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The 2018 AIA COTE Top Ten


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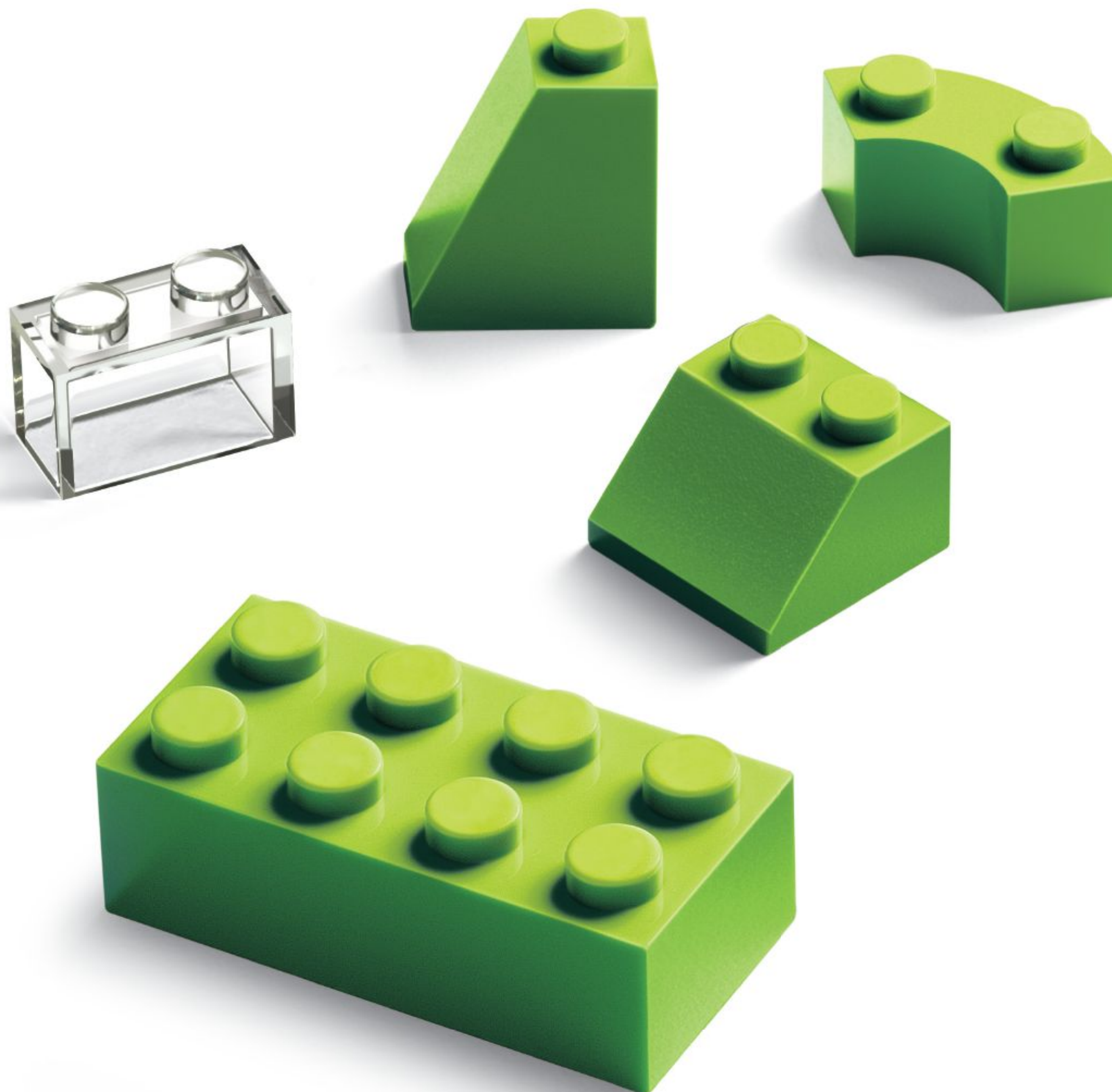

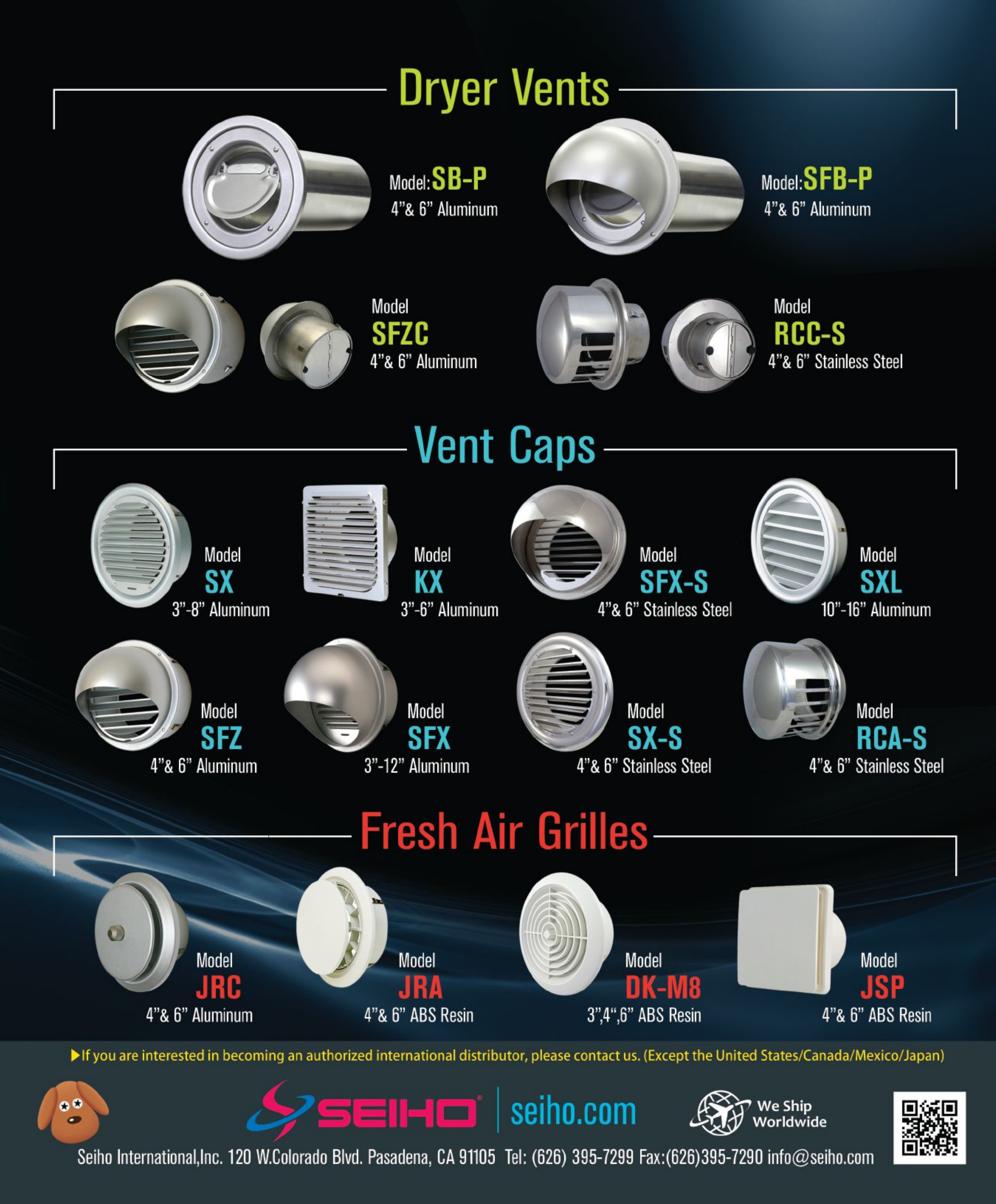
Dryer Vents
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Model:SFB-P
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Model
SFZC
4"& 6" Aluminum
Model
RCC-S
4"& 6" Stainless Steel
Vent Caps
Model
SX
3"-8" Aluminum
Model
KX
3"-6" Aluminum
Model
SFX-S
4"& 6" Stainless Steel
Model
SXL
10"-16" Aluminum
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SFZ
4"& 6" Aluminum
Model
SFX
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Model
SX-S
4"& 6" Stainless Steel
Model
RCA-S
4"& 6" Stainless Steel
Fresh Air Grilles
Model
JRC
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DK-M8
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Volume 107, number 11. November 2018.
On the cover: Ortlieb's Bottling House, the 2018 AIA COTE Top Ten Plus winner by KieranTimberlake; photo by Jason Fulford.

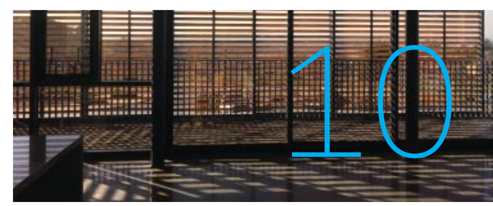

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Photo: Jeremy Bittermann, Joel B Sanders Agency
MAKING SPACES BEAUTIFUL
SOMETIMES MEANS LETTING
THE BEAUTY IN.


SIERRA PACIFIC
WINDOWS THAT
NEVER COMPROMISE

MARK SEELEN; COURTESY TASCHEN

Sum of Parts

In a 2,528-page volume published last month, architect Rem Koolhaas, HON. FAIA, distills the design of buildings into pieces of the whole: the floor, wall, ceiling, roof, door, window, and fireplace, among others. *Elements of Architecture* (Taschen, 2018) builds on Koolhaas' earlier publication and exhibition for the 2014 Venice Architecture Biennale, which originated in a Harvard Graduate School of Design research studio. Featuring a bold palette and layout by designer Irma Boom, *Elements of Architecture* includes essays by and interviews with Koolhaas, architect Manfredo di Robilant, and architect Werner Sobek, among others. —SARA JOHNSON

> *Read more about* Elements of Architecture *at bit.ly/KoolhaasElementsBook.*

GREG STORRAR

The Best of the Brits

In early fall, the Royal Institute of British Architects announced the winners of a trio of big awards: the Royal Gold Medal, the Stirling Prize, and the Stephen Lawrence Prize, the latter two of which honor the U.K.'s best new building and a project with a budget of less than £1 million (about $1.3 million), respectively. Nicholas Grimshaw, the Gold Medal recipient, founded his award-winning London-based firm in 1980. Two other London firms took home the balance: Bloomberg, London by Foster + Partners won the Stirling, and the Stephen Lawrence went to Old Shed New House in North Yorkshire (shown) by Tonkin Liu Architects. —SARA JOHNSON

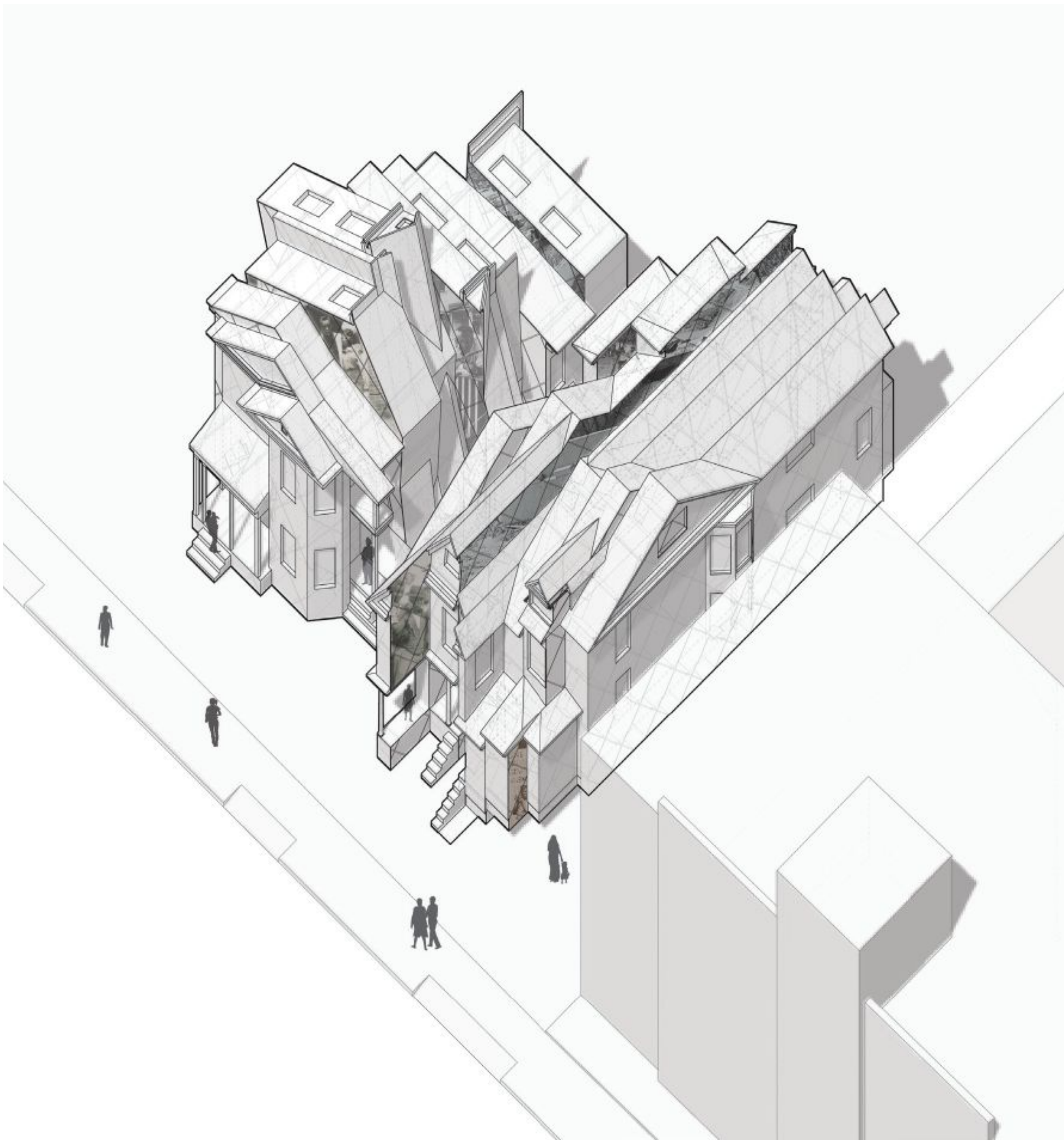
> *Read more about this year's RIBA Gold Medal at bit.ly/RIBAGold19, and the Stirling and Stephen Lawrence prizes at bit.ly/RIBAStirling19.*

CRISTOBAL PALMA

Top of the Class

This year's Mies Crown Hall Americas Prize winner is composed of 11 buildings, connected by both covered and open-air pathways. Designed by Lima, Peru–based Barclay & Crousse, Edificio E contains office and lecture space for the Universidad de Piura. "Responding to the harshness of the sun and extreme dry heat of the savanna landscape of northern Peru, the design creates a dense inner world of unexpected softness and openness shrouded by porous concrete screens," said jury chair Ricky Burdett in a press release. The biennial award was announced at a ceremony in October in Chicago. —SARA JOHNSON

> *Visit ARCHITECT's Project Gallery for more images of Edificio E at bit.ly/MCHAPEdificioE.*



SEKOU COOKE

Building Compositions

Graffiti-lined walls welcome visitors to New York's Center for Architecture, currently exhibiting "Close to the Edge: The Birth of Hip-Hop Architecture " through Jan. 12. Showcasing installations, completed buildings and proposed developments, façade studies, and academic work, the exhibition provides evidence for the existence and significance of hip-hop architecture, as influenced by the musical genre and cultural movement. Curated and designed by Syracuse University assistant professor Sekou Cooke, the show includes Cooke's own "3D Turntables: Remixing Hip-Hop Architectural Technology" (2017, shown). —KATHARINE KEANE

> *To read more about "Close to the Edge: The Birth of Hip-Hop Architecture," visit bit.ly/ARHipHopArch.*

Best Practices: Maximizing a Trade Show or Conference

TEXT BY LINDSEY M. ROBERTS

Conferences and trade shows offer opportunities to network, learn skills, and preview new products and technologies. But to get the most from these events, architects should be deliberate with their time and efforts. Here, show organizers and design practitioners offer tips for attendees.

Choose Wisely

Before setting foot in a convention center, architects must first decide how many and which events to attend in a given year. According to Christopher Gribbs, ASSOC. AIA, managing director of conference strategy and operations for the AIA, designers should attend one national event annually, plus local events throughout the year. National events offer opportunities to learn from the best in the country, while local events help "build community ties that will support your career every day," he says. Find the events that "relate most to the work you do and aspire to be involved with," he adds, and then sign up early to attend the best sessions.

"[I] got to experience a different city and hear different perspectives that you might not get from a local venue."

—Heather Young, AIA, partner, Fergus Garber Young Architects

Kate Hurst, senior vice president of conferences and events for the U.S. Green Building Council, which hosts the annual Greenbuild show, agrees that most architects and designers attend between two and four conferences a year, but that number could be higher for architects with business development responsibilities in their firm.

Plan Ahead

To reap all the benefits of a conference or trade show, Hurst recommends approaching these events as one would a client meeting. "Just like any project that you take on, think through all of your objectives and all of your goals," she says. "[Often] people forget to think about this until they get on site."

Though it will take time, prospective attendees should check out the conference schedule to reserve sessions and create an online calendar before arriving on-site, Hurst says. At large conferences, in particular, it is easy to be distracted without a plan in place. That said, keep an eye on social media during the event to see which speakers or topics are hot. "Some websites can be overwhelming with all the information, so I recommend following all of the social media handles," she says. "It distills the information down."

For those who also attend events for CEUs, planning ahead is even more important. Hurst says that Greenbuild programming is designed for attendees to get all the CEUs necessary to maintain their LEED credentials, but it is critical to reserve sessions early, particularly if they feature renowned experts. "If you preschedule, you can make sure you don't miss what you want to see," she says.

Network, Network, Network

One primary reason to attend industry events is networking. "[You can] multitask and do half a dozen emails and check on some of the feeds that you're following," says Heather Young, AIA, a partner at Palo Alto, Calif.–based Fergus Garber Young Architects, but "is that really the best use of your time in a conference in a few down moments? Or is it the opportunity to engage with someone who is sitting next to you or to follow up with a speaker you heard?"

This year, Young attended a conference in Budapest, Hungary, hosted by local architectural software developer Graphisoft, where she met other users from Europe, Asia, and South America. "I not only had the chance to interact with a different group of people, but got to experience a different city and hear different perspectives that you might not always get from a local venue," she says. Young still benefits from those relationships, following up with them when she wants fresh ideas on a problem.

Gribbs echoes Young's sentiment: "Talk to your neighbor in a class, say hello to someone in the Starbucks line, and attend conference … receptions and parties." It is often those serendipitous interactions that bear the most fruit.

> *For more tips on making the most of a trade show or conference, visit bit.ly/ARConferences.*


ORANGERIE


SWA with SkyDeck®

Detail:
Pendleton West's Acoustical Wall System

TEXT BY TIMOTHY M. SCHULER

In designing a 1,625-square-foot rehearsal hall as part of an addition to Wellesley College's Neo-Gothic Pendleton West arts building, KieranTimberlake was inspired by the wooden sounding box of violins and other instruments. The double-height space is wrapped almost entirely in a custom wood acoustical wall system, developed in collaboration with Cambridge, Mass.–based Acentech, that essentially creates a "box within a box" within the concrete structure.

From the outside in, the building's concrete shear walls support an insulated metal-stud frame sheathed with gypsum wallboard. Affixed to the gypsum wallboard are vertical furring members and 2-inch-thick, fabric-wrapped, sound-absorbing, fiberglass panels, the latter of which attach with aluminum panel cleats. The furring members are crossed with horizontal nailers, creating a 2.25-inch airspace between quarter-sawn white oak slats and the sound-absorbing panels.

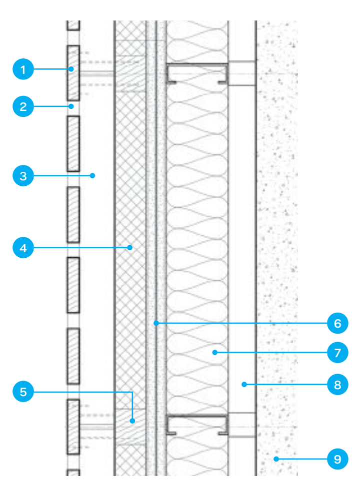
Using hand calculations and 3D modeling, KieranTimberlake built a prototype of the wall system that it then took to Acentech's office for acoustic modeling and experimentation with variables such as airspace depth, acoustical panel thickness, and wood-slat width and spacing. Finding the right combination of parameters that would perform the best acoustically is "a little bit of a dark art," says KieranTimberlake principal Tim Peters, AIA.

The testing proved invaluable. The designers learned that the upper volume of the rehearsal hall needed to reflect more sound; as a result, in that area, they closed the 1-inch gaps between slats with a solid plywood backer in the walls, eliminating the need for the fabric-wrapped acoustical panels.

CDD Custom Millwork, in Norwich, N.Y., assembled the system mostly in situ, which, Peters says, enabled them to align the panels with adjacent conditions, such as doors and windows, and coordinate with other trades on integrated components, such as airflow plenums and utility enclosures. "At the end of the day, it really worked out," he says. "The stars aligned, and we had very few hiccups."

1. 3.5" × 0.75" white oak slats
2. 1" airspace
3. 2.25" horizontal wood furring (24" o.c.)
4. 2" fabric-wrapped fiberglass panel
5. 2" vertical furring (22.5" o.c.)
6. Gypsum wallboard
7. Metal stud frame with insulation
8. 2" cavity
9. Concrete shear wall

Plan Section



MICHAEL MORAN/OTTO

> *To read more about the design, prototyping, and installation of Pendleton West's acoustical wall system, visit bit.ly/ARPendletonW.*

Next Progressives: Spiegel Aihara Workshop (SAW)

EDITED BY KATHARINE KEANE

Location:
San Francisco

Year founded:
2014

Firm leadership:
Dan Spiegel, AIA, and Megumi Aihara

Education:
Spiegel: B.A., Stanford University; M.Arch., Harvard University Graduate School of Design (GSD); *Aihara:* B.A., Brown University; M.L.A., Harvard GSD

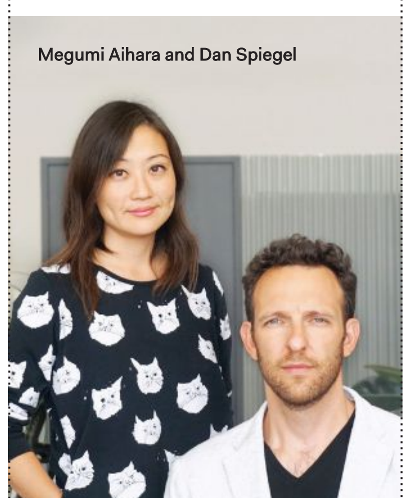
Firm size:
Six-ish

Mission:
Our practice is rooted in a hybrid of architecture and landscape architecture, allowing us to work across scales—from the tactile object to the city—and across timelines—from the immediate to the ecological—at the onset of a project.

Origin of firm name:
We usually go by our acronym, SAW. It is easier to spell than our names, is only shared with one horror film franchise, invokes a tool used for construction, and alludes to our collaborative, iterative design process.

Favorite project:
Low/Rise House was our first built work—completed before our office was officially founded—and became the basis for much of our understanding about design and construction. Our focus was simultaneously very narrow—on family, details, context—and broad—the trajectory of suburban housing in the United States. While the project is a specific response to a number of unique conditions, our intention was always to create a new residential prototype based on variable densities of inhabitation.

Second favorite project:
Our 2017 competition entry for Harvey Milk Plaza in San Francisco. It's a loaded site, full of pragmatic complexities, diverse constituencies, and symbolic content. Our proposal has no clear delineation between landscape and architecture, allowing for a particular condition of continuity that we used to test some of our ideas about ritual, movement, and memory.



Megumi Aihara and Dan Spiegel

Architecture hero:
We would probably have a different answer on any given day, but right now we are on a real Carlo Scarpa kick. The details of his work are unconventional and ornate, but manage to feel easy, clear, and obvious. The layers of material syncopate across divergent timelines and the juxtaposition of landscape and primal forms seemingly freeze moments of time.

Best advice you have ever received:
When starting out, say yes to everything.

Biggest challenge in running a successful practice:
Learning when to say no.

Design tool of choice:
The old-school, three-button scroll-wheel mouse, corded

Favorite place to get inspired:
Honolulu: It's such an improbable city, equal parts tropical Brutalism and rugged landscape, totally isolated and somehow at ease.

Special item in your studio space:
A few dozen handblown goblets from Megumi's previous life as a glass artist

Skills to master:
Speaking Japanese, to greater and lesser degrees

Social media platform of choice:
Instagram, lazily

> *To learn more about Spiegel Aihara Workshop and its work, visit bit.ly/ARSAW.*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Next Progressives:
Spiegel Aihara Workshop (SAW)

1, 2, 3: BRUCE DAMONTE

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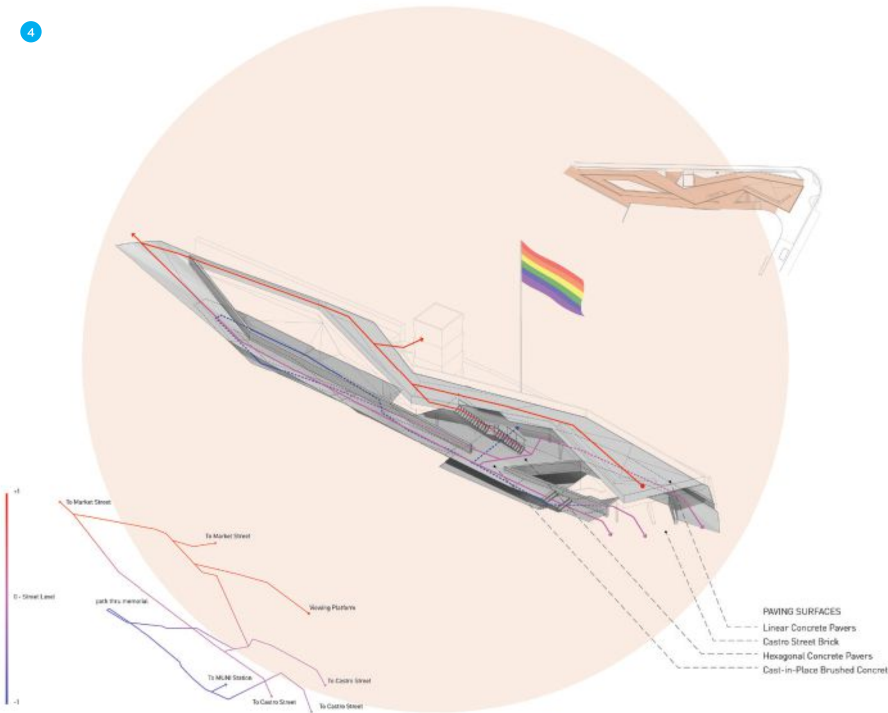

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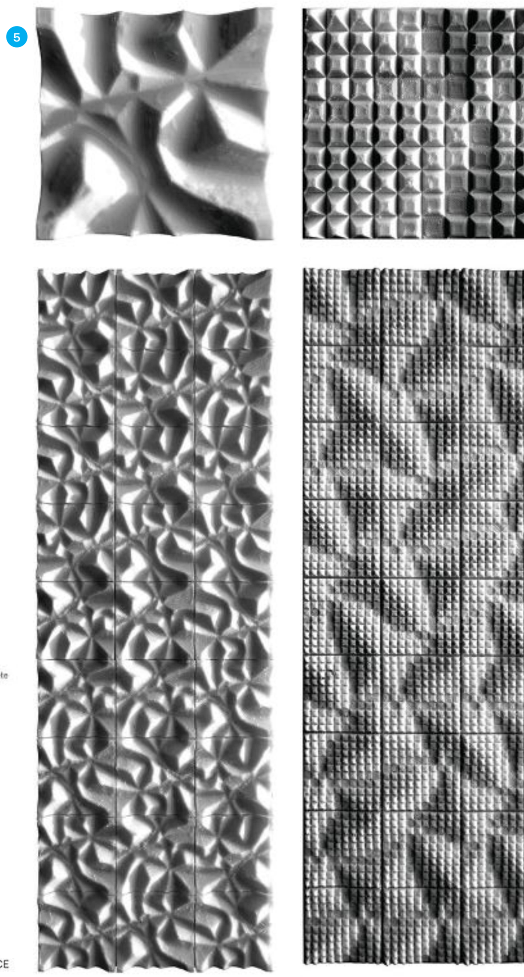

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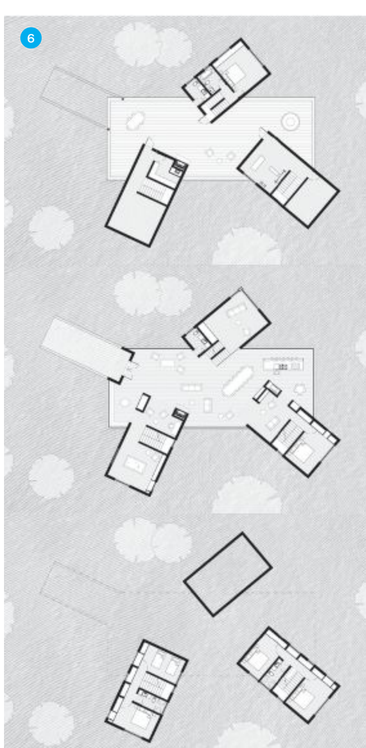

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6

4, 5, 6: COURTESY SAW

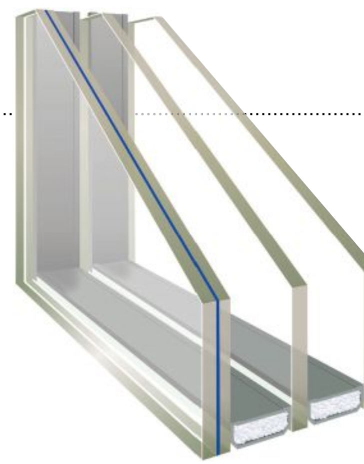
1. SAW fashioned corrugated metal into an "opaque boundary and porous threshold" that distinguishes individual and collaborative spaces at the Casper Labs R&D workshop in San Francisco. 2. The torqued Z-shaped second story addition to this San Francisco residence capitalizes on the project's hilly site and views. 3. Created in collaboration with Dustin Stephens of Mobile Office Architects, the 24-foot-long True & Co. retail vehicle comprises four fitting rooms, origami doors that unfold to provide seating and a checkout counter, and plywood-and-cedar millwork display areas. 4. For its Harvey Milk Plaza competition entry for the Castro neighborhood of San Francisco, SAW designed an angular elevated platform for community gathering and a street-level tribute wall to the politician and activist. 5. This proposed panelized façade system features square cast-concrete-molded units that create undulating patterns when configured in different orientations. 6. The Lockwood BnBnB vacation residence proposes positioning three distinct volumes for private living quarters—for owners, guests, and workforce—around shared common spaces.

