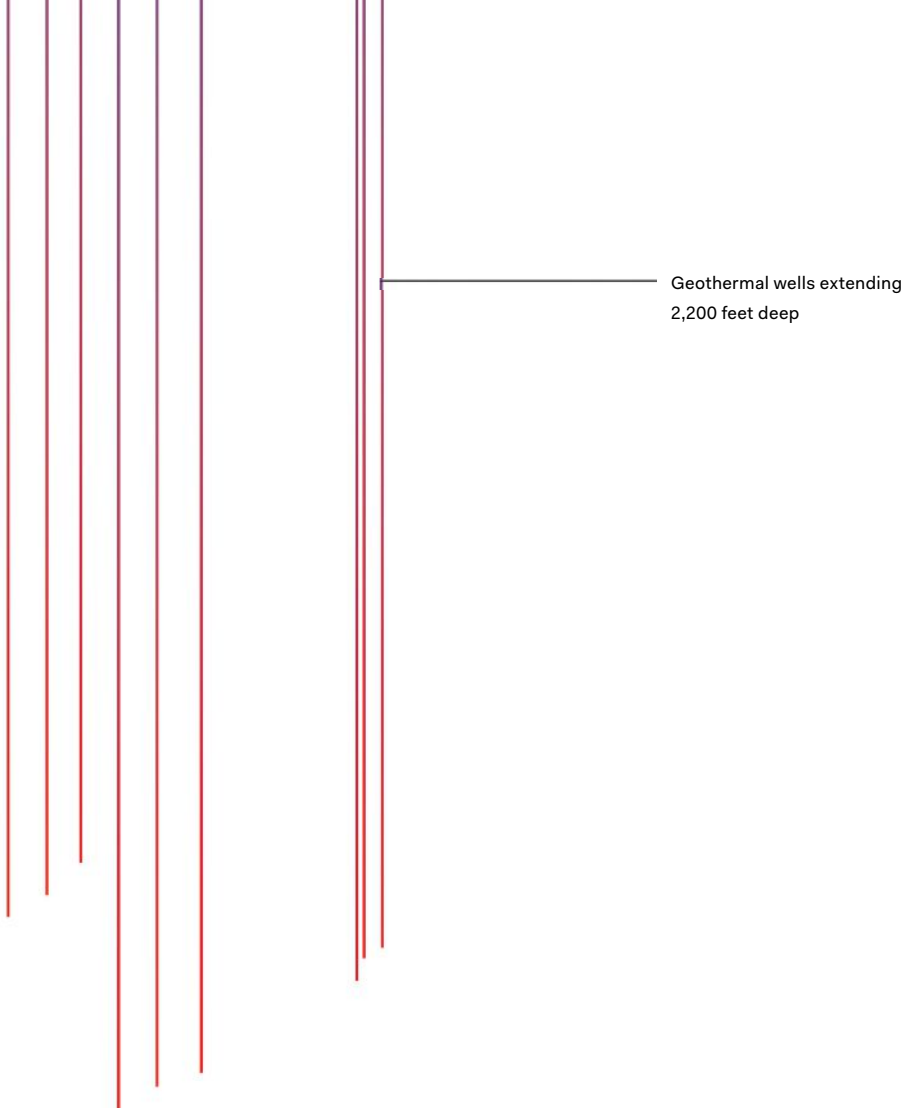
Cost Per Square Foot: $1,195

Encouraged Metrics

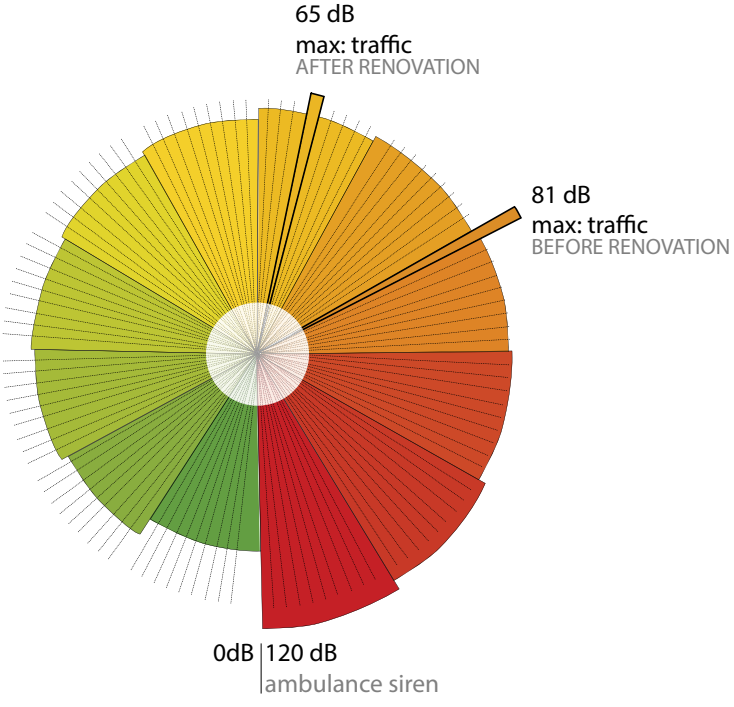
Estimated Annual Operating Cost Reduction: 29% (based on utility bills prior to construction)