Products: Greenbuild 2018 Preview and More

TEXT BY AYDA AYOUBI

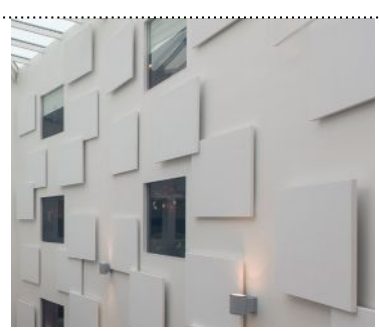
Xorel Artform, Carnegie
Designed to create an interlocking composition, these 3D acoustical wall panels are wrapped in Cradle-to-Cradle-certified textiles. Offered with a noise reduction coefficient (NRC) of 0.3 or 0.7. *carnegiefabrics.com*

ThermaTouch Plus, ThermaSol
This in-shower touchscreen controller features timers, water and steam temperature adjustments, infrared temperature-sensing, and Bluetooth technology. Offered with an Android operating system. *thermasol.com*

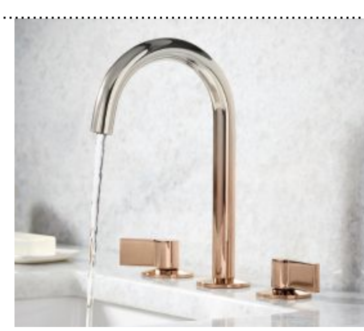


Sanctuary Glass, Zola Windows
Suitable for residential and commercial environments, this triple-paned unit features wide spacing between its lites, an acoustical lamination sandwiched in the double-glazed outer pane, and argon-filled air cavities. *zolawindows.com*

Trimless Acoustical Lighting, USAI Lighting
For use with Armstrong's pre-cut ceiling panels, this recessed LED luminaire is equipped with a seismically rated, snap-in mounting system. Available in round or square trim formats. *usailighting.com*



Rockfon Island Wall System, Rockfon
Intended for commercial environments, this frameless, wall-mounted, acoustical panel system resists water, moisture, humidity, mold, and fire. The 1.5"-thick stone-wool panels offer an NRC of up to 1.15. Fully recyclable. *rockfon.com*



Ombré Vibrant Finish, Kohler
Inspired by the fashion industry, Kohler's new Ombré finish is scratch- and tarnish-resistant and offered in two color combinations: vibrant rose gold to vibrant polished nickel, and vibrant titanium to vibrant rose gold. *kohler.com*

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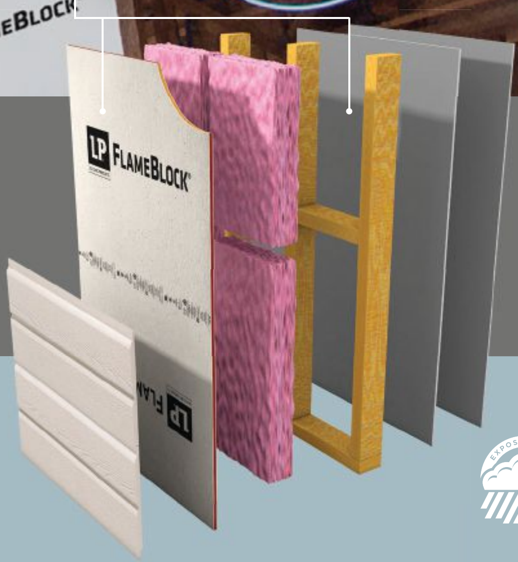

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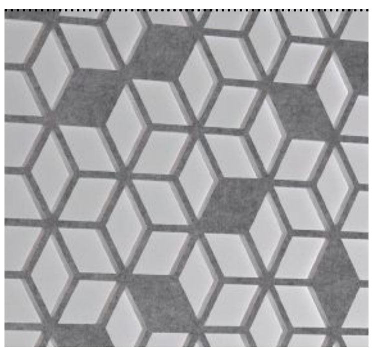
**Products:
Greenbuild 2018 Preview
and More**

Line Art, Carnegie
A design collaboration with Gensler, this line of upholstery textiles aims to re-create the comfort of residential spaces in office and commercial environments. Suitable for indoor and outdoor use. *carnegiefabrics.com*



Vapor Soft, Arktura
For use on walls and ceilings, Vapor Soft is designed to enhance the acoustic performance of commercial spaces. Each 1.5"-deep, 2'-by-4' panel comes with an NRC of up to 0.90 and a Class A or Class C fire rating. *arktura.com*

Canut, Estiluz
Featuring one adjustable arm, this 1W or 3W LED luminaire is available in 3000K with a CRI greater than 80. Measuring 1" in diameter and 17.3" tall, Canut is offered in three finishes (74 WH shown) with custom options possible. *estiluzusa.com/en*

Iltuo, 3Form
Made of translucent resin panels, Iltuo offers reconfigurable, demountable, and adjustable layouts, including floor-to-ceiling walls and partitions and enclosed workspaces, based on user needs. Available in 250 colors. *3-form.com*

Loxon Self-Cleaning Acrylic Coating, Sherwin-Williams
This exterior finish sheds dirt when contacted by water and resists alkali, efflorescence, and mildew. Available in a flat sheen that can be tinted to a wide range of colors. *sherwin-williams.com*

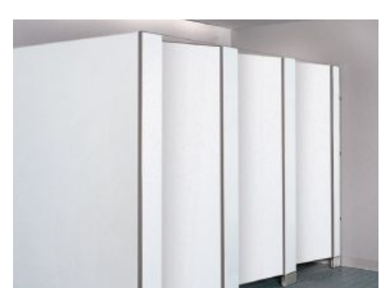
High-Performance TPO Wall Coverings, Carnegie
Updated with two new patterns (Module shown), the TPO (thermoplastic olefin) collection is free from environmental pollutants and plasticizers. Module comes in eight colorways. *carnegiefabrics.com*

Out of sight.

Bobrick's privacy partitions eliminate sight lines between doors and stiles, and above and below panels.

Gap-Free interlocking design.

Sight lines between doors and stiles are an emerging sensitivity in restrooms. Our Gap-Free design is an integrated solution.



Max. Height doors and panels.

4 5/16" floor clearance vs 12", and 72" panel height vs 58". Specify Gap-Free and Max. Height for double the privacy.

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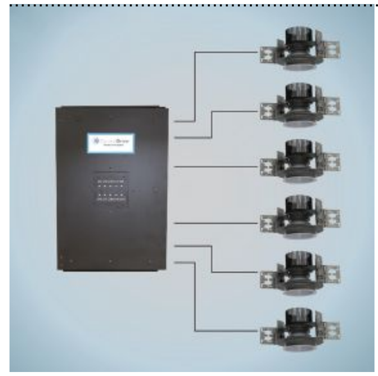
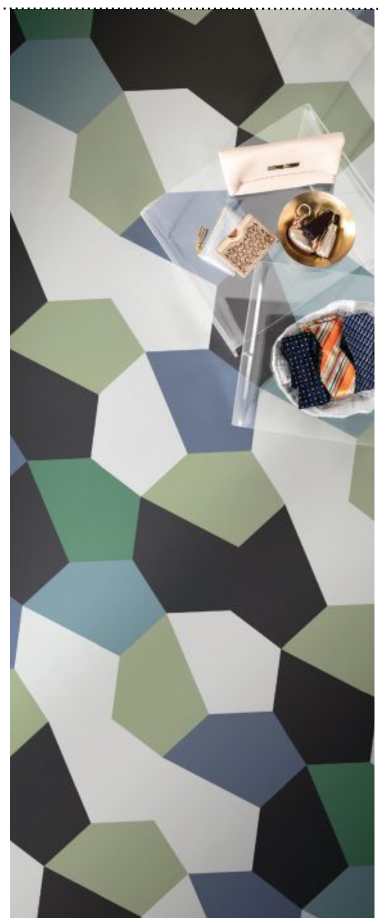
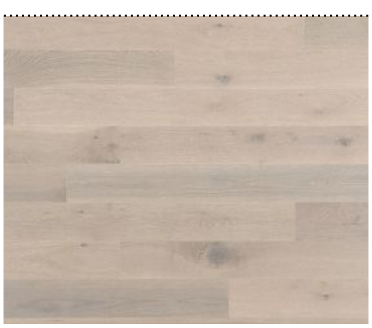


LCD CentralDrive Remote Driver, Pathway Lighting Products
This wall-mounted box can power up to 10 LED luminaires as far as 200' away and support a maximum total output of 444W. Available with a built-in diagnostics system to ease fault identification. *pathwaylighting.com*

Plena, Foscarini
This lightweight, decorative pendant is made of PVC and varnished aluminum. The 27W LED fixture comes in 2700K with a CRI exceeding 90, and delivers up to 3,250 lumens. Available in white. *foscarini.com*



TurnKey, Bendheim
This quick-assembly, clip-in system is designed to facilitate the installation of interior glass cladding and eliminates the need for adhesives or glass drilling. The 1"-tall clips are compatible with a wide range of panels. *bendheim.com*



Sweet Memories, Mirage
This collection aims to recall the rustic look of distressed hardwood floors. As part of this collection, Bubble Bath colorway is offered in solid or engineered hardwood with a plywood base and an ultra-matte finish. *miragefloors.com*

Pentagonals, Tarkett
Suitable for office, healthcare, and commercial environments, this Cradle-to-Cradle bronze-certified collection of rubber tiles comprises three pentagonal designs. Offered in 142 colors and custom sizes. *tarkett.com*

Sero, Nulite Lighting
For use in offices, this glare-free luminaire consists of an extruded aluminum housing fitted with a distributed array of LEDs. Its open optical system delivers direct and indirect light. Available in powdercoated finishes. *nulite-lighting.com*

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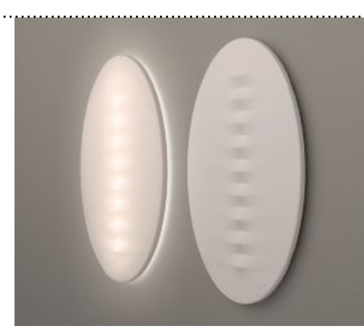
Akusto One SQ, CertainTeed
With an NRC of 0.95, this frameless wall paneling system is designed for acoustic remediation in office and commercial settings. Offered in custom shapes and sizes, and in 13 colors. Available with two mounting options. *certainteed.com*

Soffio, Foscarini
Made of handblown glass and aluminum, this table luminaire flares out from its transparent cylindrical vessel base to its top, where a frosted white finish conceals its LED light source. Delivers up to 1,300 lumens. *foscarini.com*

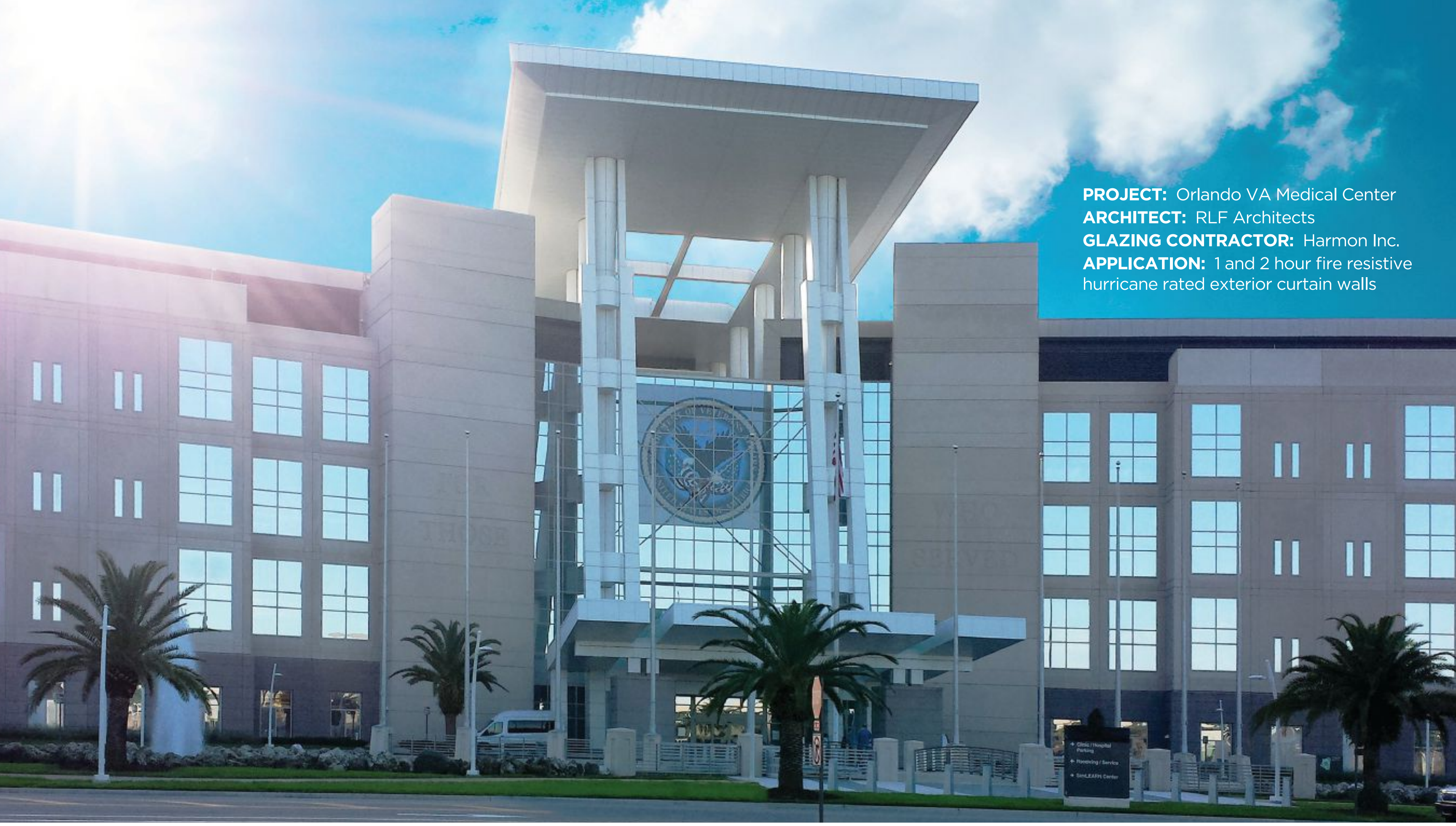
Door Lever Handle, Buster+Punch
This solid metal, knurled, and diamond-cut lever handle is available in sprung and unsprung versions. Each handle, for interior doors, measures 5.7" long and 0.8" wide, and is offered in four finish options (steel shown). *busterandpunch.com*

Metalix Architectural Glass, Bendheim
This laminated safety glass collection interlays metallic textiles and is suitable for high-traffic residential and commercial spaces, such as lobbies and elevator cabs. *bendheim.com*

Verdera Voice, Kohler
Compatible with Amazon Alexa and equipped with the Kohler Konnect, this bathroom mirror features integrated LED lights, embedded dual microphone system and speakers, and motion-activated night illumination. *kohler.com*



Superficie, Foscarini
Inspired by the works of late Italian painter Enrico Castellani, this thin-profile, LED wall lamp is characterized by a series of concave and convex reliefs, and can deliver up to 4,000 lumens. Available in white. *foscarini.com*



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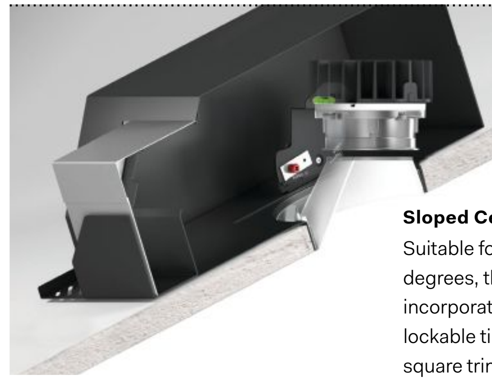
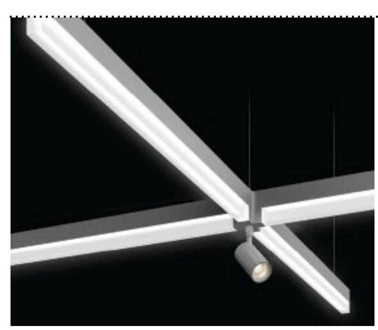


Sloped Ceiling Solution, USAI Lighting
Suitable for ceilings angled up to 45 degrees, this recessed lighting fixture incorporates a built-in leveler and a lockable tilting setting. Offered in round or square trim formats. *usailighting.com*

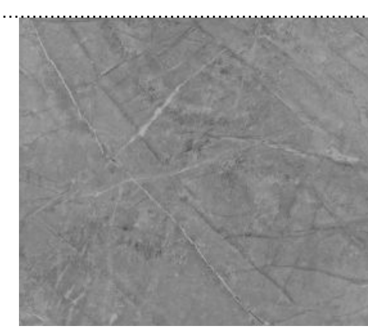
CFS Moment Frame, MiTek Hardy Frame
For use in light-frame wood construction, the CFS Moment Frame is the industry's first prefabricated, cold-formed steel portal frame, according to the manufacturer. The CFS Moment Frame weighs less than structural steel and is suitable for creating large-scale architectural openings for movable glass walls and windows due to its ability to resist high lateral loads. *hardyframe.com*

Veil Vessel Sink, Kohler
Made of fire clay, this ergonomic, asymmetrical bathroom vessel sits on countertops and requires wall- or surface-mounted faucets. Available in four colors with a high-gloss finish. ADA-compliant. *kohler.com*

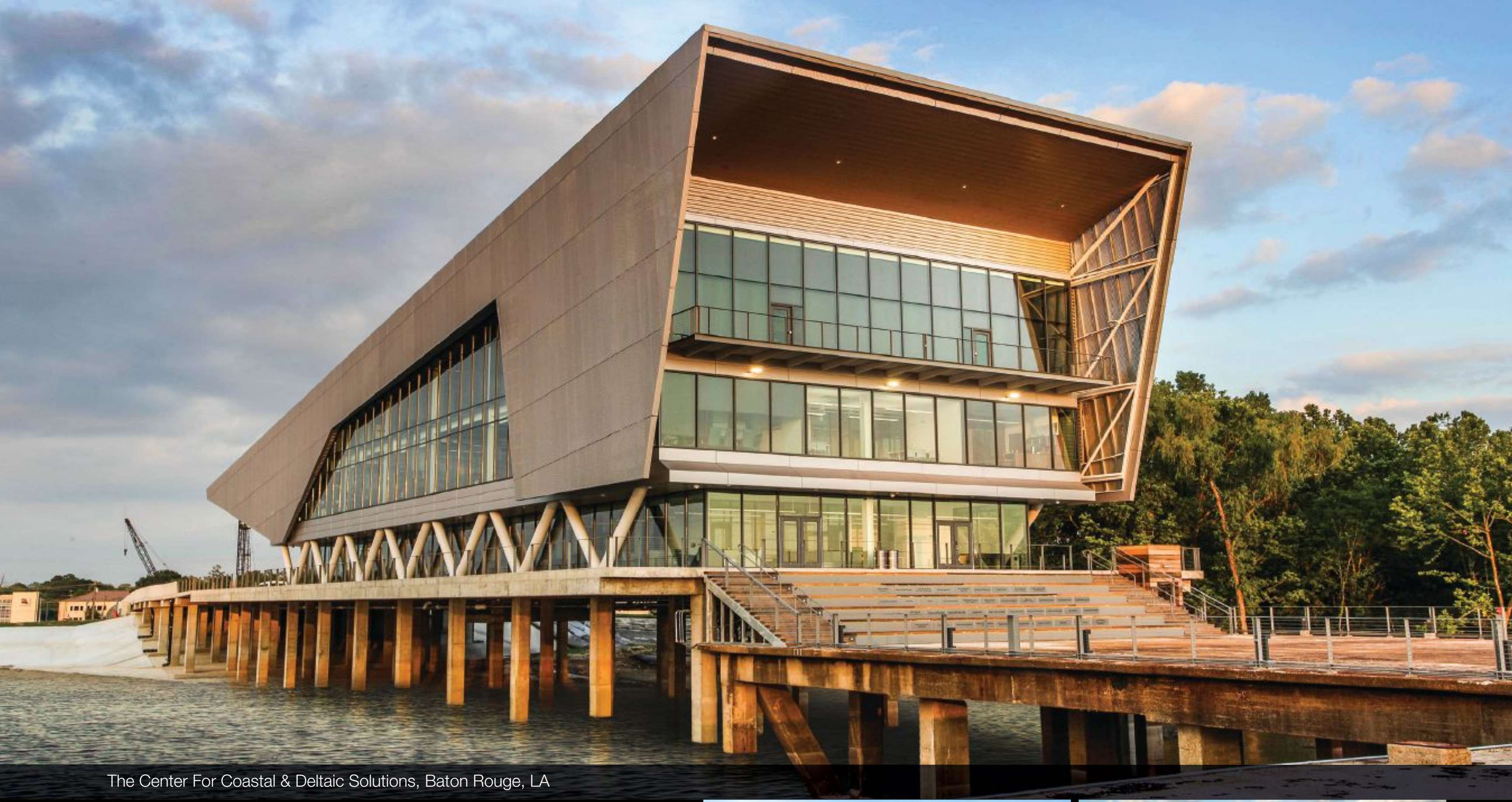
Revolta, Estiluz
This decorative suspended luminaire comes with a cylindrical aluminum housing fitted with a 6.1W LED light source and an optical acrylic diffuser. Offered in multiple configurations. *estiluzusa.com/en*



GlowSTX, LF Illumination
This suspended, linear lighting system comprises a slim-profile aluminum housing fitted with a 5W-per-foot LED strip and an extruded satin-white optical acrylic diffuser. Can be used in damp locations. *lfillumination.com*



Stonika, Dekton by Cosentino
This collection of ultra-compact architectural surfaces is suitable for indoor and outdoor use and can resist scratches, stains, heat, thermal shocks, and ultraviolet light. Available in six new colors (Sogne shown). *dekton.com*



The Center For Coastal & Deltaic Solutions, Baton Rouge, LA

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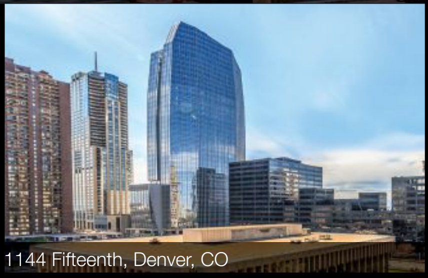

1144 Fifteenth, Denver, CO

Hale Center Theatre, Sandy, UT

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Opinion: Does Design Perpetuate Injustice?

TEXT BY ROSA T. SHENG, FAIA

Historically marginalized, economically challenged communities are likely to disproportionately bear the consequences of climate change, rising housing and education costs, reduced social services, and workforce automation. While architecture and planning might appear to be unrelated to these complex issues, I challenge architects to gain a broader understanding of how social justice is linked to our built environment.

We speak of aspiring to seek better outcomes for our civic realm, yet we often ignore or overlook how architecture—a manifestation of historic systems of power wielded by policies, procedures, and the privileged—has influenced our built context in ways that prevent equitable and just access for people of color, immigrants, and the LGBTQ+ community.

We don't need to look far back in history for examples: redlining, NIMBYism, and self-appointed watch patrols that call the police on those they perceive as not belonging in their neighborhood. Mabel Wilson's article "Mine Not Yours," featured in the U.S. Pavilion at the 2018 Venice Biennale, narrates this experience with unapologetic authenticity, underscoring the effects of feeling endangered by design.

The design of private space marketed as public space has further blurred the line of who is responsible for creating inclusive civic places. Bookstores masquerade as public libraries and coffeehouse franchises conceived as "welcoming, inviting, and familiar" places usurp locally owned cafés. Apple stores rebranded as "town squares" and the Salesforce "Park" roof garden on the San Francisco Transbay Terminal are no substitutes for public space. If anything, they confound the issue of who is at liberty to occupy them. Police arrests of those "waiting while black" affirm this crisis.

Architects impassioned to right these wrongs can get behind Design Justice, a movement that seeks to identify and subsequently mitigate the structures of oppression and barriers to success for people who have been historically marginalized. At the inaugural AIA Design Justice Summit in September, a group of social impact advocates, architects, and urban designers from across the nation gathered to unpack Design Justice in the context of the built environment and to develop solutions to address injustices communities face.

As Bryan C. Lee Jr., ASSOC. AIA, founder and director of design of Colloqate Design, in New Orleans, and founding organizer of the Design Justice Platform (DJP), noted: "For every injustice in the world, there is an architecture that perpetuates it."

Make no mistake: These barriers may be invisible to those who have benefited from the systems of power and privilege that have perpetuated injustice, such as design outcomes that don't regard the health, safety, and welfare of *all*.

In a series of workshops modeled after the DJP, teams proposed solutions that could be deployed in the near- and far-term, ranging in scale and permanency: pop-up shops to stimulate local economies, mobile medical units, and public family resource stations where nursing, pumping, changing, and resting were dignified, safe, and clean.

If architects are to advance Design Justice, we must make the cultural transformation of an integrated bottom line that prioritizes people, places, planet, and prosperity. And we must ask ourselves: Do we address social impact only when the client mandates it, or when we have a personal connection at stake? Can we provide design and problem-solving services to every person and community as part of the value we bring?

Design can inspire as well as heal, build empathy, dignity, and respect, and, yes, reconcile injustice. It is in our collective interest to learn and stay vigilant about the historical connections between design that perpetuates systems of power and privilege that results in unjust conditions. It is our ethical responsibility as architects and planners to leverage design as a means to create equitable and just outcomes in our built environment for all.

Rosa T. Sheng, FAIA, is a principal and the director of equity, diversity, and inclusion at SmithGroup.