Project Attributes

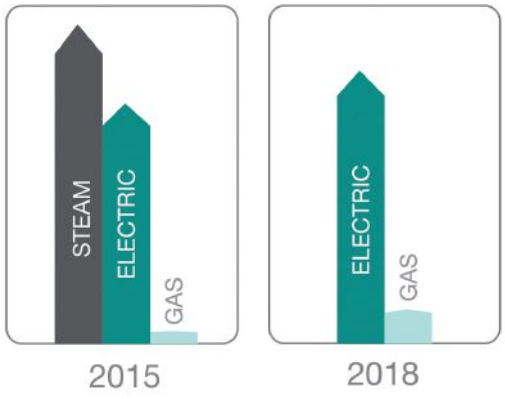
Architect: Murphy Burnham & Buttrick Architects (MBB)
Owner: Trustees of Saint Patrick's Cathedral
Location: New York
Project Site: Historic structure or district
Building Program Type(s): Religious Worship
Year of Design Completion: 2015
Year of Substantial Project Completion: 2017
Gross Conditioned Floor Area: 148,076 square feet
Gross Unconditioned Floor Area: Zero
Number of Stories: Eight
Project Climate Zone: ASHRAE 4A
Annual Hours of Operation: 6,935
Site Area: 92,000 square feet
Project Site Context/Setting: Urban
Cost of Construction, Excluding Furnishings: $177 million
Number of Residents, Occupants, and Visitors: 5 million



Noise-Level Analysis Diagram



Fuel-Use Analysis Before/After Renovation



Opposite: Structural glass in front of stained-glass panels and separating the Lady Chapel from the nave provide thermal and acoustic insulation

ELIZABETH FELICELLA

2018–2019 COTE Top Ten for Students

A collaboration with the Association of Collegiate Schools of Architecture, the COTE Top Ten for Students program recognizes 10 projects from North American schools that exemplify COTE's 10 measures of sustainability. Now in it's fifth year, the program offered winners a stipend to attend the 2019 AIA Conference on Architecture and facilitated paid internships at sustainably minded firms.

1. Transfusion: Tapering Tucson
Students: Cole Robinson and Michael Horan
Faculty Sponsors: Ulrike Heine, David Franco, and Daniel Harding
School: Clemson University

This scheme explores how multi-occupant residential buildings designed with a focus on site-specific ecologies can improve the health and wellness of residents in Tucson, Ariz.

2. Après le Déluge
Students: Will Letchinger and Jonathan Wilkinson
Faculty Sponsor: John Casbarian, FAIA
School: Rice University

Pairing historic preservation with water management, this project proposes design solutions to prevent climate change–related flooding, and preserve the existing ecosystem, at the Château de Chambord in France's Loire Valley.

3. Dyads
Students: Thomas Valcourt, Karl Greschner, and Philippe Bernard
Faculty Sponsors: Claude Demers and André Potvin
School: Université Laval

This scheme would transform an existing parking lot at Université Laval in Quebec City, Canada, into a 300,000-square-foot collaboration hub for the schools of architecture, design, urban planning, and visual arts.

4. Acclimate
Students: Philip Riazzi and Cameron Foster
Faculty Sponsors: Ulrike Heine, David Franco, and Daniel Harding
School: Clemson University

The Acclimate project turns an existing, 500-spot parking garage in Bremerton, Wash., into a space for public programming. A second phase would add four residential towers.

5. Wallingford W2E
Students: Sean Anderson, Tobias Jimenez, and Haley Ladenburg
Faculty Sponsor: Omar Al-Hassawi
School: Washington State University

Wallingford W2E offers a sustainable approach to waste management in Seattle in the form of a small waste-to-energy plant next to an existing waste-transfer station. The plant would use the waste to generate clean energy for the surrounding community.

6. Healing Habitats: Innovation Center for Disease and Water Management
Students: Catherine Earley, Elena Koepp, and Sabrina Ortiz
Faculty Sponsor: Brook Muller
School: University of Oregon

This proposed 80,000-square-foot mosquito research facility in Dar es Salaam, Tanzania, examines how water-management strategies can limit the spread of diseases such as malaria, while also addressing the economic and environmental resilience of the surrounding community.

7. "The Happy Land" | An Antiquarium for Torre Annunziata
Student: Haley Teske
Faculty Sponsors: Bradford Watson and Jaya Mukhopadhyay
School: Montana State University

This proposal presents a socially and environmentally sustainable approach to heritage tourism. It would draw tourists (and their wallets) to the Italian town of Torre Annunziata to see Villa Oplontis, a Roman ruin preserved by the 79 A.D. eruption of Mount Vesuvius, without inviting the destruction of the landscape.

8. Shore of a Hundred Islands
Students: Viviani Isnata and Maria Ulloa
Faculty Sponsor: Evan Jones and Margaret Ikeda
School: California College of the Arts

The low-lying Maldives, a nation of more than 1,000 islands in the Indian Ocean, is particularly vulnerable to sea level rise. The students responded to the growing risk of inundation by designing a self-sustaining, literally buoyant, community. Their scheme addresses problems of water collection, food production, and wastewater treatment that come with life on the water.

9. Coolth Capitalism
Students: Peter Lazovskis and Thomas Schaperkotter
Faculty Sponsor: Matthew Soules (University of British Columbia)
School: Harvard University Graduate School of Design

Coolth Capitalism proposes nine mass-timber towers for downtown Los Angeles, designed to both maximize profit for developers and to demonstrate how that financial model can be paired with hyper-efficiency to fuel social and environmental sustainability across the supply chain.

10. The Fly Flat
Students: Cynthia Suarez-Harris, Ledell Thomas, and Kennia Lopez
Faculty Sponsors: Shelly Pottorf, Shannon Bryant, and April Ward
School: Prairie View A&M University

This scheme creates a pocket neighborhood of infill housing in Houston's Independence Heights—the first incorporated black municipality in Texas—that also explores solutions for economic, social, and environmental resilience.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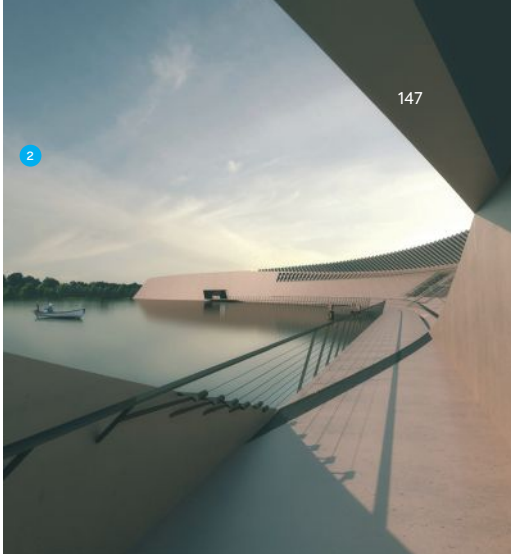
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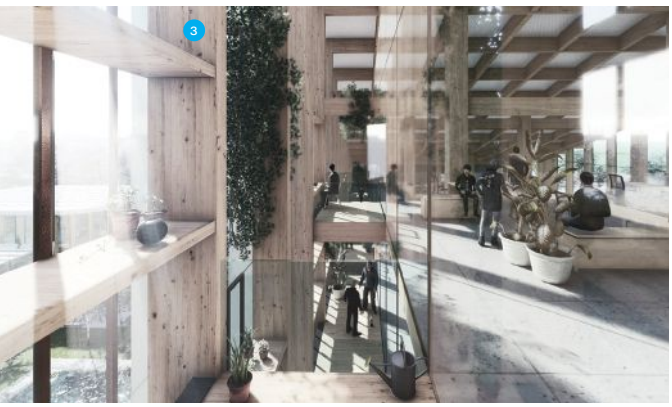
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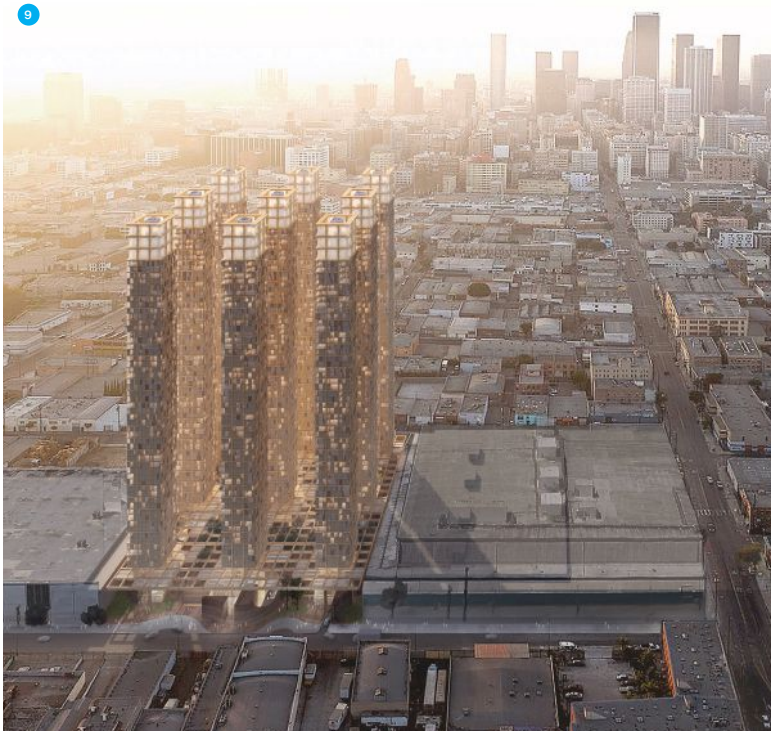
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Editorial: Et in Suburbia Ego