SCOTT R. KLINE

> *To read more opinion pieces by thought leaders in the design community, visit bit.ly/AROpinion.*

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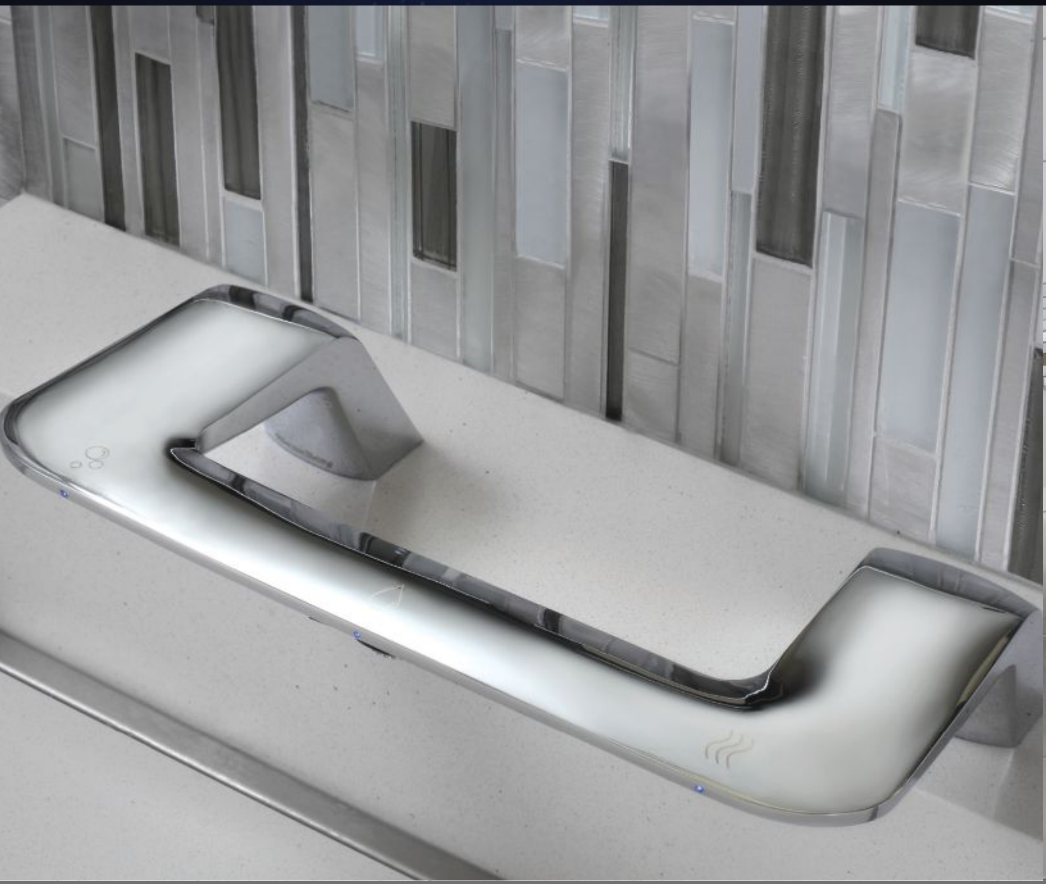

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Residential: Ziger|Snead Architects

TEXT BY EDWARD KEEGAN, AIA

The 7,000-square-foot Slate House sits on a heavily wooded 3-acre site in Baltimore County, Md., where its seclusion from suburbia is aided by an additional 100 acres of surrounding land protected by the Maryland Environmental Trust. When Douglas Bothner, AIA, a partner at Baltimore-based Ziger|Snead Architects, first visited the site, his clients' previous architect-designed, ranch-style house still laid in ruins following a devastating fire. "There was one wall of redwood still standing," Bothner says. "It was heavily gatored and really beautiful—silver and luminous with a very deep char." [Note: "gatoring" is a wood texture caused by fire.] As his firm developed ideas for a new residence for the clients, an attorney and a retired school teacher, that image stuck with the architect and "set up the idea of a black house," Bothner says.

Bothner began designing the house as a variation on the traditional H-shaped plan, with the entry and a living/dining space in the center, a kitchen, family room, and garage to the north, and the master suite to the south. To maximize views and make the house a little less formal, he opened the wings from 90 to 105 degrees and, with this slight inflection, introduced a contemporary slant on tradition that's also reflected in the gabled massing. The form comprises an extruded 25-foot-wide, 25-foot-tall gable with a traditional 12/12 roof.

The couple wished to live on a single level as they age, so the architects positioned the primary living elements

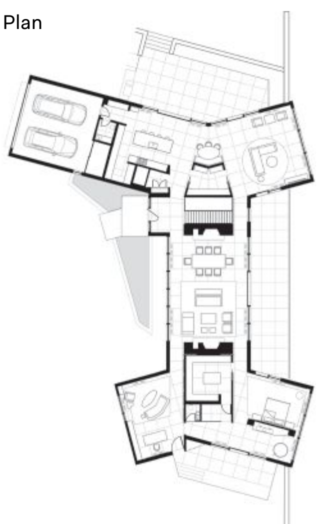
The family room on the main floor juts over the lower level and looks out to the sloped site's backyard.

JENNIFER HUGHES

> *Visit ARCHITECT's Project Gallery for more images of the Slate House at bit.ly/SlateHouseMD.*

Residential:
Ziger|Snead Architects

Main-Floor Plan



Lower-Floor Plan

and the master suite on the main floor, which meets the driveway on the sloped site. The plan for the lower floor, designated for three guest bedrooms as well as a media room, is not identical to the upstairs. Rather, its backyard-facing façade is a straight wall rendered in orange-hued Cor-Ten steel, with the east-facing gables of the main floor cantilevered over it. Outside the house, a raised terrace and swimming pool are located off the main-level family room and kitchen, and exterior stairs tucked behind the Cor-Ten retaining wall lead to a less formal lawn outside the lower level.

Jet-black slate shingles, sourced from Spain and a bit larger than average to ensure the house reads as contemporary, define the roofs and their support walls. The black-based palette continues with the wood-siding clad faces of each gable, finished with the traditional Japanese *shou sugi ban* charring technique—reminiscent of the ruined remains that greeted Bothner on his first site visit.

Although the gabled volumes are identical in section, the articulation of each of the four faces differs: The garage volume is opaque with solid wood; the master study has a punched, square window; the master suite has a 10-foot-tall window that runs the full width of the volume; and the family room is fully glazed.

Inside, black 4-foot by 4-foot Italian ceramic tiles cover the floors, but the space is otherwise finished in bright tones, with predominantly white walls and ceilings of skimcoated plaster.

The simple forms with relatively long spans were created with steel ridge beams infilled with conventional wood framing. The energy-efficient house is clad with 5.5-inch insulated panels, resulting in R-49 walls and roofs, and the 1-inch insulated, low-E, argon-filled window units help maintain the building envelope's high performance. Radiant heat flooring is provided via geothermal wells located under the driveway.

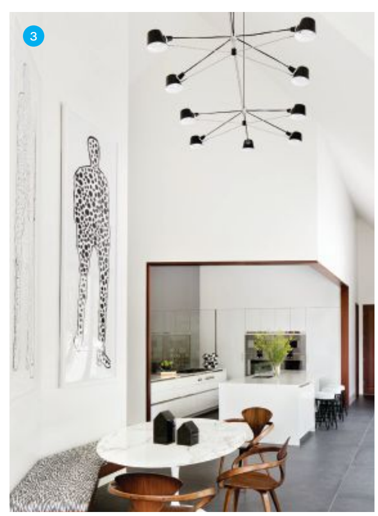
In both material and form, the Slate House is a place of memory. Its gabled roofs recall centuries of Mid-Atlantic residential architecture, overlaid with a minimal contemporary material strategy whose primary black hue subtly recalls the fate of the owners' previous house.

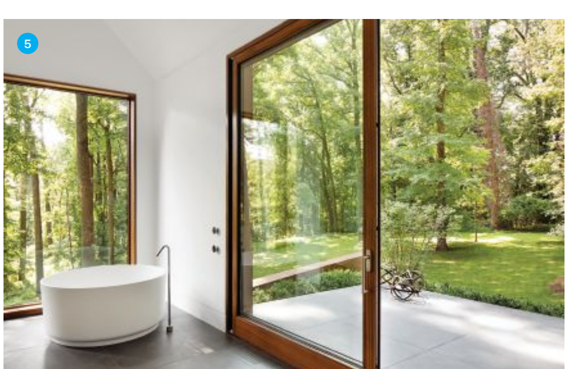
JENNIFER HUGHES

Project Credits

Project: Slate House, Baltimore County, Md.
Client: Dale and Marlene Adkins
Architect: Ziger|Snead Architects, Baltimore · Douglas Bothner, AIA (partner); Matthew Rouse, AIA (architect)
Interior Designer: Jenkins Baer Associates
Mechanical Engineer: Aire-Craft Heating and Cooling
Structural Engineer: Morabito Consultants
Electrical Engineer: Gramophone
General Contractor: Blackhorse Construction
Landscape Architect: Campion Hruby Landscape Architects
Lighting Designer: Flux Studio
Size: 7,000 square feet
Cost: Withheld

Residential:
Ziger|Snead Architects





1. Duratherm doors open to exterior spaces throughout the house, such as the north poolside terrace off the family room and kitchen. 2. The combined living and dining area is bookended by fireplaces built from locally sourced Endicott brick. 3. A small dining nook off the family room leads to the kitchen, outfitted with Kallista fixtures. 4. The house's central stair connecting the lower-level guest bedrooms to the main living spaces runs behind the north fireplace. 5. Solarban 60 glazing throughout the house, seen here in the main-floor master bath, invites the protected landscape in while promoting energy efficiency.

JENNIFER HUGHES







Before & After



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Joshua Miller (Harvey Builders), Lisa Bixler, AIA (LKB Architecture), Alex Assarian (Harvey Builders), Joe Rivers, AIA (Rivers Barden Architects), Matt Weber (Harvey Builders), Jeanette Shaw, AIA (Powers Brown Architecture), David Robinson, AIA (Powers Brown Architecture), Catherine Callaway, AIA (Kirksey Architecture), AJ Breneman (Powers Brown Architecture), Donna Kacmar, FAIA (Professor, University of Houston), Pete Simpson (Terralab Landscape Architects), Not pictured: Dan Hlavac (Harvey)

ARCHITECTURAL ULTRA HIGH-PERFORMANCE CONCRETE FOR PRE-FABRICATED WALL ASSEMBLIES

Presented by:

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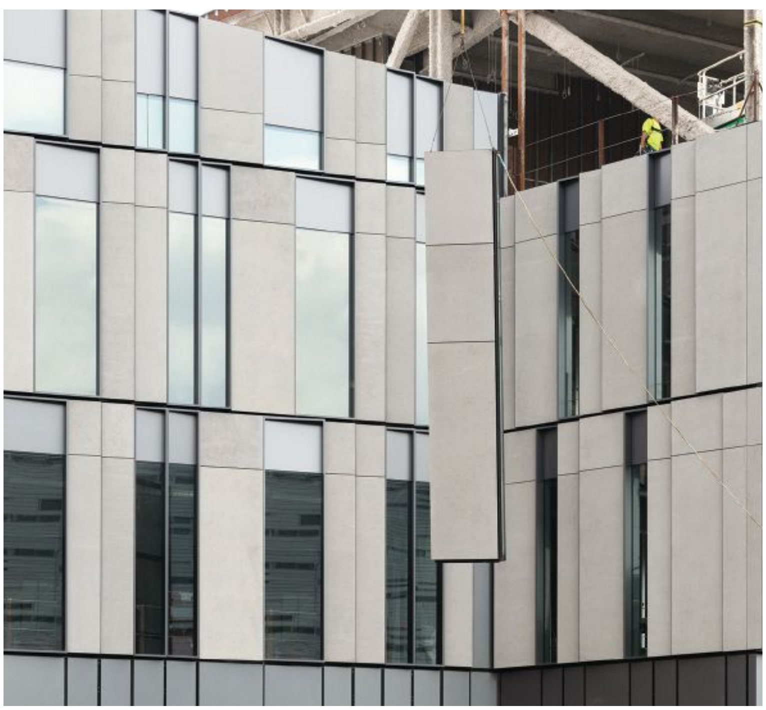


LEARNING OBJECTIVES

Upon completion of this course, participants will be able to:

1. Explain the benefits of pre-fabricated, off-site construction of wall assemblies for projects and its potential solutions for the current state of building.
2. Understand the material properties and manufacturing process for A|UHPC composite wall cladding as it relates to prefabricated wall assemblies.
3. Understand different pre-fabricated systems for opaque walls and their applications.
4. Assess the appropriateness of different systems for a particular building and understand the requirements for collaboration with material suppliers and wall system fabricators.
5. Understand some of the factors driving the trend towards prefabricated wall assemblies and the need for improved efficiencies and quality in facade construction.

CONTINUING EDUCATION

CREDIT: 1 LU/HSW

COURSE NUMBER: AR112018-2

Use the learning objectives above to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit http://go.hw.net/AR112018-2 and complete the quiz for free as you read this article. If you are new to Hanley Wood University, create a free learner account; returning users log in as usual.

INTRODUCTION

In today's rapidly changing construction industry, facade designers, manufacturers, contractors, and installers face the necessity to advance their methods, improve techniques, and generally stay competitive under ever-tightening schedules, budgets, codes, and client demands. Driven by the increased complexity of layered, ventilated facades, the downward pressure on construction budgets and timelines, and an extremely tight national labor market, factory-produced wall assemblies are on the rise. In this context, there is a growing trend toward unitized facade design and construction.

Off-site construction or pre-fabrication of building components and systems stands out for its capacity to adapt to changing design methods, leverage associated technologies (CAD/CAE/CAM), speed delivery processes, better control cost and risk, and respond to complex project requirements.

Architectural Ultra High-Performance Concrete (A|UHPC) in thin cladding panels has been established as a highly suitable material for high-performance Back Ventilated and Drained Cavity (BVDC) wall facades. A|UHPC is an order of magnitude stronger and more ductile than high strength pre-cast concrete, and it performs exceptionally well in demanding environmental conditions. Its strength derives from the carefully calibrated ratio of engineered ingredients and a mixing sequence that packs molecules together closely to create very tight bonds. The high packing density yields excellent flexural and compressive strength, while virtually eliminating the capillary pores that cause freeze-thaw degradation in other cement-based products. Its distinct material properties provide opportunities for greater spans, thinner profiles, more complex geometries, and higher performance in extreme climates than glass fiber reinforced concretes (GFRC), terracotta, or metal reinforced pre-cast concrete products while maintaining competitive installation costs.

This course investigates the current applications of panelized A|UHPC in pre-fabricated wall systems and additional potential uses and innovations possible with A|UHPC's mechanical properties, characteristics, and manufacturing methods.

UHPC DEVELOPMENT AND USE

Ultra High-Performance Concrete (UHPC) is a category of concrete characterized by exceptional strength, low water absorption, and high resistance to waterborne and airborne chemical degradation. The basic raw materials of UHPC are familiar to everyone who knows concrete: water, sand, cement, silica fume, and plasticizers. However, UHPC's performance and material characteristics are give it much hugher strengh and durability than traditional categories of concrete. No special resins, cellulose, or polymers are used to achieve the outstanding properties of architectural UHPC. Rather, the distinctions lie in the size, geometry, and carefully selected chemistry of extremely small particles that combine under exacting mixing, vibration and curing regimens to form a base matrix. The design and calibration of UHPC formulas involve state of the art concrete chemistry and micro/nano-particle engineering to optimize chemical and mechanical bonds

Developed initially for large and specialized civil engineering applications that could benefit from its high strength and durability under extreme conditions, UHPC has been used in Europe for more than 30 years. Such applications—seawall anchors, bridge abutments, super thin arches, bridge decks, and pre-cast beams for nuclear power—are still the predominant uses for UHPC.

The first UHPC structure in North America, the Sherbrooke Pedestrian Bridge, was built in Quebec, Canada in 1997. The first pre-cast UHPC application in the United States was for waffle-slab deck panels for a short span bridge (Little Cedar Creek) in Iowa in 2006. In 2014 a large project for a 2 km viaduct near Geneva in Switzerland was refurbished with 1½" (38mm) overlay of UHPC for a triple purpose: strengthening the road deck, waterproofing the structural concrete, and providing new wear surface for the roadway, which underscored its combination of mechanical and durability advantages.

INTRODUCTION TO ARCHITECTURAL ULTRA HIGH-PERFORMANCE CONCRETE (A|UHPC) CLADDING PANELS

A wide variety of UHPC formulations are being developed that advance the performance characteristics of this category of concrete and adhere to the requirements of specific applications, inclusive of everything from cast refractory components and injection-molded complex shapes to extruded profiles. Because all the properties and characteristics of UHPC that are beneficial in special civil engineering construction applications can be harnessed when UHPC is molded into high-quality elements, including surfaces, shapes, and assembled systems that were not possible until recent years, industrial, architectural, and landscape design professionals are now embracing UHPC for its aesthetic potential, outstanding strength, and durability.

Architectural Ultra High-Performance Concrete (A|UHPC) is distinct from UHPC because it brings together specialized mix designs and manufacturing methods to focus on maximizing flexural strength rather than compressive strength. High flexural strength allows for the manufacture of thin architectural components including cladding panels, screens, sills, copings, shading devices, and other elements suitable for facades. The A|UHPC industry is just getting started in the United States and, in fact, there are only a few fully integrated manufacturers of A|UHPC in the world. Nonetheless, designers' adoption of the material for cladding has resulted in installations across a wide range of building types including university buildings, museums, airports, commercial office buildings, hotel, and residential high-rise developments, governmental consulates, and courthouses.

Production of A|UHPC cladding panels is more akin to the flow of automated manufacture than to pre-cast concrete operations. Casting procedures are optimized with digitally controlled mixing and pouring equipment. Cured panels are then processed in ways similar to high volume stone panel processing operations. Flat sheet and profiles are typically trimmed to size with CNC equipment. Automated equipment provides great efficiency. By comparison, an efficient pre-cast or spray-in GFRC operation may produce several hundred square feet of material each day, while A|UHPC composite manufacturers may produce four to seven thousand square feet a day. Ultra high-performance does not yet mean "ultra-fast" cure. The current cure time required to achieve design strength is 28 days; however, methods for accelerating the cure time are being developed in ongoing laboratory testing that could potentially reduce the time required by fifty percent.

Properties

A|UHPC is extremely strong and durable, based purely on its material chemistry; however, when combined with today's advanced manufacturing technology and tooling techniques, it can meet an additional order of demands of high-performance building requirements, design aspirations, and construction economics. The material is consistent and reliable across a number of qualities that make it advantageous for panelized cladding on pre-fabricated enclosure systems including:

- Water tightness and predictable mechanical properties with very low coefficient of variation
- Extreme durability, with low maintenance requirements, outperforming GFRC and many types of stone
- Inherent strength that allows thinner and lighter panels and profiles than stone, traditional pre-cast concrete, and most profiled terracotta
- Precise replicability of mold surfaces and geometries, creating limitless possibilities for patterns, textures, and shapes
- Natural, mineral-based raw materials that afford graceful weathering and aging
- Ability to include surface aggregates to achieve a stone look at lighter weight and greater performance than stone cladding products
- Precise manufacturing capabilities to process and finish parts post-casting—CNC cutting, drilling, media-blasting—and to assemble parts with high-performance adhesives
- High strength to weight ratio that results in fewer attachment points and sub-frame components reduced installation labor, lower specialized hardware costs, and minimized transportation impacts

Panel Size, Thickness, and Attachment

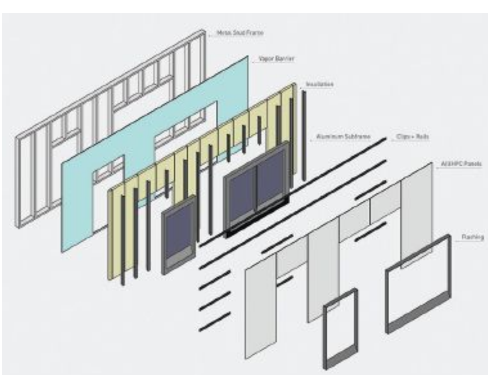
For standard, low-relief patterns, A|UHPC panels will be 5/8" thick and weigh about 6.90 pounds per square foot. At 5/8", panels can be cast and installed at sizes up to 60x144". This weight by coverage area is only 25–35% that of 1½–2" thick stone and 10–15% of the weight of 4–6" pre-cast concrete. The weight of 5/8" A|UHPC compares most closely with that of Insulated Glass Units. At 5/8", panels can be cast and installed at sizes up to 60x144". Stone and other cladding materials generally require more attachment points because they are panelized in smaller, heavier sections. Because the weight reduction is significant, using A|UHPC instead of stone or other cladding materials, can reduce the size of the foundation and primary structural framing at the perimeter of the building for multi-story and high-rise buildings. The thinness of A|UHPC cladding panels affords more room in the wall cavity for insulation to improve wall performance or reduces overall wall thickness to increase rentable floor area.

Panels may be attached with concealed undercut anchors, bolted with visible fasteners or adhered to a support frame. Engineering to determine tension loads from negative wind pressure is required to regulate spacing for attachment. There are typically more attachment points than needed based on the flexural strength of the panels alone. Panels with deeper relief surface patterns and profiles, including corners and copings, will be cast at thicknesses greater than 5/8". Greater thickness of elements requires higher capacity undercut anchors and often greater embed depth. Capacity for visible fasteners is most often determined by the gauge or thickness of the panel rail to fastener connection rather than the panel weight since the holes for visible fasteners are oversized and do not engage the concrete.

The following CEU courses in HanleyWood University provide more in-depth exploration of A|UHPC performance, manufacturing methods, and application to rainscreen design: Introduction to Architectural Ultra High Performance Concrete and Designing Ventilated Facades with Architectural Ultra High Performance Concrete.

WALL DESIGN

Back Ventilated Drained Cavity (BVDC)



The most common implementation of BVDC with A|UHPC is a light gauge steel frame and exterior grade gypsum board sheathing with a membrane and mineral fiber insulation. A|UHPC cladding is supported on an aluminum, steel, or stainless steel subframe. The pre-fabricated unit frame perimeter is gasketed and sealed, or the spandrel section is left accessible to field flashing and sealing the joint between units. Pre-fabricated wall sections can range in size from 8x10 up to 12x30 feet. Units are supported by structural steel angle connections to slab edges and either welded or bolted in place. These assemblies can integrate glazing, providing highly reliable seals and flashing. Additionally, they can accommodate multiple element types and thicknesses, such as cast corners and soffits.

When developing BVDC wall designs, careful consideration must be given to the balance of exterior and interior insulation. When the R-value of exterior insulation is twice the

Example 1

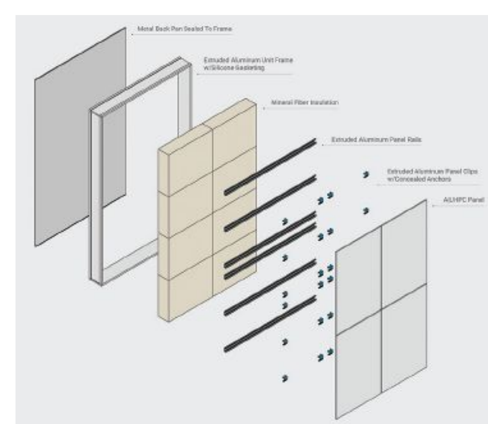
R-value of the interior insulation, the possibility of condensation occurring on the interior face of sheathing is eliminated. Factors for insulation amount and position vary with climate and occupancy. Moderate to very cold climates with higher interior humidity pose the greatest risk for interior condensation if the insulation on the interior matches or exceeds that of the continuous insulation on the exterior.

EXAMPLE 1: Commercial Facility (Northeast—Completed 2017)

This mixed-use development in Brooklyn utilized pre-fabricated BVDC units clad in A|UHPC in multiple configurations of large-scale mullions, sills, and soffits. This allowed constructors, in advance of installation, to build multi-panel units with very tight joints that appear monolithic, a result that would not have been possible on-site, in advance of installation.

Unitized Curtain Wall with BVDC

A unitized curtain wall assembly is a thermally broken, extruded aluminum frame with a gasketed perimeter that has a sealed back pan. The assembly is self-contained to be inserted as a unit into the building's structural frame. Unit sizes can range from 4X10 up to 8X24



feet. Unitized curtain walls are more commonly considered for glazed walls and storefronts. However, units can be constructed with both glazed and opaque components. The gasketed perimeter frame of a mixed material unit is virtually identical to a glazed curtain wall unit in terms of the attachment to the super-structure of the building and the manner in which it is sealed for air and water. Although these units can incorporate both glazed areas with opaque areas, our focus will be on the opaque clad unit, which is similar to a spandrel, with one key difference: outboard insulation. One fabricator referred to these units as "BVDC wall in a box," because the back pan provides the air and water seal, and the insulation is exposed to a small degree of air and water through open joints.

One advantage of marrying the control layers of the BVDC wall with a unitized approach is that the compartmentalization necessary for an effective Pressure Equalized Rainscreen (PER) is built into the units much more reliably in a factory setting than in field installed ventilated cavity walls. Another advantage of such units is the ease with which they can be incorporated into a facade with fully glazed units without introducing special transition details or new means and methods.

A|UHPC has a weight per square foot and flexural strength design values similar to insulated glass units (IGU). This makes calculating the engineering for extrusions and frame capacities virtually the same. The details for attaching glass and A|UHPC are the only difference. Using undercut anchors with extruded aluminum clips, panels typically have dead load connections along the top edge of the panel, and the remainder of the connection points serve only to resist the lateral wind load and are free to "slide" to accommodate the linear expansion of the unit frame or in-plane displacement from story drift.

This article continues on http://go.hw.net/AR112018-2. Go online to read the rest of the article and complete the corresponding quiz for credit.

SPONSOR INFORMATION

TAKTL®

TAKTL is the first company to fully integrate Architectural Ultra High Performance Concrete (A|UHPC) formulation, design, mold making and automated manufacturing to deliver high-quality architectural products made in the USA. TAKTL offers a variety of standard and custom programs to address the needs of projects spanning a wide range of design requirements, budgets and schedules.

QUIZ

1. True or False: Ultra High-Performance Concrete (UHPC) is a category of concrete characterized by exceptional strength, low water absorption, and high resistance to waterborne and airborne chemical degradation.

2. Architectural Ultra High-Performance Concrete (A|UHPC) is distinct from UHPC because it brings together specialized mix designs and manufacturing methods to focus on maximizing ______ strength rather than _______ strength.
   a. Vibration; calibration
   b. Flexural; compression
   c. Cladding; compression
   d. Compression; flexural

3. True or False. A|UHPC cladding is supported on a wooden frame.

4. In addition to a design assist/value engineering process, and the potential for factory quality control systems, prefabricated wall assemblies reduce risk for the general contractor and owner because:
   a. Pre-manufactured walls are financed with better terms
   b. Wall system fabricators do not need insurance
   c. Weather is not a factor for the wall manufacturing work schedule
   d. Deliveries are limited to truck size

5. Why is pre-fabricated/off-site construction generally considered a safer means of delivering wall systems?
   a. The installation of the walls is done by a single source/trade
   b. Erection of the building enclosure requires fewer people working at height
   c. The potential for weather related safety risks are reduced
   d. All of the above

6. True or False: One advantage of marrying the control layers of the BVDC wall with a unitized approach is that the compartmentalization necessary for an effective Pressure Equalized Rainscreen (PER) is built into the units much more reliably in a factory setting than in field installed ventilated cavity walls.

7. What type of seal forms two silicone gaskets at panel joints to form the primary barrier to air and water?
   a. Extrusion seal
   b. Continuous seal
   c. Flexible seal
   d. Perimeter seal

8. True or False: According to the article, there is an overage of construction workers due to the 2008 recession.

9. Some advantages to using A|UHPC are:
   a. Water tightness
   b. High strength to weight ratio
   c. Ability to achieve a stone look at light weight and greater performance than stone cladding
   d. All of the above

10. According to the article, Dry time (for unitized installation) is up to ______________ faster than on-site enclosures, expediting the time it takes to close the building.
    a. 85%
    b. 30%
    c. 45%
    d. 60%

Presented by:

BETTER AND BEST MOISTURE MANAGEMENT

DRAINABLE WRAPS AND RAINSCREENS

Image provided by Tamlyn

LEARNING OBJECTIVES

After reading this article, you should be able to:

1. Examine the importance of moisture management in wall assemblies, and discuss the consequences of not managing moisture effectively, such as mold, breakdown and damage to materials.
2. Analyze the ways in which drainable wrap provides better moisture management.
3. Identify the ways in which rainscreen systems provide the best moisture management solution, and explain the important part that rainscreens play in areas like drainage and water resistance.
4. Evaluate installation best practices for drainable wrap and rainscreen systems, while identifying what the advantages are of a top vent, vent strip and corrugated rainscreen.

CONTINUING EDUCATION

AIA CREDIT: 1 LU/HSW
AIA COURSE NUMBER: AR112018-3

Use the learning objectives above to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit http://go.hw.net/AR112018-3 and complete the quiz for free as you read this article. If you are new to Hanley Wood University, create a free learner account; returning users log in as usual.

INTRODUCTION TO MOISTURE MANAGEMENT[1]

Water and moisture related construction defects are some of the leading causes of building failures, call-backs, and construction litigation in the US. One ASHRAE statistic states that 90% of construction defects ligation is due to water and moisture problems. ASTM estimates that water-related defects cost Americans over 9 billion per year in finish and structural damage.

Lack of adequate drainage in the wall system can lead to issues as “simple” as paint/stain failure to more complex-to-remedy problems such as mold, breakdown of the wall materials, and damage to the structural components of walls and floors. Consumers expect their homes to resist water as well as be durable, long lasting, and healthy places in which to live.

A common misbelief is that exterior cladding systems do a good job of protecting a structure from leaks. However, all cladding systems can and will eventually leak. Cladding materials like stone, brick, and stucco store water, and some are designed with weep holes to let water escape because they are not watertight.

Codes and building standards have progressively gotten stricter as result of the increase in water- related damage in homes. The building code is clear in its requirements not only to use a weather resistive barrier but also to provide for a drainage path for water to drain from the wall assembly. In addition, the Department of Energy now requires that builders follow the Water Management Check List as part of the qualifications for homes to be certified as Energy Star Homes.

Having an adequate drainage plane design and process element, as well as an installation that helps to remove water in walls of structures has become essential. Consulting firms that specialize in enclosure performance recognize that effective drainage is a key factor of good building design. Water management is also a significant component of green building programs because longer lasting, more durable homes and buildings equate to lower greenhouse gas emissions—less resources and energy are used to repair and replace them.

These important changes in the codes and other building standards allow for the creation of homes that have fewer leaks and call backs. The results are less liability for designers and builders, as well as creating higher quality and longer-lasting homes for consumers.

Causes and Solutions: Moisture Management[2]

Often, building defects can lead to moisture problems. For instance, poor architectural design can trap or direct water back into building assemblies without allowing for sufficient drainage. In other instances, the wrong materials might be specified for an application, or poor workmanship and substandard construction practices might be at fault, causing flashing to be poorly installed or non-existent. Occupants, too, can generate moisture and fail to maintain properties. Man-made issues can lead to further damage from wind and rain. Wind and gravity-driven rainwater can get through leaks in the building envelope.

Capillary action.

Capillary action involves water being absorbed from surrounding wet materials or conditions. The solution is to avoid having reservoir cladding systems, stone stucco, and wood in direct contact with materials that can absorb and store water. A rain screen should be utilized to create an air space that creates capillary break to stop capillary moisture flow. Using a drainable housewrap can also help reduce the impact of capillary moisture because it facilitates faster, more efficient drainage of water.

Air movement of moisture-laden air in and out of envelope.

Air contains moisture, and as air infiltrates or exfiltrates through building assemblies, it can dampen building materials and even condense on cold surfaces leading to mold and decay. Properly installing a continuous air barrier system that consists of a breathable building wrap on the exterior and additional air sealing from the interior around all penetrations can manage the moisture that occurs from air movement.

Diffusion.

Diffusion is moisture flow as vapor from a higher humidity environment to a lower humidity environment. Moisture is absorbed by building materials and is then released to a dryer environment. An example of moisture flow by diffusion is the drying process that would take place if the wall sheathing was damp; the moisture would diffuse or evaporate through a vapor permeable housewrap. In colder climates, the proper class of vapor retarder for the matching climate zone as required by codes should be installed.

The solution for many of these issues is the proper installation of a high quality, drainable, weather resistive barrier, and flashing systems that promote proper drainage to the exterior.

THE 4DS OF MOISTURE MANAGEMENT

Water is also controlled by employing the four D's of water-managed design: Deflection, Drainage, Drying, and Durability.

Deflection

Deflection utilizes designs, assemblies, and products that direct rain water away from the building. For example, a one-inch rain will deposit over 600 gallons of water per 1000 square feet of roof. Designing to deflect this water away as fast as possible means that there will be less water for a building assembly to drain. Strategies include avoiding complex, drainless designs. Instead, roofs that slope away for fast and easy drainage with no horizontal valleys or surfaces should be designed. Seamless kick-out flashings should be utilized to divert roof water away from roof wall intersections.

Drainage

All cladding systems can leak and will eventually allow water penetration. The faster water can drain from a building assembly, the less water that can be absorbed by building materials. Fast, efficient drainage reduces the amount of time needed for drying because components are less wet. This means less chance for fungal decay. The key is to provide as much unrestricted drainage as possible.

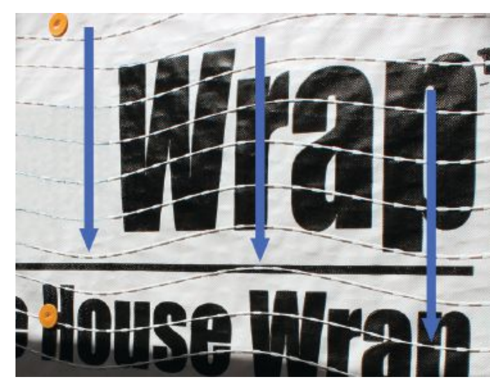
Drying

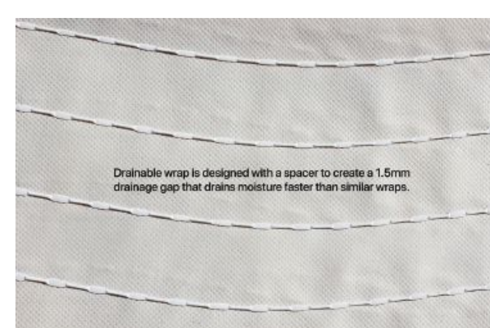
Deflection and drainage reduce the amount of water absorbed by building materials and therefore reduce the drying time. A design and construction assembly that is conducive to building assembly drying should also be constructed. Since all cladding systems can leak, the underlying building materials can get wet. The resulting damage potential is a function of how quickly wet building materials can drain and dry out. Employing a drainable water resistive barrier (WRB) or building wrap will prevent water intrusion but will also be breathable enough to allow damp building materials to dry out should water get behind the wrap.

Durability

Specifying quality construction materials that are designed to last the life of the building is crucial to preventing moisture related call-backs long term. According to the 2009 US census, 50% of all homes in America are over 40 years old, and the average age of US homes is 36 years.[3] Since building wraps, rain screens, flashings, and sealants are a primary line of defense against moisture problems, it is critical that all these components last and adhere for the life of a building, which could easily be 75 to 100 years.

Building codes require weather resistive barriers (WRBs) under all cladding systems to prevent water penetration into building assemblies. WRBs can be as simple as building paper or as multifaceted as a high-performance drainage wrap. Generally, they are a synthetic sheeting material made in a variety of materials and configurations. Overall, as well as employing the four D's of moisture management, consideration needs to be given to the components of a high-performance moisture management system. These include WRBs, drainable WRBs (better practice), and rainscreen systems (best practice).





Images provided by Tamlyn

DRAINABLE WRAP PROVIDES BETTER MOISTURE MANAGEMENT

Drainable wraps effectively eliminate excess moisture and mitigate the damaging effects of mold and rot. A drainable wrap is a non-woven housewrap that removes at least 100 times more bulk water from a wall than standard wraps.

CASE STUDY

Syracuse Plaza Housing, Denver, Colorado

Images provided by Tamlyn

Syracuse Plaza Housing is a high-rise property owned by the Denver Housing Authority that was built in 1979 and was recently in need of an exterior renovation. After considering options, a commercial grade fiber cement cladding was decided upon for most of the facility with some other materials used in select locations. In order to hold the cladding in place and achieve the desired appearance, an aluminum reveal trim system was selected and specified. This allowed the appearance to be varied, creating design impact and kept the overall façade lightweight and cost effective.

The performance of the new exterior was enhanced by the use of a building wrap material that served as an air barrier and drainage plane behind the cladding. The building wrap included an integral spacer that promoted proper moisture management and allowed full drainage between the cladding and building wrap surface. Part of the reason that this type of building wrap was used was because of the height of the building and the proven ability of the wrap to withstand high wind loads. This was achieved by the proper overlapping seams that were secured with two inch, double-sided tape to produce a full, continuous, barrier. The system was ideal for this location in that it created a fully prepared substrate surface ready to receive any variety of cladding materials.

Components of Drainable Wraps

The substrate material, or the "wrap" or "sheet," is a two-ply product consisting of non-woven base material which has a vapor permeable, water-resistant film overlaid onto the base product. Conversely, woven products tend to require micro-perforations to allow vapor-permeability, which in turn decrease the water resistance of a housewrap. Non-woven housewraps, on the other hand, are bi-laminate products that offer greater tear strength and utilize water-resistant film at their outer layer to provide the best possible water shedding. The ideal vapor permeability rating is in the range of 8 to 20 perms, which is acceptable for most climate conditions.

Filaments bonded to the base housewrap are made from a ridged, non-compressible, polyolefin monofilament material similar to a monofilament fishing line. The filament does not flatten out when cladding is attached. The filaments, which are 1.5mm in height and run continuously along the width and length of the drainable housewrap, are designed to provide a solid and strong hold-off of the exterior cladding material away from the "sheet'' portion of the housewrap, allowing effective, constant drainage.

Drainable wraps provide true drainage space or capillary break between sheathing and cladding material, and regular, compressed spaces on the filament allow drainage while providing a constant adhesion of the filament.

Overall, the attributes of the best drainable wraps include the following:

- Design removes at least 100 times more bulk water from a wall versus standard housewraps.
- Drains 2 times faster than standard housewraps.
- Drying capability of 3/8 rainscreen.
- Can be installed in any direction—horizontally, vertically, or diagonally.
- Should have an 8–20 perm rating.

In conclusion, drainable wraps promote fast and efficient drainage of water out of the assembly as well as provide a vapor-permeable membrane that allows moisture trapped in sheathing to escape. They are energy-efficient air barriers that stop air infiltration and exfiltration through walls in the home. Drainable wraps also create a weather barrier behind exterior cladding to protect the sheathing and aid in reducing water intrusion into the wall cavities.

Suitable claddings to use with drainable wraps.

Fiber cement planks of panels, natural wood sidings, processed wood sidings, vinyl, metal, stucco, stone/masonry veneer or manufactured stone, and other approved and recognized exterior cladding products are all acceptable for use with drainable wrap if proper installation practices are carried out.

If drainable wrap is used in stone or stucco applications, there should be a second layer of material such as kraft paper or building felt between the drainable wrap and the scratch coat to prevent stucco or mortar from filling the drainage plane of the sheet.

As a component to enhance and improve the total wall drainage system, drainable wrap may also be used behind the foam board in an EFIS system. On structures using an exterior insulation board wall, system drainable wrap may also provide effective coverage for drainage directly behind the final exterior cladding.

The key to the successful use of drainable wrap with any cladding mentioned above is to adhere to proper installation practices and choose drainable wraps that meet or exceed code requirements.

Code Requirements for Drainability: Testing for Water Resistance[4]

The International Codes Council (ICC) acceptance criteria ICC-ES AC38 establishes guidelines for the evaluation of WRBs which are limited to sheet materials used on exterior walls as water-resistive barriers; moisture protection barriers; weather-resistive barriers; and (optionally) air barrier materials. This acceptance criteria is designed to give the industry a list of tests that best evaluate the necessary performance factors required of a building wrap and are helpful when comparing products.

When complying with the ICC AC38 testing standard, WRBs are tested for the following:

- **Water Resistance**—the test for this is AATCC Test Method 127: Hydrostatic Pressure Test. During this test, three control specimens and three specimens that have been weathered via UV/acceleration are placed under a hydrostatic head of 55 cm for 5 hours. Wraps should have no water leakage, meaning that they met the water resistance requirement of AC38.

- **Drainage Efficiency**—the test for this is ASTM E2273. During this test, a wall assembly is created with drainage wrap over the sheathing behind the cladding, and water is applied to the assembly with the amount of drainage over time recorded. The AC38 minimum is 90%. Some manufacturers have scored as high as 96%.
- **Water Vapor Transmission**—the test for this is ASTM E96 Desiccant Method. During this test, the specimens are spread across a test dish with one side containing a desiccant (a material that absorbs moisture vapor) and then placed in a temperature and relative humidity-controlled environment with periodic weighs determining the rate of water vapor movement. The AC38 minimum is 5 perms, but the building industry trend is 10–20 perms.
- **Ability to impede air flow**—the test for this is ASTM E2178, Air Permeance of Building Materials. During this test, drainable wrap is sealed with polyethylene sheeting and tested with preset air pressure. The polyethylene sheeting is then removed, and the variation gives the air permeance. The maximum allowed by AC38 is 0.02 L/(sm²).
- **Durability and tear resistance**—the test for this is ASTM D5034, Breaking Strength and Elongation of Textile Fabric. During this test, drainable wrap is put under a constant rate of extension until breakage. The minimum for AC38 is 35 lb CD and 40 lb MD.
- **Cold weather flexibility**—During this test a specimen of drainable wrap is conditioned to 32°F (0°C), and then bent over a 1/16" diameter mandrel. To pass, it must not crack.
- **Flammability and smoke developed**—the test for this is ASTM E84, Surface Burning Characteristics of Building Materials. During this test, drainable wrap is placed in a tunnel with a burner on one end and a draft facilitates flame progression with the spread being calculated.

Overall, the 2015 International Residential Code (Section R703.1.1 Water Resistance) requires that "the exterior wall envelope shall be designed and constructed in a manner that prevents the accumulation of water within the wall assembly by providing a water-resistant barrier behind the exterior veneer as required by Section R703.2 and a means of draining to the exterior water that enters the assembly."[5]

QUIZ

1. Which percentage of construction defects litigation is due to water and moisture problems?
   - a. 50
   - b. 60
   - c. 75
   - d. 90

2. Rainscreens and drainable wraps can stop capillary moisture flow.
   - True
   - False

3. Which of the following is NOT one of the four "D's" of moisture management?
   - a. Drying
   - b. Depth
   - c. Durability
   - d. Deflection

4. Not all cladding systems leak.
   - True
   - False

5. Which of the following are components of drainable wraps?
   - a. non-woven base material
   - b. vapor permeable, water-resistant film
   - c. polyolefin monofilament
   - d. All of the above.

6. Some drainable wraps remove _______ times more bulk water from a wall versus standard housewraps.
   - a. 2
   - b. 10
   - c. 50
   - d. 100

7. When complying with the ICC AC38 testing standard, WRBs are tested for which of the following?
   - a. water resistance and drainage efficiency; ability to impede air flow
   - b. durability and tear resistance; flammability and smoke developed
   - c. water vapor transmission and cold weather flexibility
   - d. All of the above.

8. A rainscreen offers better moisture management and more protection against moisture than regular walls.
   - True.
   - False.

9. Drainable wraps should always be installed in shingle fashion starting at the base of the wall.
   - True.
   - False.

10. Which of the following is a component of a vented rainscreen system?
    - a. vent strip
    - b. corrugated rainscreen
    - c. rainscreen top vent
    - d. All of the above.

This article continues on http://go.hw.net/AR112018-3. Go online to read the rest of the article and complete the corresponding quiz for credit.

SPONSOR INFORMATION

TAMLYN®

Tamlyn was started in 1971 by Ron Tamlyn Sr and his wife Jean with $800 in borrowed money, and we continue to this day to be family owned. **Tamlyn** has brought to market a complete system of the enclosure with **TamlynWrap™**, the related **XtremeFlashing™** tapes and **XtremeSeam™** to ensure effective water management. **TamlynWrap™** is a Drainable Housewrap that exceeds all current code requirements while effectively removing 96% of moisture in testing utilizing our integrated filaments that maintain a 1.5mm stand-off from the house wraps primary surface and the cladding material.

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BENEFITS OF HIGH-PERFORMANCE WINDOWS IN HISTORIC PRESERVATION AND RENOVATION

Presented by:

WEATHER SHIELD. WINDOWS & DOORS

Planning Mill, Buffalo, New York—Adaptive reuse project consisting of loft apartments and retail space. The building was originally built in 1878 and is found in the Registry of National Historic Places.

LEARNING OBJECTIVES

1. Analyze the value of historic window replacement on sustainability, energy savings, and reuse for historic preservation
2. Examine specification standards of high-performance windows for sustainable historic preservation
3. Explore the benefits of high-performance window replacement in preservation projects
4. Identify practices and strategies for replacement windows in preservation or adaptive reuse

CONTINUING EDUCATION

AIA CREDIT: 1 LU/HSW

AIA COURSE NUMBER: AR112018-1

Use the learning objectives above to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit **http://go.hw.net/AR112018-1** and complete the quiz for free as you read this article. If you are new to Hanley Wood University, create a free learner account; returning users log in as usual.

If eyes are the windows to the soul, then windows are the soul of a building. Especially in historic buildings, windows can have the most significant architectural impact on a building's aesthetics. When cost or circumstance necessitates replacing a historic window rather than repairing or restoring it, building owners, stakeholders, and architects can help preserve the building's legacy with a blended approach of sustainability and preservation.

WHY DO WINDOWS MATTER IN HISTORIC BUILDINGS?

Windows are essential in historic buildings, as they comprise 10 to 30 percent of surface area. Windows are highly visible, impact exterior and interior aesthetics, and their workmanship and hardware are a direct reflection of the historic period. Windows need not be original to a building to be considered historic. This is extremely beneficial because historic window replacements can significantly reduce operational energy use, which supports sustainability goals and maintains preservation values simultaneously.

When dealing with historic buildings, how can an owner tell if the windows are indeed historic and worthy of preservation? According to the National Park Service, the windows should be at least 50 years old. Historic windows should have functional and decorative features that are important to the overall character of the building. The window material, how it operates, and its components are also important considerations. It is preferable to first stabilize the windows as a preliminary measure, then to evaluate the overall window condition to determine when protection and maintenance are not enough. When it is determined that a historic window does need to be replaced, the new work should match the historic material, design, scale, color, and finish.

Replacing historic windows can be challenging because there are many design details that simply don't exist today. Architectural styles have changed, and so have the ways in which we measure window performance. In many cases, even the materials and construction methods are different. Replicating details like sight lines of muntin bars, unequal sashes, and authentic wood frames also ensures the integrity of the building is maintained. Further, some modern window replacements are not built to last, leading to concerns of future repair difficulties or a cycle of waste. That's why it's so important to work closely with a window manufacturer that specializes in historic replacements and can provide the detailing, craftsmanship, and architectural support to help advocate for and deliver a quality replacement product.


A custom window renovation project for Harvey Hall at the University of Wisconsin Stout.

OVERLAPPING SYNERGIES BETWEEN SUSTAINABILITY AND PRESERVATION IN THE BUILT ENVIRONMENT

Historically, sustainability and preservation have been at odds. Whereas sustainability in the built environment focuses on maximizing energy efficiency and minimizing resource consumption, preservation seeks to uphold the historic fabric of communities. Preservation and sustainability goals conflict most when it comes to energy consumption. It's estimated that buildings account for up to 40 percent of worldwide energy consumption and are a major generator of greenhouse gases.

While preservationists argue that older buildings are green by nature, there are few substantiated benefits largely because designated historic buildings are usually exempt from energy code compliance. Further, a building's operational energy consumption accounts for up to 80 percent of all energy consumption across the building's life span, far exceeding the embodied energy resources needed to construct—or replace—the building and key structural elements, like windows.

And yet, preserving a building is often called the ultimate recycling project. Preservation maximizes the use of existing materials, reduces waste, and preserves the architectural and historical character of older communities. Green and sustainable design is an increasingly popular issue among preservationists and proponents of more efficient new construction, and the goals of each overlap.

For example, existing buildings reduce climate impact compared to new construction. Preservation can restore and reuse existing sustainable features already built into historic buildings, like working shutters, awnings, or proper use of historic window sashes (open the bottom sash from a shaded area to pull in cool air or open the top sash to allow warm air to escape). In these ways especially, all stakeholders share the common goals of sustainability and preservation.

HISTORIC WINDOW REPLACEMENTS: MYTHS VERSUS REALITY

Despite sharing common goals, there are still persistent, long-held beliefs that historic window replacements should be done only as a last resort and restrict the building and its owner in many ways.

The first myth is that replacement windows offer limited design flexibility. Unlike the many generic modern window styles available today, historic windows were often designed to give buildings a unique character and a stand-out design. This doesn't have to change. Historic window replacements typically come in several design shapes including rectangle, round-top, eyebrow and gothic. These design options paired with grille, trim and interior finish options, can be combined to create thousands of historic window styles to fit the style of a historic home or business.

In addition, historic windows are often beset with common problems including wood rot, loss of putty that holds in glass, joinery separation, and broken counter balance. Replacement windows can remediate these problems, match the original architectural style and materials, and preserve the building's essential character.

And, there are cases where only window replacement makes sense. These are instances where, for example, the surrounding frame or casing is cracked, shrunk, or severely compromised and won't hold the original window even if the window itself is repaired, or if the original window is so rotted and destroyed. Windows built in the early nineteenth century with muntins and the very thin panes of glass would fall into this category.

When historic windows are aged and losing their tightness, they permit air infiltration around the edges/perimeters and between sashes at connection points. In addition, many historic windows with true muntins also introduce points of thermal failure. Not all these windows are conducive to just glass replacement with double glazing—the entire window framework needs replaced to accommodate the depth differences. And because of all the joints and connections in old windows, there are excessive thermal failure points. Plus, many large windows that are historic are often spanning openings where the spans are too large and the old wood sags or changes shape due to moisture, rot, or inadequate size. New, modern engineered products that replicate the architectural features—but do so with modern materials and technology—can overcome these thermal failure points.

Cost is often cited as a reason to forego window replacements. However, reconstruction and rehabilitation can be costlier in some cases. There are also lower labor costs when replacing historic windows. This is because replacement windows can be customized with great accuracy, saving time during manufacturing and speeding up onsite installation, thus reducing labor costs. In many instances, the existing interior and exterior window trim is kept, which saves money on materials.

While some believe that using replacement windows limits buildings and owners, historic window replacements give owners and architects more latitude to use the building in new ways. Sometimes, adaptive reuse is the only way that the building's fabric will be properly cared for, revealed, or interpreted, while making better use of the building itself. Where a building can no longer function with its original use, a new use through adaptation may be the only way to preserve its heritage significance. Adaptive reuse has environmental, social, and economic benefits that give life to an old building and help restore its historical and cultural impact.

Finally, despite what some may believe, not all old buildings are historically significant. For a building to qualify as historic, it must meet the National Register Criteria for Evaluation. This involves examining the property's age, integrity, and significance. Most important, consider what, if any, role the property played in relation to historic events, activities, people, or developments. Even if a building is at least 50 years old, if it is not considered historically relevant, making the case for replacement windows should not be difficult.

OTHER POINTS TO CONSIDER

Historic commercial restoration projects are typically overseen by a governing historic society and/or team that dictates strict guidelines for the preservation of the structure. The appointed architectural team and historic teams work closely together to determine appropriate steps for the building windows.

Some projects may require restoration of the original windows to maintain their historic status, as dictated by the historic society overseeing the project. Other times, the project regulations may require that only a portion of windows need repaired—such as those within a certain street-side elevation—while all others can be replaced.

As a reminder, when the original building windows are irreparable, replacement is necessary. For example, parts of the trim, sash, or seal may have rotted away beyond repair, or glass may be missing from several windows.

The good news is that today's windows can be made to closely mimic the aesthetics of the historic window design—even those with ornate details—along with the added benefits of energy efficiency. If you have the green light to move forward with a historic window replacement, the first place to start is partnering with a reputable manufacturer that can help provide architectural assistance and the right products for your project.

HIGH-PERFORMANCE WINDOWS AND THEIR ROLE IN HISTORIC PRESERVATION

Windows are a key element of the historic building envelope in terms of aesthetic, function, and comfort. With windows having arguably the most significant architectural impact on the aesthetics of a building, historic window replacements help maintain the charm and elegance of these designs while improving their energy efficiency.

Sevier County Courthouse, Sevierville, Tennessee

CASE STUDY

Custom Historic Renovation Transforms Commercial Building

A window manufacturer was tasked with a custom renovation project for Harvey Hall at the University of Wisconsin Stout. More than 200 windows needed replaced while maintaining the building's original historic integrity. There were other elements to the renovation; however, replacing the windows would have the single biggest impact on the project's success.

Harvey Hall, University of Wisconsin Stout

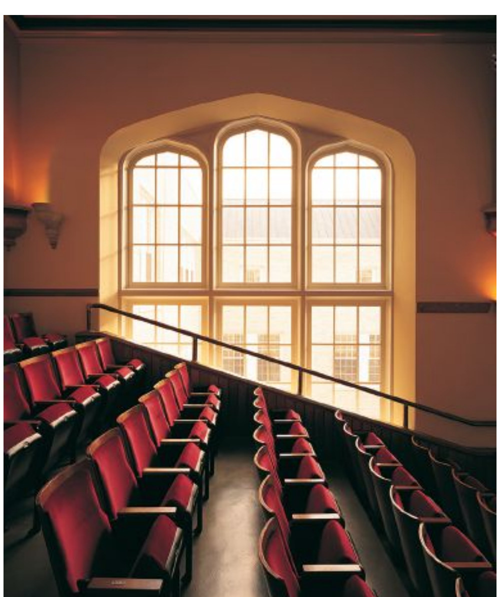
Work began with customized samples to replicate every detail of Harvey Hall's original windows and main entry doors. Project specifications included aluminum clad wood windows with custom-designed brickmold casing and sash lugs to match the originals. The manufacturer used paint samples from the original wood window frames to produce an exact color-matching profile. Next, the manufacturer secured FSC® certified white oak wood sourced from managed forests in the manufacture of all replacement windows and doors used in the renovation.

The result was a final renovation that exceeded expectations. The amount of natural light and intricately created original historical elements brought Harvey Hall back to life—and with modern energy efficient performance.

Historic window replacements come in a variety of styles designed to look great and pass strict historic district zoning requirements found in many older neighborhoods in America. These replacements feature historically accurate details, all wood frames, and thicker sashes that complement a traditional design.

The right historic windows maintain the architectural integrity associated with classic window designs but combine the efficiency and conveniences of modern windows. Historic windows were designed purely for functionality without efficiency taken into consideration. Look for wood historic replacement windows that combine high efficiency glass and dual pane construction with historically accurate window construction to create a window with superior aesthetics and energy efficiency.

High-performance windows also contribute to a historic preservation project's energy use and occupant comfort in many ways. Two components of energy conservation concern HVAC systems and solar energy strategies. For a window to create less load on HVAC systems, it should provide quality thermal and ventilation comfort by incorporating natural ventilation, if appropriate, and ensuring window openings are operable.



Hawkins Hall, University of New York, Plattsburgh, New York

This article continues on http://go.hw.net/AR112018-1.
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QUIZ

1. How much surface area do windows comprise in a historic building?
   a. 10 to 20 percent
   b. 10 to 30 percent
   c. 20 to 40 percent
   d. 40 to 50 percent

2. What shape design options are there for historic window replacements?
   a. Square, oval, rectangle, and circle
   b. Round-top, rectangle, square, and eyebrow
   c. Rectangle, round-top, eyebrow, and gothic
   d. Gothic, rectangle, oval, and square

3. True or False: There are three properties of a solar energy strategy, and they are heat gain, glare, and maximizing natural daylight.

4. In properly specified fenestration systems, lighting and HVAC costs can be reduced by _______ percent.
   a. 10 to 40 percent
   b. 5 to 10 percent
   c. 10 to 20 percent
   d. 30 to 40 percent

5. Among the 20 U.S. Green Building Council LEED-certified historic buildings in the U.S., two are the Empire State Building and _______________.
   a. U.S. Capitol Building
   b. Chrysler Building
   c. Frank Lloyd Wright's Fallingwater
   d. Thomas Jefferson's 1821 Pavilion IX

6. Historic replacement windows offer energy savings of between __________ percent.
   a. 10 and 20
   b. 17 and 29
   c. 15 and 27
   d. 23 and 40

7. A survey to specify replacement windows should consider many factors, such as __________ and _____________.
   a. Location and sizes
   b. Color and glass type
   c. Age and trim detail
   d. Sizes and solar coefficient

8. True or False: The first step in documenting a historic window replacement project is taking clear pictures of all windows.

9. There are five main window types used in historic replacement projects, and they are hung, casement, ________, slider, and fixed.
   a. transom
   b. picture
   c. awnings
   d. stationary

10. There is a _____ percent federal income tax credit available for income-producing historic buildings that are rehabilitated.
   a. 10
   b. 20
   c. 25
   d. 30

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PHOTOGRAPHY: SAM DIEPHUIS

Helping Architecture Embrace Technology

Cory Brugger, ASSOC. AIA, is the chief technology officer at worldwide firm HKS. Such a wide-spanning role can lead to incredibly unique opportunities, including working with NASA as a juror for a 3D printing competition to design habitats on Mars. But most of the time it requires Brugger to ask big questions, such as: "How can technology best support design?" and "How can designers learn to embrace tech?"