I moved to the burbs last month, and since then my dog Mortimer and I have established an evening ritual that would have been impossible at our old row house on Capitol Hill. The new place is a split-level in a 1960s enclave designed by early Washington, D.C.–area Modernists Keyes, Lethbridge & Condon, who sited 275 understated houses in a raw woodland landscape. In place of a Kentucky bluegrass lawn, our front door opens directly onto trees and undergrowth, providing excellent cover as we sit on the stoop at sundown and watch the local deer parade by. They come startlingly close, a few yards away, drawn to corn that a neighbor leaves out for them. Mortimer, who is 11, doesn't chase the deer the way he would have when he was younger, but from the moment the rustling leaves signal their arrival, his body tenses with a hunter's adrenaline. I imagine it's the highlight of Mortimer's day. It certainly is one of mine.

The primary reason for the move was pragmatic: getting my partner closer to his job on the outskirts of the metro area. In that regard it's already a success. His old, hour-long travel time has been cut in half. Mine has increased from roughly 20 minutes to slightly over 30 on a good day. After a decade having geography in my favor, it's a fair trade—the kind of compromise, I suppose, upon which healthy relationships are built. On the flip side, neither of us has adjusted yet to the cultural and social differences. We'd both been urbanites since college, and like many in our generation (the skeptical Xers), I grew up idolizing the city as edgy and meaningful, and decrying suburbia as bland and artificial. The prejudice lingers, having been reinforced along the way by the argument that higher population densities are more sustainable.

So it's hard to shake the feeling that moving to suburbia makes me a traitor to culture and climate. Conversely, I fear that my antipathy to it is just rank snobbery and reflexive tribalism. While McMansions and big-box stores will never be my thing, I now see how one can settle the perimeter in relatively healthy ways: Keyes et al.'s respect for the natural order—in the form of largely undisturbed topography, native forest plantings, buried power lines, dry swale water management, and so on—strikes me as an imitable, potentially virtuous act.

As a committed neurotic, I weighed the pros and cons *ad nauseam*—fretting over which setting, city or suburb, would prove more resilient in the face of extreme weather (it's a crapshoot), and rating the potential mitigatory effects of installing solar panels on the roof and trading my gas guzzler for an electric car (yes to both, as finances, and my partner, permit). Broadly speaking, architects are making similar judgments as they design for life on a hotter planet. It's no exaggeration to say that civilization depends on choices the profession—and society in general—makes in the next decade or so. For my small part, the deed is done: We've signed a 30-year fixed mortgage, moved all of our stuff across town, and sold the row house to a nice young couple who, their real estate agent avows, will respect its quirky Queen Anne character. Goodbye, walks to the corner store. Hello, walks along the stream that runs behind our lot. The trade-off, I hope, will be worth it—Mortimer certainly seems to think so—and the climate, I'm calculating, would agree.

STEPHEN VOSS

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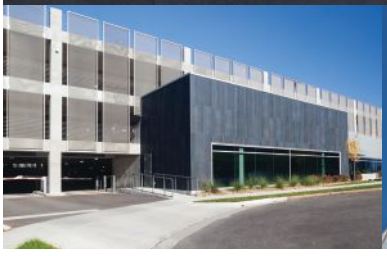

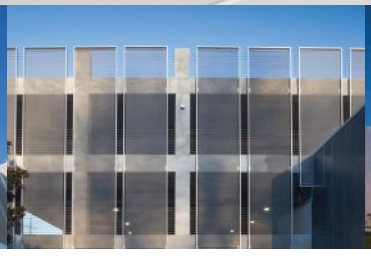


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