As told to Steve Cimino

NASA's Centennial Challenge competitions are amazing. They've been set up to support and instigate new thinking about a particular area of practice, and they're always centered around a very pragmatic use case. There are four competitions running right now; beyond 3D printing, the most interesting one involves creating vascular human tissue for space missions and for use on Earth. NASA plans all these competitions to explore options for changing technology while also pondering how it might benefit them—or us—five, 10, or 20 years down the line.

And if you think about the structure of any organization, we should all be looking at moon shots. We should be wondering what we can benefit from now, with the intent of also helping our company or practice evolve. What are our short-, mid-, or long-term innovations? Some of them will be incremental, but others can be truly transformative. How do you build the foundation of culture? That's something the industry has lacked for a long time.

When technology comes up in conversation, I try to instead talk about innovation. Many in the industry are derogatory towards technology or see it as subservient, and that's one of the things I've been working hard to change. We need to develop a different understanding of how technology applies to what we do. We all send emails because they became more efficient than phone calls, letters, and faxes. But fundamentally they are the same thing.

If we look at that as the foundation, then the value we provide to clients is ultimately just a set of drawings. And when you break down the profession, what we're selling is our hours and our expertise to produce those well-coordinated drawings. We take away the ability to position ourselves as a true professional service.

That's really the question I've been asking: How do we shift from producing a set of drawings—or the vision of what a building is—to focus on addressing the fundamental needs of the stakeholders we design for? How do we reposition the value of an architect as something more than just the idea for a building? And how can technology help? AIA

AIANow

By Kathleen M. O'Donnell

Art Spaces for All

Small galleries, nonprofit museums, and community art centers require partnerships with architects to fulfill their mission of bringing art to the public. "Art is not something that people feel is very accessible to them," says Amanda Harrell-Seyburn, ASSOC. AIA. A designer at East Arbor Architecture in East Lansing, Mich., Harrell-Seyburn leverages her background as a gallerist and curator to create functional and welcoming art spaces. "As a designer, I think about how I can make a space approachable but still maximize the opportunity to exhibit work," she says. She hopes to encourage architects to understand their role in providing quality environments where the public can interact with art.

Historic or even underutilized buildings present some of the richest opportunities for galleries, large-scale installations, or incongruities that make us rethink spaces that we have taken for granted, or that we might not have ever noticed before. "So often, a building is saved by a visual art space moving into it," Harrell-Seyburn says. "It's ideal because the community already cares for that building and has embraced it."

These four organizations, all housed in a redesigned or historic structure, demonstrate how architects are enhancing access to visual arts across the country.

Lansing Art Gallery & Education Center—Lansing, Mich.

For over 30 years, the Lansing Art Gallery and Education Center has been a cultural resource for the citizens of Michigan's capital. Now situated in the lower level of a former 20th-century department store, the headquarters boast a subterranean retail gallery representing more than 100 Michigan-based artists as well as exhibition and education spaces. Committed to inclusive programming, the organization expands its impact via a large-scale public project, ARTpath. The gallery benefits from a sustained relationship with Harrell-Seyburn, who regularly provides pro bono design services ranging from simple structural fixes to space planning for annual shows and events.

Academy Art Museum—Easton, Md.

A cultural staple of Maryland's Eastern Shore for 60 years, the Academy Art Museum promotes visual arts education, practice, and appreciation for local residents as well as a national audience that flocks to Easton for annual cultural and heritage festivals. Built from a block of 19th-century historic houses, Academy Art Museum buildings include art studios, exhibition galleries, and flexible spaces that support a broad range of media and techniques. The museum is currently undergoing an entry expansion project, designed by Baltimore-based Ziger|Snead Architects. Its new entrance is grounded by a welcoming glass cube—rotating on a 45-degree angle—that will serve as a new hub for the community, honoring the historic structures and echoing the organization's forward-looking mission.

ILLUSTRATION: LAUREN NASSEF

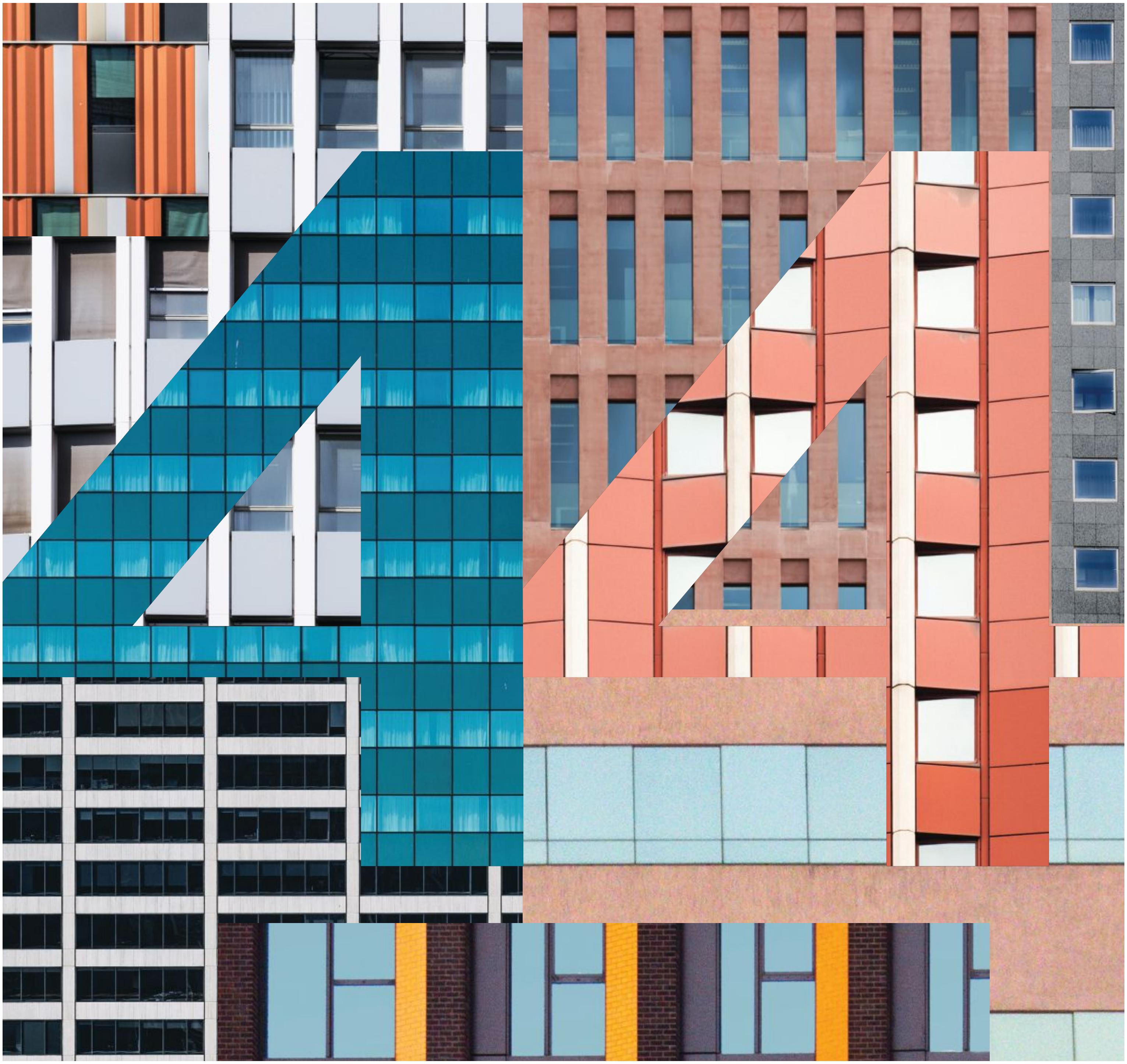
The Volland Store—Alma, Kans.

After the Volland Store sat idle for 40 years, two local residents bought and transformed the former mercantile and post office into an art space, honoring the building's history as an unlikely gathering place in Kansas' Flint Hills region. The organization's mission is to bring new ideas into the community and build common ground for rural and urban citizens. To bring this mission to life, Kansas City firm El Dorado and interior designer George Terbovich envisioned a flexible contemporary space within the historic brick building. Since its 2015 reopening, the Volland Store's programs and exhibits have spanned the arts and sciences, inspired by conservation efforts for the area's endangered tall grass prairie ecosystem. As part of their ongoing relationship with El Dorado—which recently brought on an art curator as principal—Volland Store is building an arts and humanities residency program to engage artists, writers, and thinkers with the communities and landscape of Flint Hills.

Ashé Cultural Arts Center—New Orleans

A centerpiece of the historic Oretha Castle Haley Boulevard in New Orleans' Central City district, the Ashé Cultural Arts Center (CAC) offers creative activities that emphasize all artistic disciplines. Bringing to light narratives of people of color, Ashé CAC utilizes culture and art to heal, strengthen, and engage its community. A new collaborative design for the center's main space—one part of its 18,200-square-foot multiuse facility—is in development. Led by Steven Bingler, AIA, of Concordia, artists and musicians are contributing to the project, which welcomes the public in a contemporary setting that honors African antiquity and its history in New Orleans. Centered on a curving "Bamboula" wall inspired by the African-based rhythms at the core of jazz and African-American music, the design includes an inviting public visitors center, marketplace, restrooms, and a nursing lounge, in addition to performance and exhibition spaces.

AIAKnowledge



DESIGN: SCOTT LIVINGSTON

44 Percent of Design Activity is Devoted to Existing Building Projects

The results of the 2018 AIA Firm Survey Report reveal that 44 percent of design activity is dedicated to improving existing buildings. Typically, existing building work shrinks during strong construction markets (like the one we are currently experiencing), but this time it has continued to hold steady. The persistent activity demonstrates the shift in owner focus to making current assets as valuable as possible—and the impact of incentives for investment in improvements versus replacement. Through existing-building work, architects can continue to have a tremendous impact on improving the efficiency of structures, combating the impact of climate change, and preserving our history. AIA

—Michele Russo

AIAFeature

Retaining Women in Architecture: Four Perspectives

Architects talk about professional advancement and what can be done to keep women in the field.

Kim O'Connell and Kathleen M. O'Donnell

ILLUSTRATION: POLYGRAPH

For a profession with such a long history, architecture has evolved very slowly in one critical way. Although women and men now enroll in architecture school in roughly equal numbers, it's still a vastly male-dominated profession, with women representing only about one in five licensed practitioners.

According to a 2015 AIA survey about diversity in the profession, 69 percent of women respondents felt that women were "somewhat underrepresented" or "very underrepresented" in the profession.

Data points from the AIA's most recent firm survey report, *The Business of Architecture 2018*, indicate progress toward more equal representation. According to the report, women comprised over a third of all architecture staff in 2017. Most of them, however, are unlicensed—some on the path to licensure, some serving in non-architect capacities. Keeping young professionals on the licensure track and providing career fulfillment so women don't seek opportunities elsewhere is imperative for today's architecture firms. The 2015 survey found that women leave the profession for a variety of reasons, including inequitable pay, lack of advancement opportunities, inflexible schedules, and long hours that might be incompatible with raising a family or maintaining a work-life balance. Not only does this "brain drain" deprive the profession of smart designers who help represent the diversity of the clients the profession serves, it also hurts the profession's reputation at a time when architects are still fighting to be understood and valued in the marketplace.

The opportunity for women to lead is the best path forward for representation, career fulfillment, and a secure future for firms. The 2018 survey report shows that the share of women in principal or partnership roles at architecture firms has increased by 18 percentage points in the last 10 years, with a 10 point gain in just the last two years. Women in firms across the country are staking a claim for themselves, and firms are rapidly supporting them.

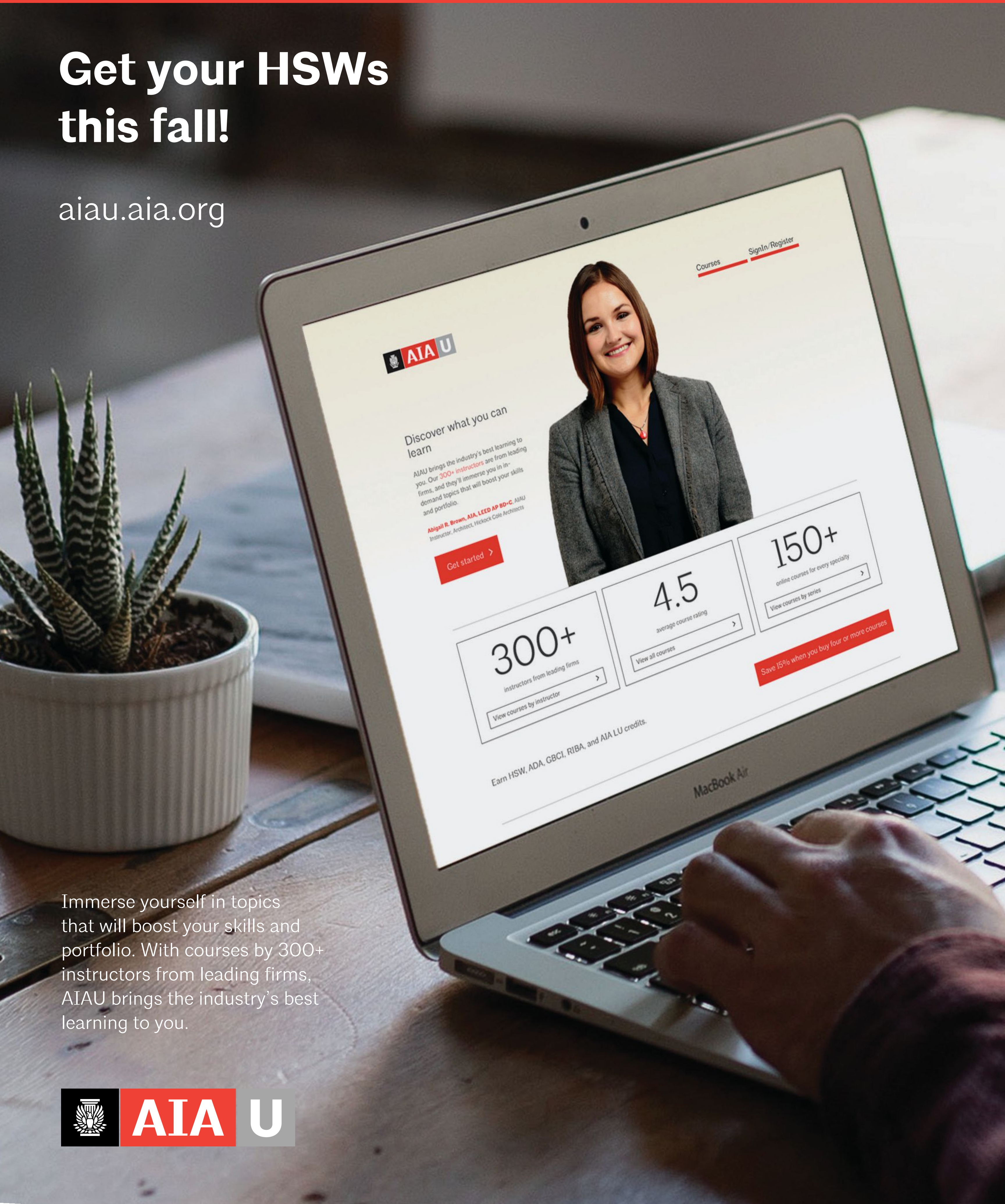
To understand what can be done to retain women and promote them as leaders, while benefiting firms in the process, we talked to four architects about barriers they have encountered and what they and others are doing to help women stay in architecture. Whether it was starting a firm, pursuing unique specialties, developing mentorship programs for emerging professionals or building volunteer networks, these women are making strides to advance the field.

Rosa Sheng, FAIA, is a principal and the director of equity, diversity, and inclusion for SmithGroup and member of the AIA's national Equity and Future of Architecture Committee. She is also the president of AIA San Francisco and a founder of Equity by Design (EQxD), an AIASF Committee aimed at conducting research, creating workshops, and sponsoring initiatives that advocate for equitable practice and culture change in architecture.

"No one comes out of school thinking that there will be barriers to advancement, because you're isolated in an academic environment where you're told you can do anything. I was fortunate that, early in my career, I didn't observe the impact of these challenges. In EQxD we do research on the topic of talent retention. We refer to 'pinch points,' to describe areas of challenge that one could face throughout one's career from graduation all the way through retirement. After I got married and started having children, I noticed that things were different for women at these pinch points. In that period in my life, there was a questioning of whether I wanted to continue my career as an architect. It was during the recession, around 2009 or 2010, and the outlook for projects and advancement was pretty bleak. With all the other challenges of parenthood, it just didn't seem worth it.

"At that point, I went to a symposium that was about understanding why there was a lack of licensed architects who are women. Shortly thereafter, we started a committee within AIA San Francisco to do research into why women were leaving the profession. We called it "The Missing 32 Percent," which eventually became known as Equity by Design. That has created a groundswell movement. It's not enough to just say it isn't fair how women are treated. We're generating a larger thesis that it's not just about representation and talent retention; it's tied into the quality and impact of the work we do, and it's about reinforcing our value to the clients.

"People need to understand that bias doesn't go away, but with a constant intentionality, it can be managed. You can't get to diversity and inclusion without the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acknowledgment of sources of inequity and the importance of reducing barriers. Part of our effort is to redefine design excellence to include equity, dignity, and respect. When you drill down into it, what are some of the things we do and the attitudes we have that create disrespect? And how does that affect the design?

"We often encounter firms that say, 'We're not the worst—we have some diversity or equity measures in place, so we're not that bad, and that's good enough.' Or they say they're going to implement a program, but they just don't have an infrastructure. We've learned that without intentional structure and the authority and agency to implement the change, it's difficult. It's a culture change. It's often taking a company in a different direction. We can't remove barriers entirely, but we can do our best to level the playing field."

Andrea Love, AIA, is a principal and director of building science at Payette. After working as a licensed architect and discovering a passion for sustainability and performance, she pursued a graduate degree in building technology that set her on a path towards leadership at a firm she praises for its investment in employees.

"I graduated architecture school in 2002, when people were just starting to get interested in sustainability. There was a void in the profession of people who had that experience and interest, so I was able to step into that role at a number of architecture firms. Then I felt with just an architecture degree, personally, I lacked some of the technical knowledge to push building [design] as much as I wanted to. I was already licensed and working as an architect, but I decided I needed to go to grad school eight years after I finished school. I went to MIT and the building technology program to get that technical background so I could leverage that building science side to really push design. I didn't want to become an engineer, but I wanted to understand that engineering is a way to influence and inform design. When I left MIT is when I joined Payette.

"They were interested in creating a building science group. At that point, it wasn't viewed as a leadership role, but more as a specialty role within the firm to help advance the practice. I do think having a specialty role allowed me to stand out a little more than someone else. In a firm of 160 people, it's a little easier to get lost amongst the project teams, and so by having a specialty role, I was able to always have my own voice in the projects and within the firm. That helped me in my path towards leadership.

"For the most part, because I was creating my own path, I didn't face the same challenges other people did. There were perceptions or biases people had around me, for example, when I was pregnant—about what I could or could not do or what I would be able to do when I came back. I had to be pretty vocal. It wasn't because they didn't think I could do something, but they were overly cautious. There was more of that sort of thing than there were explicit hurdles for me. But because I had a unique position and it was a role that hadn't existed in the firm, I was able to forge my own path.

"One of the things I really like about Payette is that there's an interest in longevity. It's not just a place that people come to work for a year or two years, get burnt out, and go somewhere else. It really is about trying to create work-life balance; it's a place you stay for your career. There's an interest and emphasis in trying to help develop people. The other thing from a firm culture side that appeals to me is the ability to change. It's not to say that we're perfect by any means, but the interest and willingness to continue to evolve is important, and something that not all firms possess."

Sharon Davis, ASSOC. AIA, is founder and principal of Sharon Davis Design in New York City. After spending years in another field, she earned her M.Arch. from Columbia University and founded her firm in 2007. Her work includes the design of the Women's Opportunity Center in Kayonza, Rwanda.

"I feel that women need flexibility, whether it's in education, in licensing, or in the first five to 10 years of work.

"I was an unconventional student in that I was older, married, and had children. I was surprised by the lack of flexibility in the curriculum and hadn't understood the importance of being in the studio working—as opposed to working from home.

"My youngest child was 3 when I started the program, and although my husband was very supportive, my being in the studio constantly was rough for the whole family.

"My second year, I dropped a class and made it up during the summer. I chose to spend the summer breaks with my family, so I didn't get the work experience that other students had, which was a disadvantage when I graduated.

"I feel that women need flexibility, whether it's in education, in licensing, or in the first five to 10 years of work."
—Sharon Davis, ASSOC. AIA

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"In terms of mentoring, I continue to be incredibly thankful to Louise Braverman, FAIA. She is a single practitioner and has given me helpful advice about managing my business. We met while we were both working on projects in Africa."

Jess Garnitz, AIA, is a designer with Stantec and a co-founder of the Mid-Career Mentorship Program run through the Boston Society of Architects. The program connects women at the midpoint of their careers with women principals for ongoing discussions about career trajectories and professional opportunities.

"After I got my undergraduate degree, I got a job working at ARC/Architectural Resources Cambridge. I was working in their design studio and touching a lot of projects. It was a lot of fast-paced work. I had a great mentor there, and he taught me a lot about the professional aspects of architecture. He was always conscious to explain what he was doing and why. I eventually got a master's at Syracuse and went to work for ADD Inc., which was later acquired by Stantec.

"I had been a co-chair of the Emerging Professionals Network with the Boston Society of Architects [BSA]. After a few years, when I felt like I had emerged, I was looking for something similar that would provide support and programming for new issues I was facing as I entered my mid-career, but I couldn't really find anything. I was talking with Caroline Fitzgerald of the BSA's Women Principals Group, and she was saying that she'd also heard from others that there wasn't enough support for mid-career women. She introduced me to other women thinking along these same lines, and we decided to start BSA's Mid-Career Mentorship Program as one of a few new initiatives that targeted mid-career women.

"It's a self-sustaining program. We put a lot of time and effort into matching people—women principals and mid-career design professionals. Participants have talked about salary negotiations, career transitions, future employment, how to handle a challenging boss, and long-term career planning. Another popular topic is self-promotion: How to speak up for yourself without being off-putting. I plan to apply to the program myself.

"Principals get a lot out of it, too. They say that they enjoy giving back to the community. They get to meet others who could be potential leaders and know that they are helping to shape the design future of the Boston area." AIA

AIAPerspective

PHOTOGRAPHY: GABRIELA MARKS

Truth and Reconciliation

Knowledge comes in different forms.

After 27 years in prison, Nelson Mandela became president of South Africa. His greatest challenge was to successfully transition the country from apartheid to a multicultural society. Mandela understood that South Africa's survival depended on uniting a deeply divided nation. Recognizing that the inequities and crimes of the past must be confronted as the first step toward forgiving, trusting, and healing, Mandela established the Truth and Reconciliation Commission.

Today the architectural profession is compelled to confront its own history of inequities, and even crimes, if it is to survive and thrive into the future. This year, the #MeToo movement has given voice to thousands, mostly women, who have suffered harassment and abuse in the workplace, including several high-profile cases in the architectural profession.

Our profession must do everything possible to support those who have been targeted and abused, and to hold harassers and abusers fully accountable for their actions. But if we are going to make our profession equitable and just, we cannot stop there.

The stories reported this year reveal a profession that all-too-frequently favors talent over character. Abuse in architecture is not limited to sexual abuse—far from it. Our profession has been shown to knowingly tolerate, even enable, abuses by the powerful and acclaimed, and practices that perpetuate inequality, inequity, and exclusion.

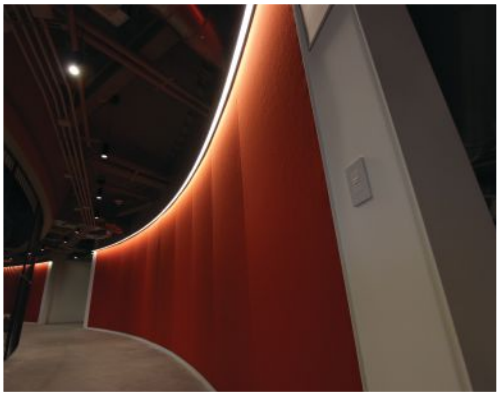
As our association works diligently and urgently to eliminate harassment, abuse, and inequity, I have come to understand that most acts that tolerate and enable them are born of ignorance and an outdated professional culture. But, as the saying goes, "Ignorance is no excuse." Culture changes as attitudes and actions change.

Is our profession capable of praising the creations of, for example, Stanford White and Louis Kahn without idolizing them as people? This is not an easy proposition. It requires complex and nuanced thought, qualities that are all too often missing in today's discourse. Granted, our profession requires singleness of purpose, but not at the expense of common decency and respect for the contributions of others.

Our profession cannot transform studio and workplace culture without changing how we teach and work. How many universities have truly changed the design studio experience? I know of few, most at community colleges. How many firms are still built around a single master designer? On this count I'm more optimistic. Larger-than-life personalities are being displaced with branded firms. (I say this without cynicism. Branding is this era's method for defining common purpose.)

The AIA is publishing its first set of equitable practice guides for architecture firms. More will follow next year. Download them. Read them. Live by them. It is time to accept the truth about our profession: Too few firms sufficiently promote equity, diversity, and inclusion. Reconciling this means taking intentional steps to correct errors of both commission and omission. Let's start together now. AIA

Carl Elefante, FAIA,
2018 AIA President



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KEYNOTE

Steven Johnson,
Author, *Wonderland* and
How We Got to Now

DEANS

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“I’ve been looking for the young landscape architect who is the next Olmsted,” Jobs told Olin.

The Untold Story of Apple Park by Witold Rybczynski, HON. FAIA

The Landscape Plan for Apple Park

Perimenter transplants
Existing trees
Conifers
Evergreen oak trees
Fruit trees/orchards

NICOLAS RAPP

Most press coverage of the new Apple headquarters in Cupertino, Calif., designed by Foster + Partners, has not been kind. There are stories about people bumping into glass walls, and employees complaining about the open-plan offices. Why are the parking garages so big, the critics have complained? Why is the building so isolated from its surroundings? "There's too much that makes [the project] incredibly backward thinking (and not just its lack of child-care facilities)," wrote Allison Arieff in *The New York Times*. The media reporting was necessarily second hand because, with the exception of Steven Levy, who wrote a long piece for *Wired*, no journalist has actually visited the place. My own request was politely turned down. "We're not hosting any tours at the moment," I was told. "You're more than welcome to stop by the Visitor Center and see the augmented reality experience of the campus." Augmented reality? That wasn't very helpful. But if I couldn't see the real thing, I could at least talk to someone who had.


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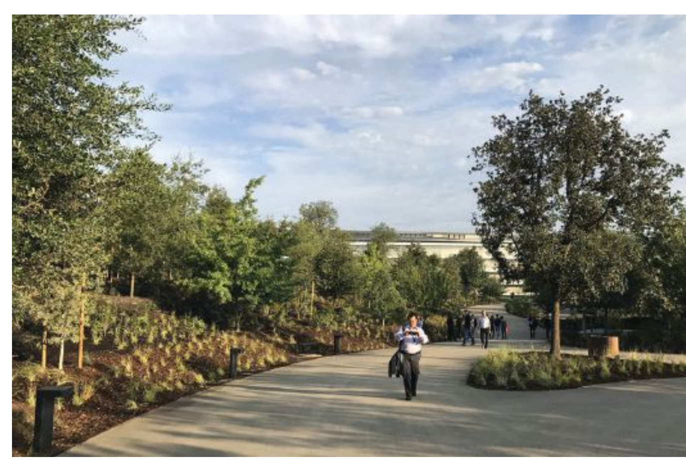
The landscape architect Laurie Olin, HON. AIA, has spent the last seven years working on what has become known as Apple Park. (Full disclosure: Olin is a University of Pennsylvania colleague and we have written a book together.) The landscape did not get much attention in the early press coverage—partly because the planting was incomplete, partly because the reporting was based on drone views taken from 100 feet up in the air, and partly because the architecture critics were not that interested in what Alexandra Lange in Curbed called "the landscaped ring of trees around the architecture that buffered it from the traffic on the multi-lane roads all around it." But according to Olin, the landscape was one of the things that was uppermost in Steve Jobs' mind.

Looking for the Next Olmsted

Olin was approached by Apple in the spring of 2011. By then, the Foster office had been working on the building for almost three years, but apart from a local arborist who had been advising on tree planting, no landscape architect had been appointed. Olin, whose firm is based in Philadelphia, flew out to Cupertino and met Jobs.

Olin recounted the meeting to me. "I've been looking for the young landscape architect who is the



The Apple campus, which was designed to be a retreat for employees

CHRIS DAVIES

next Olmsted," Jobs told him, referring to the great 19th-century park builder. Olin, who was 73 at the time, wasn't sure how to respond and said something about Olmsted being unique. The name came up several times in their conversation. Olmsted had laid out the Stanford University campus in Palo Alto, where Jobs lived, and Jobs referred repeatedly to Stanford's Main Quad. At one point, after Jobs had talked about what he liked in a landscape, Olin asked him what sorts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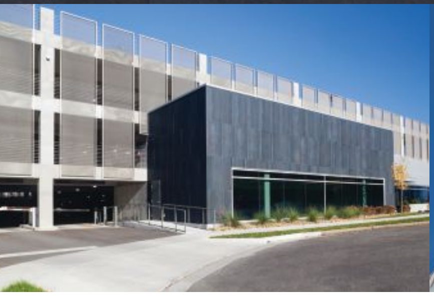

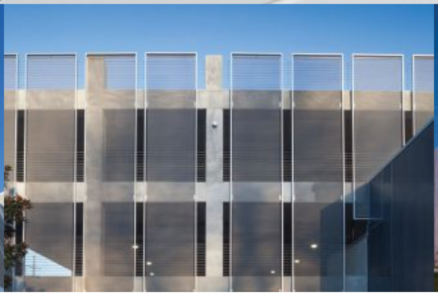

of things he didn't like in a landscape. "Anything modern," said Jobs. "But you're the most modern person there is," a surprised Olin replied. Jobs didn't elaborate; he just threw his hands up in the air and repeated, "Anything modern."

When Olin met Jobs, the 56-year-old business magnate was undergoing treatment for cancer—he would die in October of that year. Olin describes their relationship as "a brief encounter, but very intense." They met in Jobs' home—his medical condition prevented him from going to the office—and one of the first things that Olin noticed was a large portfolio of Ansel Adams landscape photographs on a table in the living room. Jobs, who was born in San Francisco and raised in the Bay Area, fondly recalled the apple orchards of his youth. Olin was impressed by Jobs' deep knowledge of the local landscape, for he himself was no stranger to northern California. He had grown up in Alaska and studied architecture in Seattle, but he had done his military service at Fort Ord on Monterey Bay, and later had worked on many projects in the Bay Area, most recently the master plan for Mission Bay in San Francisco.

Olin's firm got the Apple commission. At Jobs' suggestion, Olin himself moved to Palo Alto for four months. This was an opportunity not only to familiarize himself with the project and the site but also to revisit the many landscapes of northern California, both natural and manmade: oak forests and orchards, grazing lands and meadows, pine groves and gardens. He and Jobs determined that the landscape of the site would function as a retreat for Apple employees, and the design would be guided by two main principles. "Health, in terms of mental and physical stimuli and ecology, and the regional landscape of northern California, in terms of history, fact, and myth," Olin says. He stresses that Apple Park is a representation of this landscape, not a copy. This was one of Olmsted's great discoveries: that parks could be designed like landscape paintings, but whereas the painter used oil paint as a medium, the park builder used nature itself. This conflation of medium and content has been a source of confusion for the public ever since. Park-goers assume that a landscape such as Central Park is "natural" because it is created using natural means, whereas in reality the park is as manmade as one of Albert Bierstadt's monumental canvases of Yosemite.

In the same way, Apple employees walking to the auditorium or the fitness center, or jogging on the trails surrounding their new workplace,


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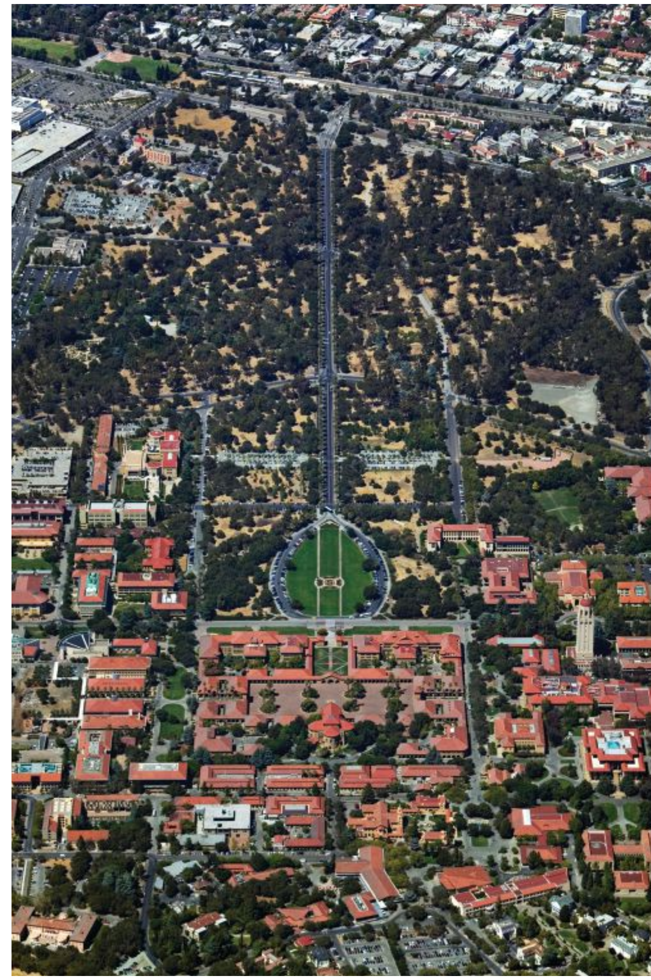

Stanford's campus, whose master plan was designed by Olmsted (the main quad is immediately below the green oval)

AERIAL ARCHIVES

may well imagine that they are surrounded by "nature," whereas in fact the hilly topography of Apple Park is entirely manmade. When Apple acquired the property, which Jobs remembered from his childhood as an apricot orchard, it was perfectly flat, a Hewlett-Packard office campus. Once the buildings, access roads, and parking lots were removed, the site was turned into a park—at 150 acres, a substantial one. The court inside the circular building alone covers 20 acres which, as Olin pointed out to me, is larger than the entire Stanford Quad.

The logistics of creating a manmade landscape are challenging. Apple Park required more than 8,000 new trees (some fully grown) and many more shrubs, which nurseries had to grow well in advance. The emphasis was on native plants, but anticipating a changing climate, the Olin team included non-native species that would better survive warmer summers, colder winters, and more serious storms. A 2.5-mile pipeline was built to


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enable irrigation with reclaimed water from a Santa Clara Valley treatment plant. In line with Jobs' vision, hundreds of fruit trees were planted, not only apple orchards but also apricot, pear, plum, and cherry trees. (The harvested fruit will be served in Apple's cafeteria.) Meadows with grasses and wildflowers are usually planted from seed and take several years to establish; with Apple's support, the Olin team built test plots and developed a method of planting some meadows with sod to jump-start the process. One of the landscape features initially proposed by Foster + Partners was a 160-foot-diameter circular pool in the court. Olin decided to make what he calls a "ripple pool," and his firm developed a mechanism that created a tiny concentric wave motion over the surface of the water. "Apple being Apple, they decided to build a full-size mock-up of a portion of the pool to study different kinds of pebbles and wave effects," he

A sketch by Laurie Olin of the Apple Park central garden

told me. He pointed out that unlike the extensive landscapes of the suburban corporate parks of the 1960s, which were chiefly decorative—designed to be looked at—the Apple landscape was designed to be used: 2 miles of walking paths, bicycling and jogging trails, sitting areas beside the pool, and two freestanding terrace cafés in the interior court.

If you're not an Apple employee you can get a partial idea of the ground-level experience of the place from a recent Apple commercial filmed on the property: a young woman sprints through the building, splashes across the shallow ripple pool, and runs up a long meadow to breathlessly deliver a suitcase to CEO Tim Cook as he prepares to unveil a new Apple product. All the people in the video are company employees—Apple Park is not open to the public, although with 12,000 individuals using the site it's not exactly private either. Olin, who has designed large public parks, including the 445-acre Hermann Park in Houston, reminds me that Olmsted's final project was a private park, the immense Biltmore Estate in Asheville, N.C. Apple may not be Olin's last project

LAURIE OLIN


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but there is another parallel: like Biltmore, it is a personal meditation on the art of landscape design by a seasoned master.

An Unfortunate Meme

Back in 2011, when Steve Jobs presented the plans for Apple's new headquarters to the Cupertino City Council, he showed an aerial view of the vast circular building. "It's a little like a spaceship landed," he joked. The metaphor stuck and became a meme—but not in a good way. Christopher Hawthorne of the *Los Angeles Times* mentioned the project's "futuristic gleam" but found it "a doggedly old-fashioned proposal" and compared it unfavorably to the suburban corporate architecture of the 1960s and '70s. "Buildings aren't spaceships," wrote Paul Goldberger, HON. AIA, in *The New Yorker*. He questioned the scale of the design and found it "troubling, maybe even a bit scary."

I asked Olin what he thought of Norman Foster, HON. FAIA's building. "There are some architecture firms that could do a project of this size but not as refined, and there are firms that could produce as refined a design but could not handle the scale," he responded. "Foster is one of the few firms in the world that can do both."

Olin describes the project as more like a piece of infrastructure than architecture. "It's so large that you never see more than a small piece at a time." This is where some of the criticisms miss the mark. Relying on aerial views, they describe Foster's building as a gigantic flying saucer. But judging from the photos that Olin showed me, the ground-level perception is quite different: snatched glimpses of a continuous four-story curved glass façade among the trees, and in much of the large wooded site no views of the building at all. The chief experience on the site, both from outside and inside the building—whose circulation, at Jobs' insistence, is along the glazed exterior—is of the landscape, a landscape composed of naturalistic elements. There are no grand axes, no allées or parterres, none of those stylish geometric curves that are so fashionable these days. Instead there are clumps of trees, rolling greensward, wildflower meadows, and functioning orchards.

A very Olmstedian landscape, or rather, Olinian. "Apple Park should end up as one of the most significant works of my career," he emailed me. No small statement, coming from the designer responsible for the makeover of Bryant Park in New York, the gardens of the Getty Center, and the grounds of the Washington Monument.

This year's installment of the ARCHITECT 50 is a testament to the program's staying power and momentum. The depth and talent of the participating firms—160 completed submissions—was unparalleled. As always, we calculated scores in three categories (business, sustainability, and design) and added them together to create an overall ranking. This year, the biggest change came in how we calculated the sustainability ranking (see the methodology on page 126). The result? The list featured a nice mix of small boutique firms and giant multinationals, repeat winners and new practices that scaled the charts. Turn the page to see which firms had the best year in 2017.

The 10th Annual ARCHITECT 50

DREW KELLY

INTRODUCTION BY ERIC WILLS
TEXT BY DAVID HILL

01 Top Firm

15
17
05

Left to Right: WRNS partners Tim Morshead, AIA, Raul Garduño, Wright Sherman, AIA, Russell Sherman, Mitch Fine, AIA, Bryan Shiles, FAIA, Lilian Asperin, AIA, Jeff Warner, AIA, Pauline Souza, AIA, Sam Nunes, AIA, Kyle Elliott, Melinda Rosenberg, ASSOC. AIA, David Englund, AIA, Adam Woltag, AIA, John A. Ruffo, FAIA, and Brian Milman, AIA

WRNS Studio

DREW KELLY

When San Francisco–based WRNS Studio nabbed the top spot on the ARCHITECT 50 list for the first time, in 2013, the firm was just eight years old and 60 employees large, and had recently completed what would prove to be a transformational project: a new campus in Lehi, Utah, for tech giant Adobe. “This burgeoning firm has nowhere to go but up,” predicted one critic back then.

That prediction was prescient. WRNS has now become only the second firm to earn the number one overall ranking twice. (Skidmore, Owings & Merrill, which did it last year, was the first.) WRNS’s growth has been remarkable: Today the firm has 180 employees, with offices in San Francisco, Honolulu, New York, and Seattle. In 2017 alone, WRNS added 44 employees; the firm also enjoyed a 19 percent increase in net revenue from 2016. The Adobe project helped position the firm as a go-to architect for the tech world, and WRNS has since completed (or is working on) high-profile office projects for Airbnb, Intuit, and Microsoft.

Even with the firm’s rapid growth, WRNS has stayed true to its core values, says Sam Nunes, AIA, who founded the firm with Jeff Warner, AIA, John Ruffo, FAIA, and Bryan Shiles, FAIA. “Our projects end up being a manifestation of our enormous curiosity about the world,” he says. “We strive for our work to be socially responsible. We understand that architecture has a great impact on people’s lives, and that it can do a whole lot of good if done properly.”

John King, urban design critic for the *San Francisco Chronicle*, says that “there’s a general high level of consistency in their work that I appreciate. There’s always a certain clarity and rigor to their buildings.”

Among WRNS’s recent projects: a cube-like screening room, with a perforated aluminum skin, in San Francisco for Dolby Laboratories; a LEED Platinum–targeted wellness center at San Francisco State University; the Collision Lab at Cornell Tech on New York City’s Roosevelt Island; and a student center at Sonoma Academy in Santa Rosa, Calif., which won an AIA COTE Top Ten award and is on track for Living Building Challenge Energy and Materials Petal certification. (Learn more about the project in our Top Ten coverage, which starts on page 128.)

With two of the firm’s founding partners, Warner and Ruffo, slated for retirement next year, WRNS seems poised for change. Not to worry, insists Nunes. “This place is in constant transition,” he says. “That’s the way it’s set up. There’s always a bit of the old and bit of the new at any one time.”

OVERALL RANK

FIRM
NAME

DESIGN RANK
BUSINESS RANK
SUSTAINABILITY RANK

GROSS REVENUE ■ LESS THAN 1 MILLION; ■■ 1–9.9 MILLION; ■■■ 10–99.9 MILLION; ■■■■ 100–999.9 MILLION; ■■■■■ 1 BILLION+

EMPLOYEES ■ 1–10; ■■ 11–99; ■■■ 100–499; ■■■■ 500–999; ■■■■■ 1000+

+ FIRST TIME MAKING THE TOP 50 OVERALL ↑ BIGGEST MOVERS

0 50 100
POINTS

Overall Rank	Firm Name	Design Rank	Business Rank	Sustainability Rank	Gross Revenue	Employees	Biggest Movers
02	BROOKS + SCARPA	02	130	10	■■	■■	
03	WILLIAM RAWN ASSOCIATES	51	05	26	■■■	■■	
04	CANNONDESIGN	12	40	27	■■■■	■■■■	↑42 PLACES
05	HOK	53	28	03	■■■■	■■■■■	↑30
06	STUDIO MA	36	14	24	■■	■■	↑25
07	HKS ARCHITECTS	31	13	29	■■■■	■■■■■	↑20
08	TOULOUKIAN TOULOUKIAN	22	25	19	■■	■	↑22
09	SKIDMORE, OWINGS & MERRILL	16	49	15	■■■■	■■■■■	
10	LMN ARCHITECTS	34	42	06	■■■	■■■	
11	HASTINGS ARCHITECTURE ASSOCIATES	82	01	37	■■■	■■	
12	MITHUN	69	33	02	■■■	■■■	
13	LAKE | FLATO ARCHITECTS	25	53	13	■■■	■■■	
14	HDR ARCHITECTURE	109	10	04	■■■■	■■■■■	
15	PERKINS+WILL	29	58	09	■■■■	■■■■■	
16	PAYETTE	45	20	22	■■■	■■■	
17	THE MILLER HULL PARTNERSHIP	55	111	01	■■■	■■	
18	ADRIAN SMITH + GORDON GILL ARCHITECTURE	23	12	59	■■■	■■■	
19	ZGF ARCHITECTS	16	73	25	■■■■	■■■■	
20	CLARK NEXSEN	68	03	55	■■■	■■■	↑110

21	HGA	07	50	69	
22	SMITHGROUP	38	48	19	
23	FX-COLLABORATIVE	47	24	40	
24	OPSIS ARCHITECTURE	73	36	12	+
25	STEINBERG HART	74	07	52	+
26	LORCAN O'HERLIHY ARCHITECTS	01	128	84	+
27	HACKER	26	114	28	
28	DLR GROUP	58	88	14	
29	LEDDY MAYTUM STACY ARCHITECTS	42	03	30	
30	ARCHIMANIA	08	145	41	
31	HENNEBERY EDDY ARCHITECTS	76	71	11	+
32	EYP	60	34	41	
33	SOLOMON CORDWELL BUENZ	37	56	45	↑53
34	SRG PARTNERSHIP	28	118	33	
35	LEERS WEINZAPFEL ASSOCIATES	72	80	18	
36	BRUNER/COTT & ASSOCIATES	71	112	08	
37	CO ARCHITECTS	47	30	62	
38	AYERS SAINT GROSS	50	29	64	
39	SASAKI ASSOCIATES	52	09	31	↑20
40	ESKEW+ DUMEZ+ RIPPLE	20	129	45	
41	CBT ARCHITECTS	40	09	44	
42	BNIM	38	86	51	
43	BALLINGER	64	76	36	↑51
44	ANN BEHA ARCHITECTS	66	27	61	
45	LPA	110	26	23	
46	SEMPLE BROWN DESIGN	62	09	09	+
47	ZIGER | SNEAD ARCHITECTS	56	85	49	
48	NAC ARCHITECTURE	80	39	50	+
49	STUDIO GANG ARCHITECTS	13	82	01	
50	MARLON BLACKWELL ARCHITECTS	05	04	112	

26

01

128

84

Top Firm for Design

02 BROOKS + SCARPA 03 LTL ARCHITECTS 04 RICE+LIPKA ARCHITECTS 05 MARLON BLACKWELL ARCHITECTS
06 ANMAHIAN WINTON ARCHITECTS 07 HGA 08 ARCHIMANIA 09 TRAHAN ARCHITECTS
10 NARCHITECTS 11 NADAAA 12 CANNONDESIGN 13 STUDIO GANG 14 EL DORADO 15 WRNS STUDIO
16 (TIE) SKIDMORE, OWINGS & MERRILL AND ZGF ARCHITECTS 18 BEHNISCH ARCHITEKTEN
19 DESAI CHIA ARCHITECTURE 20 (TIE) ESKEW+DUMEZ+RIPPLE AND WORKS PROGRESS ARCHITECTURE
22 TOULOUKIAN TOULOUKIAN 23 ADRIAN SMITH + GORDON GILL ARCHITECTURE
24 ALLEY POYNER MACCHIETTO ARCHITECTURE 25 LAKE|FLATO ARCHITECTS 26 HACKER ARCHITECTS
27 IKON.5 ARCHITECTS 28 SRG PARTNERSHIP 29 PERKINS+WILL 30 ARCHITECTURE RESEARCH OFFICE
31 (TIE) HKS ARCHITECTS AND 5G STUDIO 33 TEN ARQUITECTOS 34 LMN ARCHITECTS
35 TIGHE ARCHITECTURE 36 STUDIO MA 37 SOLOMON CORDWELL BUENZ 38 (TIE) SMITHGROUP
AND BNIM 40 (TIE) CBT ARCHITECTS AND EHRLICH YANAI RHEE CHANEY ARCHITECTS
42 LEDDY MAYTUM STACY ARCHITECTS 43 (TIE) GO LOGIC AND HUFFT PROJECTS 45 PAYETTE
46 OVERLAND PARTNERS 47 (TIE) FXCOLLABORATIVE AND CO ARCHITECTS
49 SNOW KREILICH ARCHITECTS 50 AYERS SAINT GROSS

Lorcan O'Herlihy Architects

For Lorcan O'Herlihy, FAIA, founding principal of Los Angeles–based Lorcan O'Herlihy Architects, buildings are not isolated objects. "Architecture is a social act," he says. "When we design a building, we're concerned about how it impacts the sidewalk and the street, and how it impacts the social and civic world." His term for this approach: "Amplified urbanism."

That philosophy—an especially forward-thinking one in sprawling LA—helped Lorcan O'Herlihy Architects earn the top spot in the design category of this year's ARCHITECT 50. "Coherent and unique projects with tremendous range," said the design judges about the firm's portfolio. "The work possesses an impressive catalog of variation and invention concerning approaches to architectural identity."

Consider the firm's design for MLK1101, a mixed-use housing complex for formerly homeless veterans located near LA's Exposition Park. The four-story, L-shaped building sits on a busy thoroughfare between a McDonald's and a bland low-rise apartment structure. Developed by the local nonprofit Clifford Beers Housing, MLK1101 includes ground-floor retail space and a central staircase that leads to an elevated courtyard for residents. There's a security gate at the top of the stairs, not on the sidewalk, a subtle design move that helps blur the line between the public and private realms. "The design strategies open the building toward the street and foster a sense of community within the neighborhood," O'Herlihy says.

The firm brought a similar sensitivity to public space with its design of Mariposa1038, a market-rate apartment building in LA's Koreatown. It's a five-story box, but with a twist: the sides are all pushed inward to create concave façades. On the street-facing side, the result is a welcoming semi-public outdoor space between the sidewalk and the building.

The firm, which was founded in 1994 and is now 25 employees large, is also working on several projects in Detroit, including a renovation and expansion of the MBAD African Bead Museum and a mixed-use project called Big Box DD, which will be constructed in the Eastern Market neighborhood using modified shipping containers. It includes flexible space for retail, food vendors, and co-working spaces.

Lawrence Scarpa, FAIA, principal of Brooks + Scarpa (number two in this year's list of top design firms) and a longtime friend of O'Herlihy's (they've collaborated on three projects), praises the architect for taking a "fairly mundane program like housing" and coming up with a fresh slant. "Every project is different," Scarpa says. "He's always searching, always looking for new ideas. And he has the tenacity to get stuff done. When everyone says, 'No you can't,' Lorcan says, 'Yes I can, and here's how.' And he does it with grace and style and beauty."

A dance performance at Mariposa1038

MINH T.

11

82
01
37

Top Firm for Business

02 BLAIR + MUI DOWD ARCHITECTS **03** CLARK NEXSEN **04** PBK **05** WILLIAM RAWN ASSOCIATES
06 MARK CAVAGNERO ASSOCIATES **07 (TIE)** STEINBERG HART **AND** SPECTOR GROUP
09 SEMPLE BROWN DESIGN **10** HDR **11** DESIGN BLITZ **12** ADRIAN SMITH + GORDON GILL ARCHITECTURE
13 HKS ARCHITECTS **14** STUDIO MA **15 (TIE)** CAMBRIDGE SEVEN ASSOCIATES
AND CARRIER JOHNSON + CULTURE **17** WRNS STUDIO **18** FERGUS GARBER YOUNG ARCHITECTS
19 GOETTSCH PARTNERS **20** PAYETTE **21** POPULOUS **22** PAGE **23** CORGAN ASSOCIATES
24 FXCOLLABORATIVE **25** TOULOUKIAN TOULOUKIAN **26** LPA **27** ANN BEHA ARCHITECTS
28 HOK **29** AYERS SAINT GROSS **30** CO ARCHITECTS **31 (TIE)** PERKINS EASTMAN **AND** BWBR
33 MITHUN **34 (TIE)** EYP ARCHITECTURE & ENGINEERING **AND** BORA ARCHITECTS
36 OPSIS ARCHITECTURE **37** TREANORHL **38** SCHRADER GROUP ARCHITECTURE
39 NAC ARCHITECTURE **40 (TIE)** CANNONDESIGN **AND** ANMAHIAN WINTON ARCHITECTS
42 (TIE) LMN ARCHITECTS **AND** ROWLAND+BROUGHTON ARCHITECTURE/URBAN DESIGN/INTERIOR DESIGN
44 HORD COPLAN MACHT **45** ROSSETTI **46** BRPH **47** ZEROENERGY DESIGN
48 SMITHGROUP **49** SKIDMORE, OWINGS & MERRILL **50** HGA

Hastings Architecture Associates

Hastings Architecture Associates claimed the top spot in business on this year's ARCHITECT 50 list in part by being in the right place at the right time. The firm, based in Nashville, Tenn., has benefited from that city's current building boom, which shows no signs of slowing.

Over the last 10 years, says principal William Hastings, the firm—founded in 1985 by Hastings' parents, Jim and Jeannie Hastings—has experienced double-digit growth in both revenue and staff size. Last year alone, the firm added 11 new positions, and it now includes 71 employees in total. Hastings enjoyed a 46 percent jump in net revenue from 2016 to 2017.

"We've definitely benefited from the fact that we are heavily focused in this community," Hastings says. "And we have been for many years, even before Nashville became the 'it' city that it is today."

Projects by the firm—including a number of high-profile residential and commercial commissions—are scattered throughout the region. They include the Thompson Nashville, a 224-room boutique hotel in the city's Gulch neighborhood; the 51-unit Eastland apartment complex; a renovation of Nashville's historic Ryman Auditorium; and the Bridge Building, an expansion of a 1908 industrial structure overlooking the Cumberland River in downtown Nashville.

Hastings insists that the firm's success has as much—if not more—to do with its employee-friendly policies. "We have a super low turnover rate, less than 2 percent," he says. "That's because we're able to provide everyone with the growth opportunities that they want in their careers." It helps that Nashville is now increasingly a draw for potential hires. "That has obviously helped us recruit and retain some absolutely world-class talent," Hastings says.

Once a year, the firm closes shop and takes an all-staff trip to learn about the architecture and design of a major U.S. city. Recent destinations have included Minneapolis, Denver, Chicago, Philadelphia, Baltimore, and Dallas. "Even as the firm has grown," Hastings says, "we continue to do it. In fact, it's a non-negotiable item." Another perk: The firm closes its office at 3 p.m. on Fridays. "We often have to encourage people to turn off their computers and start the weekend," Hastings says, laughing. "They want to keep exploring and keep working."

In the end, says Hastings, that kind of dedication "is the single biggest reason not only for the design success of our projects, but also for the success of the business itself."


The Thompson Nashville

ALBERT VECERKA/ESTO

17

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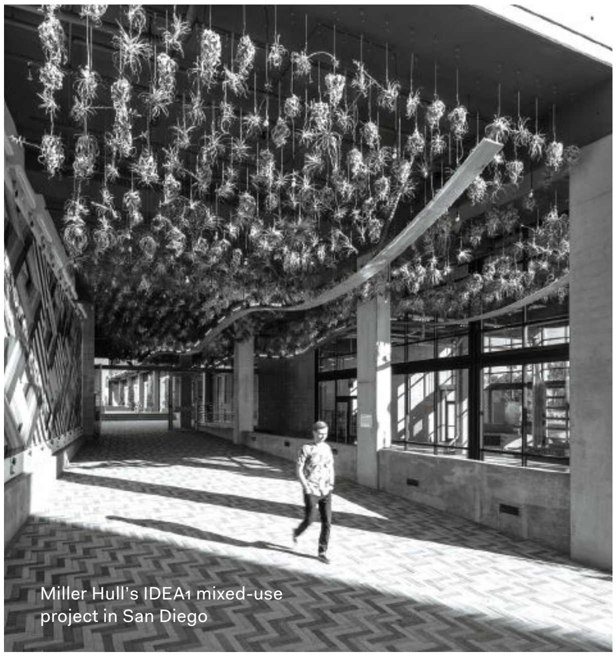
01

Top Firm for Sustain-ability

02 MITHUN **03** HOK **04** HDR **05** WRNS STUDIO **06** LMN ARCHITECTS
07 LORD AECK SARGENT **08** BRUNER/COTT & ASSOCIATES **09** PERKINS+WILL
10 BROOKS + SCARPA **11** HENNEBERY EDDY ARCHITECTS **12** OPSIS ARCHITECTURE
13 LAKE | FLATO ARCHITECTS **14** DLR GROUP **15 (TIE)** SKIDMORE, OWINGS & MERRILL
AND GWWO ARCHITECTS **17** KIRKSEY ARCHITECTURE **18** LEERS WEINZAPFEL ASSOCIATES
19 (TIE) TOULOUKIAN TOULOUKIAN **AND** SMITHGROUP **21** STUDIOS ARCHITECTURE
22 PAYETTE **23** LPA **24** STUDIO MA **25** ZGF ARCHITECTS **26** WILLIAM RAWN ASSOCIATES
27 CANNONDESIGN **28** HACKER **29** HKS ARCHITECTS **30** LEDDY MAYTUM STACY ARCHITECTS
31 SASAKI ASSOCIATES **32** VMDO ARCHITECTS **33** SRG PARTNERSHIP **34** WEBER THOMPSON
35 ROSS BARNEY ARCHITECTS **36** BALLINGER **37** HASTINGS ARCHITECTURE ASSOCIATES
38 (TIE) RICHÄRD+BAUER ARCHITECTURE **AND** KAPLAN THOMPSON ARCHITECTS
40 FXCOLLABORATIVE **41 (TIE)** EYP ARCHITECTURE & ENGINEERING **AND** ARCHIMANIA
43 HMC ARCHITECTS **44** CBT ARCHITECTS **45 (TIE)** SOLOMON CORDWELL BUENZ
AND ESKEW+DUMEZ+RIPPLE **47** ARCHITECTURAL RESOURCES CAMBRIDGE
48 ORCUTT | WINSLOW **49** ZIGER | SNEAD ARCHITECTS **50** NAC ARCHITECTURE


Miller Hull's IDEA1 mixed-use project in San Diego

COURTESY THE MILLER HULL PARTNERSHIP

The Miller Hull Partnership

Seattle-based Miller Hull Partnership, this year's top firm in sustainability, received near-universal acclaim for its design of the Living Building Challenge (LBC)–certified Bullitt Center, which opened in 2013. A six-story office building with an oversized solar array on the roof, the Bullitt Center set a new standard for net-zero commercial buildings.

But the firm, founded in 1977 by David Miller and the late Robert Hull, is no one-hit wonder. Long before LEED and the LBC, Miller Hull was designing environmentally friendly buildings using passive heating and cooling strategies that the founding architects had discovered during Peace Corps stints in Brazil (Miller) and Afghanistan (Hull).

Still, the Bullitt Center has had a clear ripple effect. Miller Hull (collaborating with Lord Aeck Sargent) was recently commissioned to design a similar building, now under construction, for Georgia Tech's Atlanta campus. The 40,000-square-foot Kendeda Building for Innovative Sustainable Design, which received top marks from the green project judges, aims to achieve LBC certification in part by employing a dramatic overhanging solar canopy that creates a shaded porch-like space over the building's west entrance. The biggest challenge, says one of the firm's partners, Brian Court, AIA, is meeting the LBC's rigorous standards in Atlanta, with its sweltering heat and humidity. But he's confident it can be done.

Meanwhile, back in Seattle, the firm recently renovated its own office space—in a converted 1910 warehouse in the city's Pioneer Square neighborhood—to meet LBC Place, Materials, Beauty, Equity, and Health and Happiness Petal certifications. "We have to walk the walk," says principal Margaret Sprug. "We need to be able to show our clients what we can do, even in an old warehouse building."

Miller Hull also demonstrated its sustainability chops with its reliance on energy modeling in the early stages of project design and by submitting an energy report in 2017 as part of the AIA's 2030 Commitment.

Of course, not every client is willing to go the LBC route, but Miller Hull's focus on sustainability infuses every project. "Even with the smallest project," Court says, "we can take all the research that's gone into more complex projects and use it to raise the design to a higher level. All good design should include an environmental sense of mission and responsibility."

Top Firms for Equity Hiring

EMPLOYEES
■■ 50–99
■■■ 100–499
■■■■ 500–999

Biggest Movers in Percentage of Women Designers

Firm	Employees	2017	2018	% Chg
GOETTSCH PARTNERS	■■■	12	18	50.0
ELKUS MANFREDI ARCHITECTS	■■■	29	42	44.8
5G STUDIO COLLABORATIVE	■■	32	45	40.6
POPULOUS	■■■■	25	35	40.0
OVERLAND PARTNERS	■■	29	40	37.9
ARCHITECTURE RESEARCH OFFICE	■■	31	42	35.5
FXCOLLABORATIVE	■■■	35	46	31.4
NAC ARCHITECTURE	■■■	32	41	28.1
HMC ARCHITECTS	■■■	25	32	28.0
ROSSETTI	■■	21	26.2	24.8

Biggest Movers in Percentage of Designers Who Are Racial and Ethnic Minorities

Firm	Employees	2017	2018	% Chg
BEHNISCH ARCHITEKTEN	■■■	8	27	100+
VMDO ARCHITECTS	■■	4	8	100.0
ESKEW+DUMEZ+RIPPLE	■■	10	20	100.0
MITHUN	■■■	12	20	66.7
POPULOUS	■■■■	13	20	53.8
CLARK NEXSEN	■■■	10	15	50.0
GOETTSCH PARTNERS	■■■	31	44	41.9
TREANORHL	■■■	10	14	40.0
SOLOMON CORDWELL BUENZ	■■■	23	32	39.1
RATIO ARCHITECTS	■■■	10.2	13.9	36.3

Methodology
List 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 included, not just firms that were ranked in the top 50.


NATURAL
BEAUTY.
NWH
NORTHWEST
HARDWOODS
KEEP PIONEERING
northwesthardwoods.com
That's the casual comfort of Alder.
Warm, friendly and welcoming, Alder's rustic elegance is a favorite among fans of the less formal. Its light brown and reddish undertones stain smoothly and while the wood has a rustic reputation, if you go less knotty it does contemporary with ease. Trust the on-grade quality of Northwest Hardwoods, America's largest and only coast-to-coast hardwood lumber producer.
Image c/o Canyon Creek

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, 160 firms qualified. Data was from the 2017 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

07% 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

04% Design awards, including awards issued by ARCHITECT and prominent institutions such as the AIA and the ASLA

03% 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.

Michael Maltzan, FAIA, is the design principal of Michael Maltzan Architecture in Los Angeles. He is a recipient of the 2012 American Academy of Arts and Letters Architecture Award, and the 2016 AIA Los Angeles Gold Medal honoree.

Claire Weisz, FAIA, is a founding principal of WXY in New York. She has received the Architectural League of New York's Young Architects Award and its Emerging Voices Award with her firm. WXY won the 2016 AIA New York State Firm of the Year Award.

Paul Andersen, AIA, is the director of Independent Architecture in Denver. He teaches at the University of Illinois at Chicago and has been a guest curator at the Museum of Contemporary Art Denver and the Biennial of the Americas.

BUSINESS

56% Net revenue per employee

14% Profitability (positive change in net revenue from 2016)

13% Business practices, including the percentage of women and minority designers, percentage of new full-time positions, and voluntary staff turnover rate

17% Employee benefits, including ARE benefits, stock options, and the value and scope of other fringe benefits

SUSTAINABILITY

17% 2030 Commitment: Participation in the AIA's 2030 Commitment program as well as submittal of a report of predicted energy use of active projects to the AIA in 2017

17% Energy and water metrics: Percentage of projects that were in design during 2017 that met or exceeded the 2030 energy target (70 percent better than a baseline building as measured by the 2003 Commercial Building Energy Consumption Survey or the 2001 Residential Energy Consumption Survey); that achieved a 20 percent 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 phrase 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

06% 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 were in design during 2017 that 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

40% 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.

Vivian Loftness, FAIA, is a professor at Carnegie Mellon and the former head of the university's School of Architecture. She has received the Sacred Tree Award from the U.S. Green Building Council and her work and research has focused on environmental design and sustainability and advanced building systems integration.

Stephanie Carlisle is a principal at KieranTimberlake and author of *Embodied Energy and Design* (Lars Müller Publishers, 2017). She led the materials database development for Tally, a custom app that calculates the environmental impacts of building material choices.

2 COTE
4 TOP
8 TEN

INTRO BY KATIE GERFEN
PROJECT DESCRIPTIONS BY EDWARD KEEGAN, AIA, CLAY RISEN, AND GIDEON FINK SHAPIRO

Last month, the United Nations' Intergovernmental Panel on Climate Change (IPCC) released a report saying that limiting global warming to 1.5 degrees Celsius above preindustrial levels—the ideal target of the Paris Agreement—would require "rapid, far-reaching and unprecedented changes in all aspects of society," according to an IPCC press release. The report says that the planet is likely to hit a global increase of 1.5 C between 2030 and 2052, but to keep the increase at that level, and not higher, action must be taken immediately—carbon emissions must be reduced 45 percent by 2030, and humanity needs to reach net-zero by 2050.

This is not new news, but definitely ups the stakes: Last year, the climate already reached 1 C of warming above preindustrial levels, and if carbon emissions remain unchecked, IPCC scientists predict we could see catastrophic effects within the next 15 to 20 years. Pair the fact that buildings account for 40 percent of all greenhouse gas emissions with the United Nations Environment Programme's 2017 prediction in its Global Status Report that the global building stock will double by 2060 and the question isn't whether architects should be involved in a carbon-neutral solution, but how they should be involved.

Several knowledge communities and working groups of the American Institute of Architects have been tackling this problem for years, including the Committee on the Environment (COTE). Founded in 1990, COTE's mission is "to advance, disseminate, and advocate—to the profession, the building industry, the academy, and the public—design practices that integrate built and natural systems and enhance both the design quality and environmental performance of the built environment."

COTE is led by an advisory group of volunteer experts from leading sustainable design practices around the country. "Everyone on the advisory group is trying to help members and firms get on board with sustainable ideas more quickly and easily within their own firms," says Angela Brooks, FAIA, the 2018 chair of the COTE advisory group and the managing principal of Los Angeles–based Brooks + Scarpa. "Each initiative we have working right now adds something to that idea."

But central to the ethos of COTE and its members is that sustainability and good design should not be treated as two separate goals, but rather should receive equal priority in every project. To demonstrate that this gold standard is possible, the committee launched the annual AIA COTE Top Ten awards program in 1997—this year's winners are showcased in the following pages—to highlight "projects that are beautiful and would win design honor awards, and that also meet really high performance standards. They do both," Brooks says.

TEN-POINT FRAMEWORK

In 2016, COTE revamped the awards submission process to highlight 10 holistic measures of sustainability—such as community, water, and resources—to encourage architects to think about sustainability as more than just energy consumption. The goal was "to include actual performance metrics because a lot of people want proof," Brooks says. "A lot of buildings will say they're green, but then they operate and it turns out that they're really not."

To instill an integrated approach to sustainable design in future generations of architects, COTE launched a student competition, run in collaboration with the Association of Collegiate Schools of Architecture, in 2014. "There's no time like right now if we're going to solve the issue of climate change, and the next generation of architects is going to need to be equipped with the tools and the creativity and the confidence to come up with solutions," says Marsha Maytum, FAIA, a COTE advisory group member and a founding principal of San Francisco–based Leddy Maytum Stacy Architects.

THE NEXT GENERATION

For the past two years, the student program—which requires that student projects address the same 10 measures as the professional awards, and which had more than 1,000 participants in the 2018 iteration—has also featured a summer internship component supported by the Santa Fe, N.M.–based nonprofit Architecture 2030. Each winning student is offered a paid summer internship in a leading sustainable design firm around the country. The students get hands-on experience, and the firms gain something as well, Maytum says: The summer interns, including one at her own firm this past summer, "energize the whole office around the topics of sustainability, resilience, and adaptive design—all things that students are very excited about around the country."

But training students for the future doesn't help with the immediate challenges of curbing resource use and minimizing the environmental impact of buildings: That requires more buy-in from the profession. After attending the Global Climate Action Summit in San Francisco with an AIA delegation in September—just weeks before the most recent IPCC report came out—AIA president Carl Elefante, FAIA, says that there was already "a very heightened sense of urgency: The starting gun has fired, and we need to be really sprinting from here on out" towards achieving carbon neutrality.

"The top performers [in sustainable design] are performing at a very admirable level," he says, but notes that penetration of sustainable principles in the marketplace is "nowhere near what it needs to be." To that end, the AIA added new statements to its code of ethics and professional conduct related to sustainability—both in terms of advising their clients about the environmental impact of buildings, and in setting ambitious goals for energy and carbon savings and minimizing resource use. "It's about having our policies and ethics really be where they ought to be," Elefante says.

A CALCULATED STANDARD

Throughout the industry, groups are looking at how to stem the tide of energy and carbon use in the built environment. In April, Edward Mazria, FAIA, and Architecture 2030 published the Zero Code standard, which proposes building net-zero-carbon new construction by supplementing a highly energy-efficient design with a more flexible approach to on- and/or off-site renewable energy, which makes compliance easier for towers or urban sites. The standard was designed to incorporate the forthcoming ASHRAE 90.1—2016 building energy code, but offers calculators so architects in municipalities that haven't adopted it can still comply with the Zero Code on their projects, if the base design is energy-efficient enough.

As for Elefante, he looks to history for inspiration in finding a path forward: "Years ago, there were no fire codes. The world and architects agreed that the right number of people to die in a building fire was zero, and we've made continuous improvement to try to get to that number," he says. "Now we're in the same situation with carbon, and we can do it, we just need to do it much quicker. We have the tools, we need to help our clients, and we need to help our communities. But we have to get there and we have to get there now."

A SET OF NEW RESOURCES

To help all architects achieve the high quality of the Top Ten winning projects, COTE will be releasing several important resources this winter.

The Toolkit

Based on the 10 measures that serve as the basis for the criteria of the COTE Top Ten, the Toolkit will be an online resource that will gather the best resources for achieving success in those areas of environmental and social sustainability. "This tool is about making sustainability accessible from a time perspective," says Corey Squire, AIA, a member of the COTE advisory group, and the sustainability process manager at San Antonio, Texas–based Lake|Flato Architects. "It gets you the answer you need in one place—quickly, easily, and in digestible chunks."

Each of the 10 sustainable measures will be broken down into best practices, with resources such as recommendations for third-party references and tools, and case studies of past COTE award-winning projects that have achieved particular success in that measure. "There are also going to be a few recommendations that we call out, as: 'If you can only do one thing,'" Squire says. "These are the highest impact, lowest cost, lowest barrier to entry things where if you don't have the time, budget, or knowledge to really improve your problem, you can still incorporate these ideas and they'll have a really big impact on your project."

The Calculator

Another tool under development is a so-called "super spreadsheet," that will make calculating metrics for a project in order to track its resource intensity much easier. When a user enters basic project data, the calculator will automatically crunch the numbers to provide metrics such as EUI and carbon usage—the same metrics that are both required and encouraged for the COTE Top Ten awards. Those results will then be set alongside results from both a baseline project and a high-performance building so that architects can see how their design compares.

"We want every project to be using some sort of way of calculating their performance," says COTE advisory group member Tate Walker, AIA, who is a sustainability director in OPN Architects' Madison, Wis., office.

"A fun goal early in this project was 'quantify everything,'" Lake|Flato's Squire says. "One reason we feel that energy has been such a hot-button topic in the field of sustainable design is because it's easy to quantify. If we can quantify community, ecology, or resilience just as easily as we can energy, then all of those things gain equal importance."

But the tool isn't just intended to test projects after they are built. "It's really powerful for goal setting earlier in design," Walker says. It's convenient, too. "Instead of going all over the web finding 10 decent calculators, it starts to align all them in one space so that people are using a similar baseline."

The Searchable Database

As the COTE Top Ten awards celebrates its 22nd year, another working group is looking at "how the winning projects of the past can help influence the future," Brooks says, by organizing information from the more than 220 winners into an interactive online database where users can learn best practices for sustainability from the case studies. "There's so much information, and we need to be able to disseminate that knowledge into a resource that can be used by the entire architecture community," says Varun Kohli, AIA, a COTE advisory group member and a principal and sustainable design leader in HOK's New York office. "A lot of that information is already online, but if we can make it more usable, and filterable, then it becomes much more powerful."

The team has already developed several search filters, which will allow projects to be sorted by maximum predicted EUI, category, site context, climate zone, and so forth. The hope is that the number of filters, and the robustness of the data, will continue to grow over time as new winning projects are added each year. "It's pretty clear over the past 20 years that the amount of hard data that we are asking for is getting more granular," Kohli says. "If we start to build this up, it could turn into a solid set of information."

New United States Courthouse
Los Angeles
Skidmore, Owings & Merrill

This new federal courthouse beat its mandated energy goals by leveraging glass and daylight to create a modern, transparent house of justice.

What should a 21st-century courthouse look like? For a new federal courthouse in downtown Los Angeles, Skidmore, Owings & Merrill (SOM) decided it should be glass-clad and light-filled to evoke the transparency of the rule of law, while also emphasizing a civic duty to sustainability.

The 633,000-square-foot cube sits on the side of a hill a few blocks from the Walt Disney Concert Hall. Early on, says José Palacios, AIA, a design director at SOM, both the architects and their client, the federal government's General Services Administration (GSA), knew they wanted to utilize as much glass as possible to emphasize the democratic openness of the judiciary system and to allow as much light as possible into the 10-story tower's 24 courtrooms.

As an additional civic gesture, they also wanted it to be square with the street grid—it sits at the corner of South Broadway and West 1st Street. But that presented a problem: The downtown Los Angeles street grid is off-axis by 38 degrees, meaning a building true to the grid is unable to take advantage of the region's abundant sunlight. "Ideally we would have oriented the building to face north," Palacios says, "but that would not have been a civic orientation."

This was especially challenging because the GSA had mandated that the building achieve a maximum energy use intensity—or EUI, a measure of energy used per square foot—of 35, to be verified during the first year of operation. "For a facility like this, that's pretty low," says Steve Zimmerman, AIA, an associate director with SOM. "The requirement caused the design team to focus on energy as one of the drivers."

SOM's solution was elegantly simple: The building's four glass curtainwalls are pleated vertically, angled so that they shift the courthouse's glazing to a true north–south direction. "Instead of orienting the building, we oriented the façade," Palacios says.

The glass on the northern and southern sides is clear, to maximize light, while the glass on the east and west sides is opaque, allowing in sufficient light but reducing heat gain. The pleats are lined with aluminum fins, which reduce glare through the windows.

Additionally, the building uses pleated skylights along the roof of the courthouse, which allow diffuse light to filter into a 10-story atrium at the heart of the building; that light then flows through clerestory windows into each of the courtrooms.

The building includes yet another innovative gesture toward sustainability: Its steel-and-concrete structure lifts the building off the ground, so that the cube seems to float over its concrete plinth. In addition to elegantly reducing the building's vulnerability to ground-level blasts, it also required less concrete, further reducing its carbon footprint.

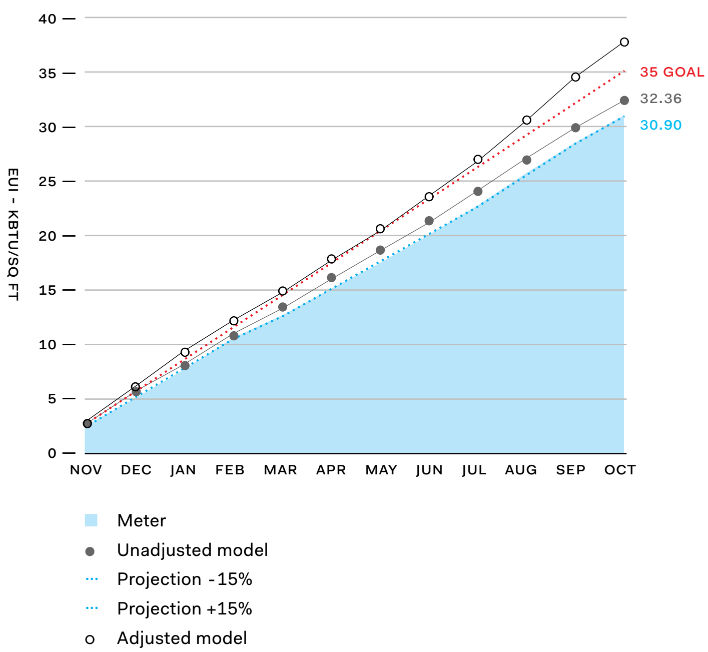
As part of its contract, the GSA required both the architects and the design/build contractors to stay on for a year to monitor the building's performance. "As architects, we're interested in the post-occupancy question," Zimmerman says. But "typically, architects do projects and then walk away. People say they look nice, but the architects don't know the numbers to gauge how well their designs are actually doing."

Thanks to the pleats, the building's annual solar radiation load is 47 percent lower than it would be with a flat glazed façade. Add displacement air systems to reduce cooling loads and automated controls to maximize energy efficiency, and the courthouse's average EUI is 31, four points below the GSA mandate and 54 percent below the national benchmark for a similar building. That number will drop further once its 900 rooftop photovoltaic panels are operational.

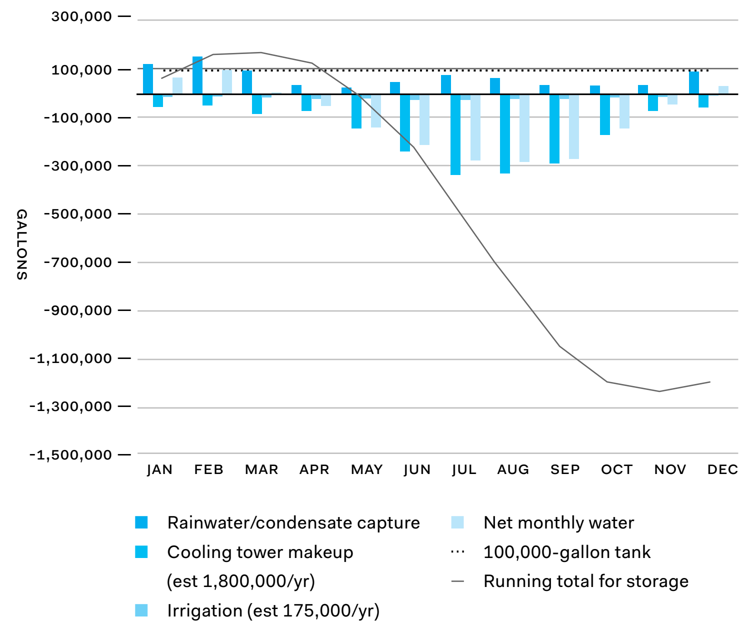
The result is a structure that is big on sustainability and low on energy use while remaining pleasant to be in—an important quality in a courthouse. "The people who are going into this building, a lot of the time they're going to court, which is not the best day of their lives," Zimmerman says. "With this building, at least they go through that experience in comfort." —C.R.

BRUCE DAMONTE

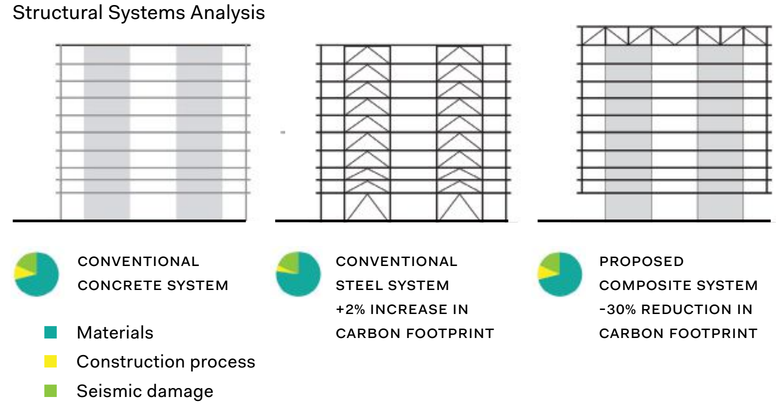
EUI Comparison, Including Projection



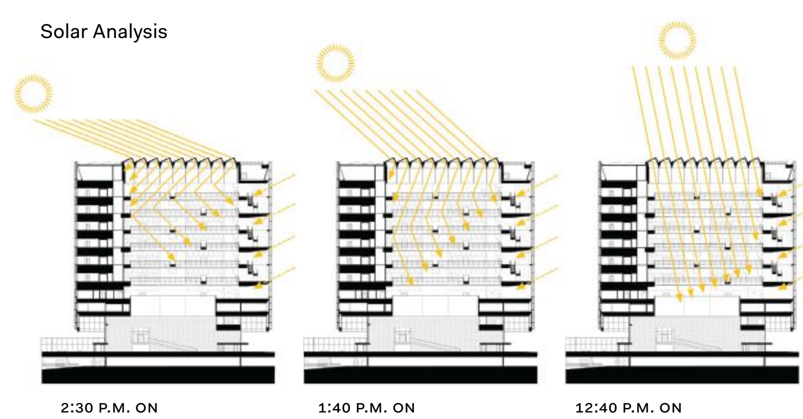
Proposed Water Usage, Based on Pre-Construction Modeling



Structural Systems Analysis



Solar Analysis



To ensure that the courthouse meets the energy- and resource-usage goals outlined by the GSA, SOM conducted extensive modeling during the design process, for everything from water usage (top, right), to the benefits of different structural systems (middle, right), to daylight analyses of light into public spaces (bottom, right). The result is a building that has beat the EUI target laid out by the GSA during its first year of use (top).

COURTESY SKIDMORE, OWINGS & MERRILL

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2016
Year of Substantial Project Completion	2016
Gross Conditioned Floor Area	515,862 square feet
Gross Unconditioned Floor Area	117,138 square feet
Number of Stories	10
Project Climate Zone	ASHRAE 3B
Annual Hours of Operation	2,400
Site Area	138,447 square feet
Project Site	Brownfield
Project Site Context/Setting	Urban
Cost of Construction, Excluding Furnishing	$326 million
Number of Occupants or Visitors	205,440

Integration

How did the approach towards sustainability inform the design concept?

The project goals were established during the competition phase and included architectural excellence, timeless design, high sustainability, beautiful durable finishes, highly functional reliable systems, efficient layout of spaces, and bringing best value to the taxpayer. Raising the cubic volume above the street level created a civic entry plaza allowing both visual and physical connections to the broader context of the Los Angeles Civic Center.

Community

Community Engagement

Stakeholders were provided with opportunities to provide input at pre-designed points in the process.

Walk Score	95

Ecology

Percentage of the site area designed to support vegetation	31%
Percentage of site area supporting vegetation before project began	Zero
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	100%

Water

Predicted annual consumption of potable water for all uses, including process water	40.52% per full-time employee (FTE)
Is potable water used for irrigation?	No
Actual annual consumption of potable water for all uses	25.5 gallon/year/FTE

Percentage of water consumed on-site comes from rainwater capture

15% (Only a small percentage of the tank capacity is being used on-site. Both rainwater and cooling tower condensate water is captured and is included in annual calculation.)

Percent of rainwater that can be managed on-site	80%

Metrics of water quality for any stormwater leaving the site

CDS vortex pre-treatment device at cistern removes 80%–100% total suspended solids; Irrigation pump in the tank includes a 100-micron filter just before the pump which removes remaining TSS prior to release to drip irrigation line or spill.

Is rainwater captured for use by the project?	Yes

Economy

Cost per square foot	$515

Comparable cost per square foot for other, similar buildings in the region

$591/sq ft for California court facilities, per the Judicial Council of California, 5/28/2016

Life Cycle Analysis of the costs associated with measures taken to improve performance

Energy savings measures were reviewed for their impact to EUI, initial cost, and payback period.

Energy

Predicted consumed energy use intensity (EUI)	35.08 kBtu/sq ft/yr
Predicted net EUI	32.26 kBtu/sq ft/yr
Predicted net carbon emissions	6 lbs/sq ft/yr, uses 0.65 lbs/kWh and 12.5 lbs/therm as basis per 2014 EPA EGRID data.
Predicted reduction from national average EUI for building type	53%
Predicted lighting power density	0.69 W/sq ft

Actual consumed energy use intensity (Site EUI)

31 kBtu/sq ft/yr, the last month of data (month 12) is not yet available and was estimated based on energy model. Please note that while photovoltaics are installed they are not operational pending interconnection agreement with local utility company so they are not deducted in net calculations.

Actual net EUI	31 kBtu/sq ft/yr
Actual net carbon emissions	6 lbs/sq ft/yr
Actual reduction from national average EUI for building type	54%

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	59%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	Zero

Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting

64.8% >300 lux at 3 p.m. March 21. Percentage indicated excludes the courtrooms since there are line-of-sight privacy/security issues and they are not regularly occupied. The percent including the courtrooms is 51.9%.

Is this project a workplace?	Yes
How many occupants per thermal zone or thermostat	2
Occupants who can control their own light levels	50%

Resources

CO_2 intensity	17,402 metric tons
Estimated carbon emissions associated with building construction	60.6 lbs/sq ft
Percentage (by weight) of construction waste diverted from landfill	82%

Change

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	3

Percentage of power needs supportable by on-site power generation

8.9%. Rooftop photovoltaics are installed and have been commissioned, but are not operational as the federal government and the local utility are in the process of finalizing their interconnection agreement.

Discovery

Post-occupancy evaluation summary

No. While input has been provided by tenants to the GSA, per GSA standards, comfort satisfaction surveys are performed after the first year of occupancy for new structures, in this case scheduled for mid-2018. This strategy allows for minor issues to be worked out during the course of the first year of operations.

Nancy and Stephen Grand Family House
San Francisco
Leddy Maytum Stacy Architects

A housing complex for sick children and their families uses sustainable principles to create the healthiest environment possible.

The Nancy and Stephen Grand Family House in San Francisco's Mission Bay neighborhood provides temporary housing for children receiving treatment at the University of California, San Francisco (UCSF) Benioff Children's Hospital, as well as for their families. Designed by local firm Leddy Maytum Stacy Architects (LMSA), the five-story structure marries sustainability with its social mission by leveraging the mild climate of Northern California and combining 73,057 square feet of conditioned space with an additional 16,143 square feet of unconditioned area.

The location's Walk Score of 87 makes it easy for patients to get almost anywhere, including the hospital that's just two blocks away, principal Richard Stacy, FAIA, explains. But while the site allows users easy access to the city's varied attractions, the designers realized the most important goal was to provide the healthiest and most comfortable environment for residents who are visiting the city under difficult circumstances.

While Family House has a history dating back to 1981, this was its first new construction project. "They didn't have a sustainable agenda at the outset," Stacy says, although the architects recognized the opportunity for an environmentally sensitive solution.

Stacy notes three specific factors that drove the effort: First, Northern California's cooperative climate and state-mandated efficiency requirements provide a good baseline for success. Second, energy efficiency in a residential program is particularly attractive, as every dollar that a not-for-profit operator can save is a dollar it doesn't have to raise in the future. And third, ill children and their often-traumatized families are particularly sensitive to the benefits of a health- and wellness-based solution, focusing on daylighting, healthy materials, views, and access to nature.

Serving twice as many families as the organization's previous home, the architects devised a scheme for the new structure that breaks the building down into a series of "neighborhoods" with 10 families in each sharing kitchen, living, and common areas. The C-shaped plan puts all guest rooms on the exterior of an extra wide corridor, providing city views for every room. Most living spaces are on the interior side of the corridor, where they overlook an interior courtyard that's placed on the second floor and serves as a green roof over the parking structure. More than 95 percent of the interior spaces have direct views of the outdoors.

The ground floor contains public spaces and administrative offices that further shield the first-floor parking garage from the public (and user's) view. The entry is configured with welcoming reception desks and a grand stair meant to evoke a hotel, according to Stacy. The stair provides additional play area for the children and leads to the second-floor courtyard.

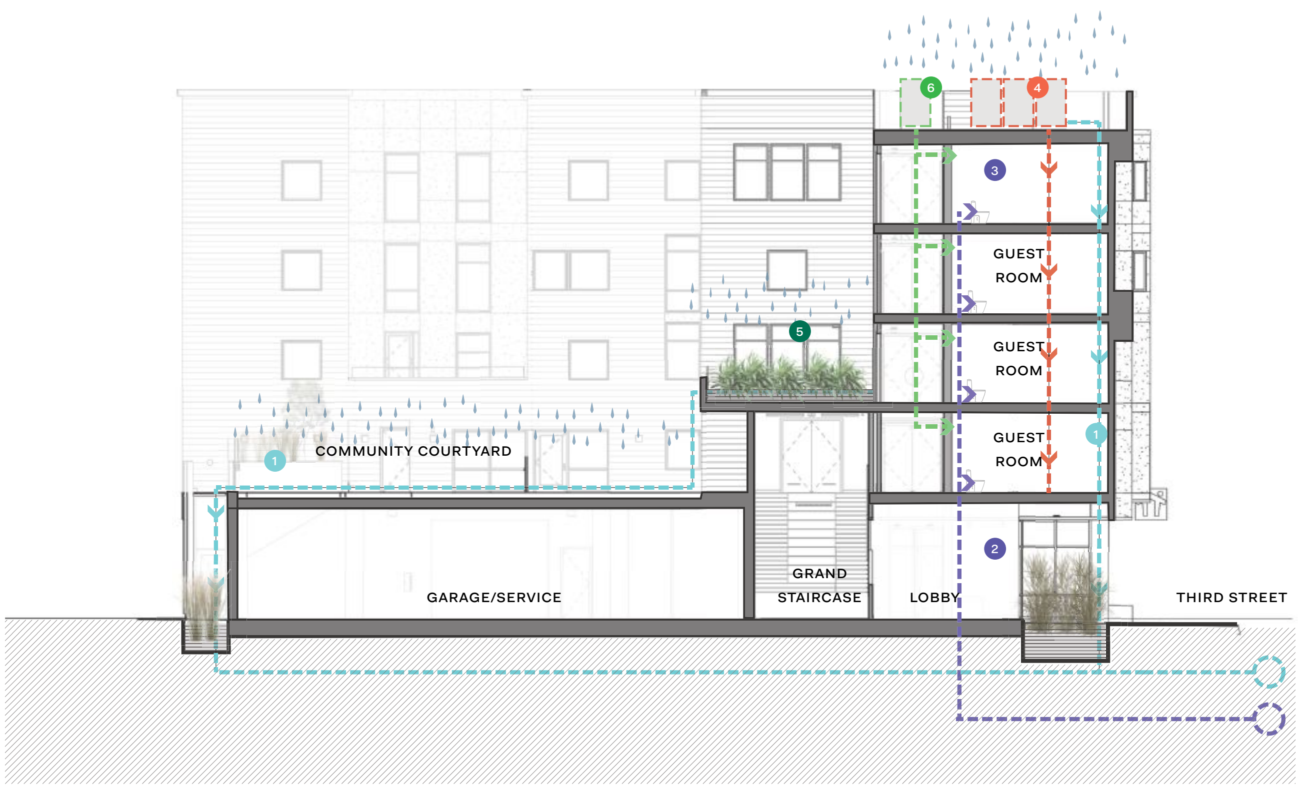
Economy and health are served by inexpensive electric heating and good ventilation with filtered air throughout—with air conditioning only in some common rooms. The success of this strategy seems to be confirmed by early results: "The building is using less energy that predicted," LMSA associate Gwen Fuertes, AIA, says. "Probably because they're using less air conditioning than expected." A solar heating system provides 50 percent of the guests' hot water supply.

The landscape design allows 90 percent of stormwater to be managed on-site, with "flow-through" planters that slow and filter stormwater before it enters the municipal stormwater system. A water-efficient landscape covers 22.5 percent of the site, including the internal courtyard and green roofs—an immense environmental improvement for land that had previously been an industrial brownfield.

Since its completion in spring 2016, the Nancy and Stephen Grand Family House has served roughly 8,000 occupants and post-occupancy surveys have validated the design's intended effect on its users—providing a supportive environment during a challenging period in its occupants' lives. —E.K.

BRUCE DAMONTE

Section Diagram



Family House's new facility provides filtered natural ventilation to help create a healthy environment for sick children and their families. But the LEED Platinum building also incorporates sustainable systems to reduce energy use and cost, including solar hot water heaters, efficient fixtures, and infrastructure to accommodate municipal graywater once it is adopted in San Francisco.

- Stormwater diverted to planters
- Recycled water system for future municipal supply
- Efficient water fixtures
- Solar hot water system
- Green roof
- Merv 13 filtered fresh air ventilation

COURTESY LEDDY MAYTUM STACY ARCHITECTS

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2014
Year of Substantial Project Completion	2016
Gross Conditioned Floor Area	73,057 square feet
Gross Unconditioned Floor Area	16,143 square feet
Number of Stories	5
Project Climate Zone	California climate zone 3 (Title 24)
Annual Hours of Operation	8,760
Site Area	31,831 square feet
Project Site	Brownfield
Project Site Context/Setting	Urban
Cost of Construction, Excluding Furnishing	$29.2 million
Number of Occupants or Visitors	8,000

Integration

How did the approach towards sustainability inform the design concept?

Developed on a site two blocks away from a new children's hospital, the Nancy and Stephen Grand Family House provides a comforting and supportive environment for 80 families in a non-institutional, residential setting. The design team's sustainable strategies focused on providing healthy living spaces, including a continuous air ventilation system and nontoxic building materials, achieving LEED Platinum certification. Supporting community was a central design strategy as well; shared living and gathering spaces are integrated throughout the building, with two community living rooms, kitchens, and dining rooms on each floor, a courtyard on the second level, a flex conference room, and meditation space.

Community

Community Engagement

A partnership was formed with stakeholders to share in the decision-making process, including development of alternatives and identification of the preferred solution.

Walk Score	87
Estimated occupants who commute via alternative transportation (biking, walking, mass transit)	60%
Estimated annual carbon emissions associated with the transportation of those coming to or returning from the building	9.0 metric tons/yr (U.S. Department of Transportation)

Ecology

Percentage of the site area designed to support vegetation	22.5%
Percentage of site area supporting vegetation before project began	Zero
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	61.8%

Water

Predicted annual consumption of potable water for all uses, including process water	Indoor water use: 1,908,082 gal/yr. Indoor water use reduction results in 35% from baseline.
Is potable water used for irrigation?	Yes
Predicted peak month consumption of potable water for outdoor (irrigation) purposes	1.25 gal/sq ft/peak month
Actual annual consumption of potable water for all uses	Actual water bills were not yet available.
Percent of rainwater that can be managed on site	90%
Metrics of water quality for any stormwater leaving the site	80% of total suspended solids are removed from runoff.
Is rainwater captured for use by the project?	No
Is graywater or blackwater captured for reuse?	No, but plumbed to use municipal recycled water once city system goes online.

Economy

Cost per square foot	$327

Comparable cost per square foot for other, similar buildings in the region

$337 per square foot—firm's historic average (over past 10 years) for multifamily housing in San Francisco

Estimated annual operating cost reduction	18%

Energy

Predicted consumed energy use intensity (EUI)	39.6 kBtu/sq ft/yr
Predicted net EUI	34.1 kBtu/sq ft/yr
Predicted net carbon emissions	1.93 lbs/sq ft/yr
Predicted reduction from national average EUI for building type	41%
Predicted lighting power density	0.89 W/sq ft
Actual consumed energy use intensity (Site EUI)	30.6 kBtu/sq ft/yr. Solar hot water is not submetered, so only Actual net energy use intensity is available.
Actual net EUI	30.6 kBtu/sq ft/yr
Actual net carbon emissions	1.33 lbs/sq ft/yr
Actual reduction from national average EUI for building type	49%

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	95%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	80%
Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	81% >300 lux at 3 p.m. March 21
Is this project a workplace?	Mostly no
Annual daylighting performance	87% of regularly occupied area achieving at least 300 lux at least 50% of the annual occupied hours.

Resources

CO_2 intensity	2,340 lbs
Estimated carbon emissions associated with building construction	78 lbs/sq ft
Percentage (by weight) of construction waste diverted from landfill	78%

Change

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	Zero
Percentage of power needs supportable by on-site power generation	10%

Discovery

Post-occupancy evaluation summary

Family House has asked families to complete an exit survey. The results indicate that the guests are overwhelmingly pleased with the building. This is attributable to its design and function to provide support to families during an emotionally and economically challenging period. Guest book entries and other anecdotes from families are indicative of families that are grateful for this space and the services provided. The elements that exceeded expectation the most include bedroom and furniture, the outdoor courtyard area, and computer connectivity/Wi-Fi connection. The elements that performed less successfully include the shuttle service, music room, and laundry facilities. We are working with the owners to expand the exit survey to also include metrics related to comfort, controllability, acoustics, daylight and electric light levels, and other specific metrics to interpret the success of the design.

The Renwick Gallery of the Smithsonian Art Museum
Washington, D.C.
DLR Group | Westlake Reed Leskosky

A largely behind-the-scenes renovation brings a historic museum into an energy-efficient 21st century.

Preserving an old building is a sustainable act in itself. Retrofitting a 150-year-old historic landmark to be a top energy performer? That's truly impressive. And it's just what Cleveland-based Westlake Reed Leskosky (WRL), now part of Omaha, Neb.–based DLR Group, did with the Renwick Gallery of the Smithsonian Art Museum, a delectable French pastry of a building designed in the ornate Second Empire style by James Renwick Jr. and completed in 1859 as the Corcoran Gallery of Art.

Last renovated between 1967 and 1972, the 46,800-square-foot building—located not on the National Mall, but on Pennsylvania Avenue—was plagued by difficulties with its mechanical systems and an antiquated public image when engineer Roger Chang, a principal at DLR Group | WRL, first visited in 2009. "As soon as I walked in, I thought, 'This is incredible,'" he says. In 2012, after the Smithsonian issued an RFP for its renovation, Chang headed the team that won and, in 2015, completed the job.

The brief was to overhaul the building's obsolete systems and to improve the visitor experience. Rather than take advantage of potential exemptions granted to historic structures, Chang was determined to bring the building fully up to date in all respects. The results have dramatically improved the museum's energy efficiency while accommodating a spike in attendance from 175,000 annual visitors in 2012 to 800,000 annual visitors since the museum's reopening in 2015.

Behind the scenes, the reported actual energy use intensity (EUI) of 102.3 kBtus per square foot over the building's first 12 months of continuous operation after the renovation represents a 49 percent reduction against the last full-year of pre-renovation data from 2012. As the COTE jury said, "The Renwick Gallery renovation wove complex and robust new systems while preserving the impressive historic design and collection. All of this was done within a very restrained site, budget, and schedule."

The museum's new, all-LED lighting system is partly responsible for the improvement in energy efficiency. Chang explains, "The rooms have tall ceilings, but they are relatively narrow. So you have to illuminate an object from far away with a focused beam of light." There were no such LED products available in 2013, so DLR Group | WRL joined the museum's lighting designer, Scott Rosenfeld, in working with manufacturers to develop new lighting products, such as a four-degree LED spotlight that doesn't overheat when a plastic lens is placed in front of it. Now the museum uses only 1 watt of power per square foot.

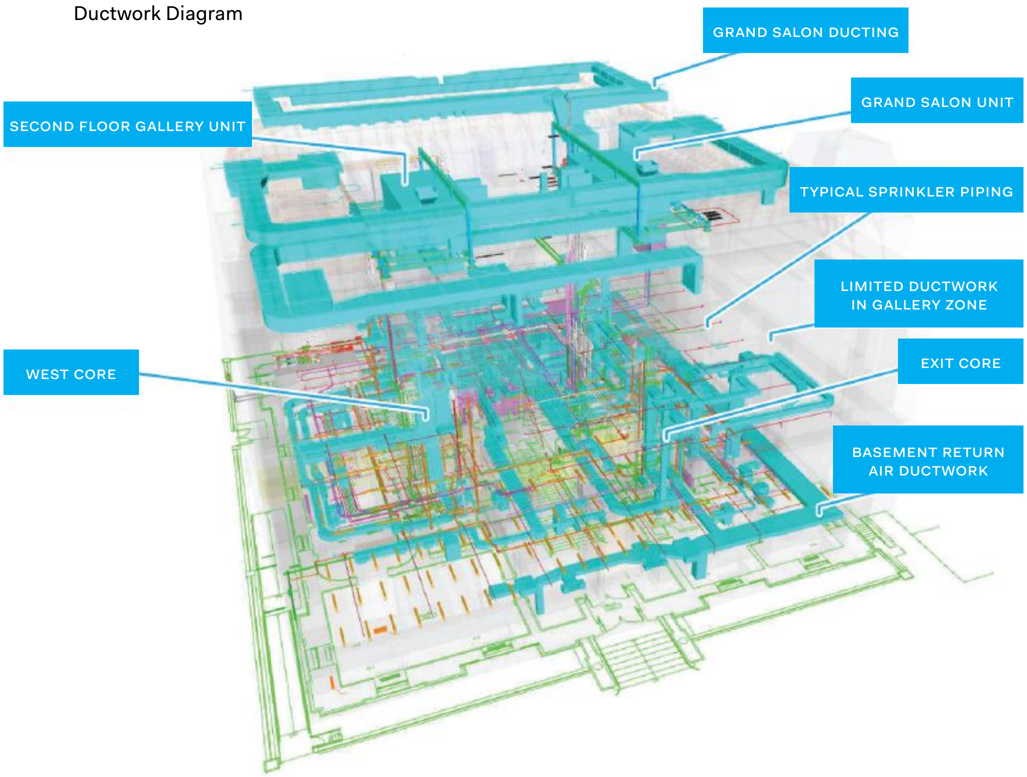
Cooler lights, in turn, reduced the demand for cooled air, Chang says, allowing for an uncommonly thrifty HVAC system. The firm's integrated M/E/P engineering team replaced the old air-handling equipment, which was difficult to access and challenging to maintain, with three modern units in the attic and basement, coupled with approximately 30 networked variable air volume boxes. These units are stacked in mechanical rooms to ease maintenance and eliminate hydronic piping—potential leak hazards—over gallery spaces. Since the building has virtually no ceiling plenums, all the ductwork runs vertically through a series of hidden cavities, Chang says. "It was an incredible puzzle to work with."

Humidity must be kept below 50 percent to avoid potential damage to the museum's artworks, Chang says, so the air conditioning system wrings moisture from the air. "But instead of throwing away the condensate, we recycle it by sending it to the cooling tower," Chang says. This cooling-coil condensate saves about 100,000 gallons of potable water a year.

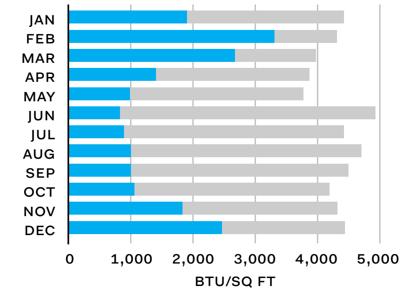
Visitors won't notice the new mechanical systems, and that's okay. Though Chang is proud of his team's invisible accomplishments, he wants visitors to experience the excitement he felt when he first saw the space: "We want people to fall in love with the building." —G.F.S.

KEVIN G. REEVES

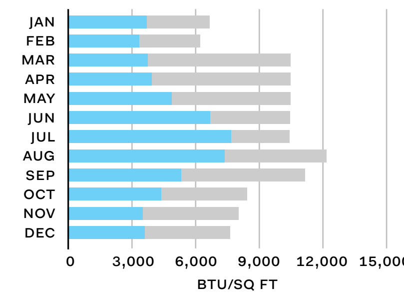
Ductwork Diagram



Gas Usage



Electricity Usage

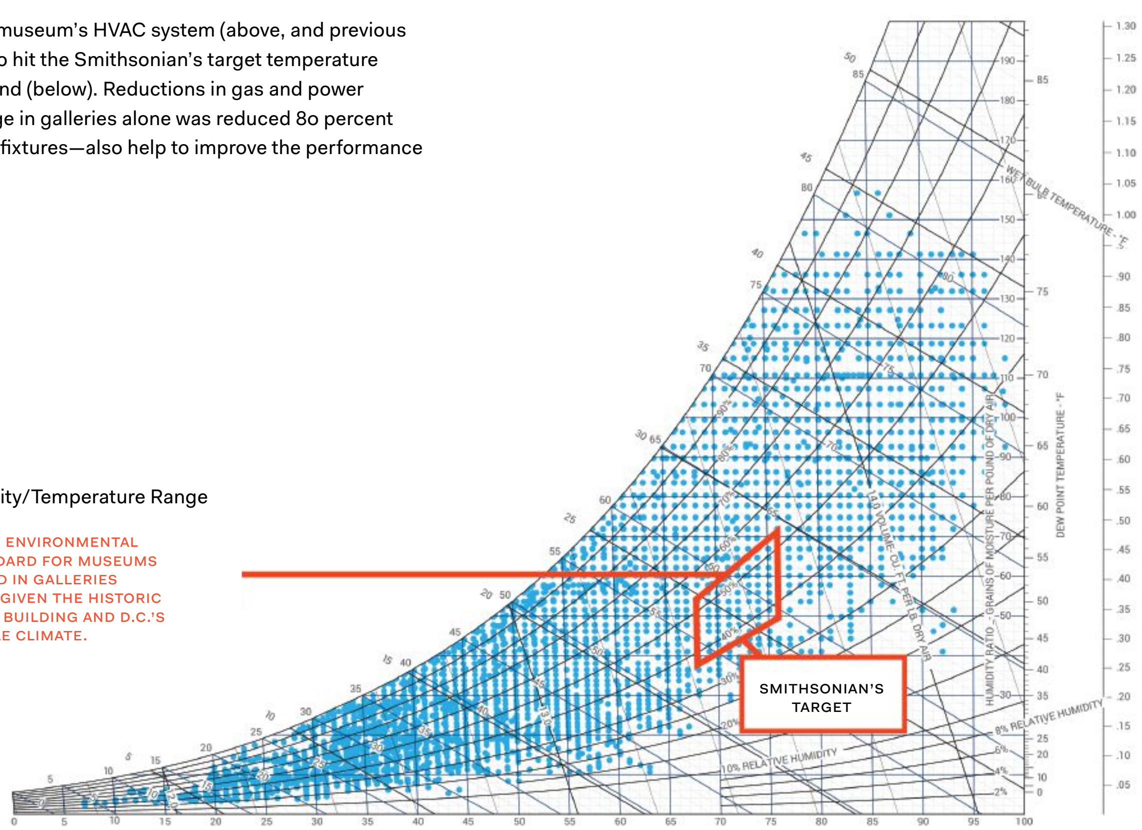


Pre-renovation usage
Proposed gas usage
Proposed electricity usage

By completely updating the museum's HVAC system (above, and previous spread), the team was able to hit the Smithsonian's target temperature and humidity range year-round (below). Reductions in gas and power loads (right)—lighting wattage in galleries alone was reduced 80 percent with the introduction of LED fixtures—also help to improve the performance of the renovated building.

Target Humidity/Temperature Range

SMITHSONIAN'S ENVIRONMENTAL CONTROL STANDARD FOR MUSEUMS ARE MAINTAINED IN GALLERIES 24/7/365, EVEN GIVEN THE HISTORIC NATURE OF THE BUILDING AND D.C.'S HIGHLY VARIABLE CLIMATE.



COURTESY DLR GROUP | WESTLAKE REED LESKOSKY

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2013
Year of Substantial Project Completion	2015
Gross Conditioned Floor Area	46,800 square feet
Gross Unconditioned Floor Area	Zero
Number of Stories	6
Project Climate Zone	ASHRAE 4A
Annual Hours of Operation	3,000
Site Area	17,000 square feet
Project Site	Historic structure or district
Project Site Context/Setting	Urban
Cost of Construction, Excluding Furnishing	$20 million
Number of Occupants or Visitors	800,000

Integration

How did the approach towards sustainability inform the design concept?

This project represents a complex historic preservation performed with a broad group of stakeholders including the Smithsonian, the arts community, visitors to D.C., and local, regional, and federal governmental agencies. Priorities were integrated to meet a tight budget, a schedule driven by minimizing closure of the museum, and a strong commitment by the Smithsonian to institutional sustainability. Flexible and predictable environmental control for 21st-century exhibits was a top priority.

Community

Community Engagement

A partnership was formed with stakeholders to share in the decision-making process including development of alternatives and identification of the preferred solution.

Walk Score	98
Estimated occupants who commute via alternative transportation (biking, walking, mass transit)	75%

Ecology

Percentage of the site area designed to support vegetation	Zero
Percentage of site area supporting vegetation before project began	Zero
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	Zero

Water

Predicted annual consumption of potable water for all uses, including process water

Indoor plumbing fixtures: 213.3 kgal.
Cooling tower: 369 kgal.
Condensate reclamation offset: 112 kgal.
Net potable water use: 470.3 kgal.

Is potable water used for irrigation?	No
Actual annual consumption of potable water for all uses	0.5 gallon per visitor (estimated potable water use)
Percent of rainwater that can be managed on-site	100%
Is rainwater captured for use by the project?	No
Is graywater or blackwater captured for reuse?	No

Economy

Cost per square foot	$427
Comparable cost per square foot for other, similar buildings in the region	$772 per survey of 137 museums by American Alliance of Museums (2003–2010)

Estimated annual operating cost reduction

26% from baseline energy code, excluding credit for gallery LED lighting use. When including credit for gallery LED lighting use, versus a traditional halogen-based solution, a 40% energy cost savings from the baseline energy code is achieved.

Energy

Predicted consumed energy use intensity (EUI)	92 kBtu/sq ft/yr
Predicted net EUI	92 kBtu/sq ft/yr
Predicted net carbon emissions	16.1 lbs/sq ft/yr
Predicted reduction from national average EUI for building type	54%
Predicted lighting power density	1 W/sq ft
Actual consumed energy use intensity (Site EUI)	102.3 kBtu/sq ft/yr
Actual net EUI	102.3 kBtu/sq ft/yr
Actual net carbon emissions	17.7 lbs/sq ft/yr
Actual reduction from national average EUI for building type	49%

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	90%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	Zero. Not feasible for a fine art museum in this climate zone.
Percentage of floor area or occupant workstations achieving adequate light levels without the use of artificial lighting	15% >300 lux at 3 p.m. March 21

Is this project a workplace?

Yes. Office program area is a relatively small component of the overall building program.

How many occupants per thermal zone or thermostat	2
Occupants who can control their own light levels	100%
Peak measured CO_2 levels during full occupancy	1,200 ppm

Resources

CO_2 intensity	1,409 metric tons embodied using carbon calculator
Estimated carbon emissions associated with building construction	70 lbs/sq ft
Percentage (by weight) of construction waste diverted from landfill	70%
Percentage of materials reused from existing buildings by volume	90%
Environmental product declarations (EPDs) summary	Data related to VOC content was collected for all finish materials. All four LEED low-emitting credits were achieved.
Percentage of materials reused from existing buildings by weight	70%
Percentage (by cost) of materials with comprehensive third-party certifications (Declare, Cradle-to-Cradle, etc.)	Zero

Change

Percentage of project floor area, if any, that represents adapting existing buildings	100%
Anticipated number of days the project can maintain function without utility power	2

Carbon emissions saved through adaptive reuse vs new construction

1,056 metric tons. This is based on a 75% reduction from the emissions estimate for new construction using the Construction Carbon Calculator. This is a very approximate figure, given the non-standard nature of this historic building's construction.

Discovery

Post-occupancy evaluation summary

The museum closely tracks environmental performance for art conservation. Systems have been able to achieve Smithsonian required control standards reliably. Full-time occupants report satisfaction with acoustics, lighting, and thermal comfort.

Sonoma Academy's Janet Durgin Guild and Commons
Santa Rosa, Calif.
WRNS Studio

For a new building on a private school campus in Santa Rosa, Calif., WRNS Studio worked with the municipality to incorporate sustainable design strategies that are ahead of code.

With a mixed-use program of dining facilities, teaching studios, and fabricator spaces, the Janet Durgin Guild and Commons is a new two-story building on Sonoma Academy's 34-acre campus in Santa Rosa, Calif. The elegant Y-shaped, steel-and-glass two-story building is built into a sloped site between existing structures on the preparatory school's rural campus.

Northern California is hardly hostile ground to environmentally friendly architecture, yet one notable aspect of the project is how hard the San Francisco–based team from WRNS Studio had to work to implement some of the building's more innovative initiatives. While local regulatory agencies are not resistant to tackling the issues, they do still struggle with what's new: "They don't always know how to review the data," WRNS Studio partner and director of sustainability Pauline Souza, AIA, says.

The parts of the lower level that are built into the hillside incorporate watershed block—a concrete masonry unit that uses pressed local soil to reduce embodied carbon. "We had to show that its compressive strength meets that typical of a block element," Souza says. The structural engineer partnered with the manufacturer to sell the idea to officials—requiring numerous conversations, calculations, and proof of concept.

Incorporating a geoexchange system to provide heating and cooling required more time with the campus' neighbors than agencies: Nearby homeowners were worried about the potential construction noise and vibrations when they heard about the 30-foot-deep wells. "We shared sound impact data with them," Souza says. "It was a construction issue that required continual conversation to meet their concerns."

A blackwater system and composting toilets proved too advanced to gain acceptance from local authorities at the time, but the architects designed the building to accept such features in the future. "We had to set an example," Souza explains. "We can educate the students as environmental stewards."

Despite some of the high load functions of the building—a commercial kitchen that serves the dining room and a second teaching one, for example—the Commons achieves net-zero energy. There's no gas cooking—electric induction is used instead—a decision that required some convincing by the architects. And not only is the kitchen powered solely by the PV array atop the building—its footprint is considerably smaller than usual. The designers achieved this by providing smaller food prep areas than typical in new construction—a trick they learned from fitting restaurant kitchens into existing urban locales.

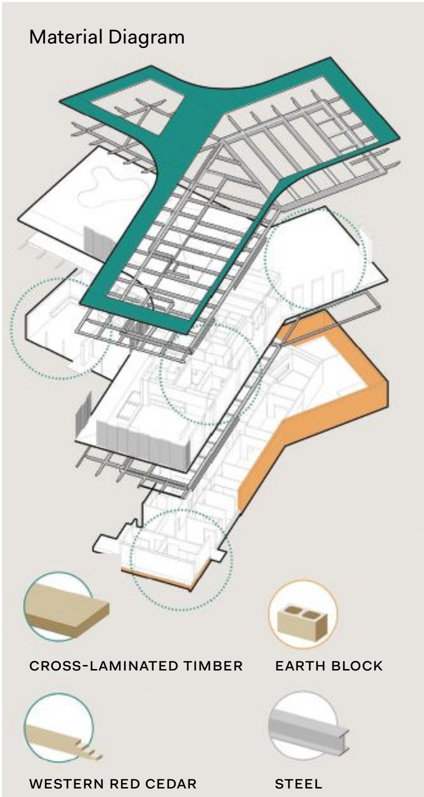
Ground-source heat pumps provide radiant heating and cooling—typically through the floor—in all spaces. Ductwork is solely used for the ventilation of the academic studios, and is aided by ceiling fans and large glass garage doors that open to the lower courtyard to provide fresh air. The studios and fabricator spaces are located on the lower level, where they nestle into the hill, providing acoustical isolation from the rest of the campus and neighbors.

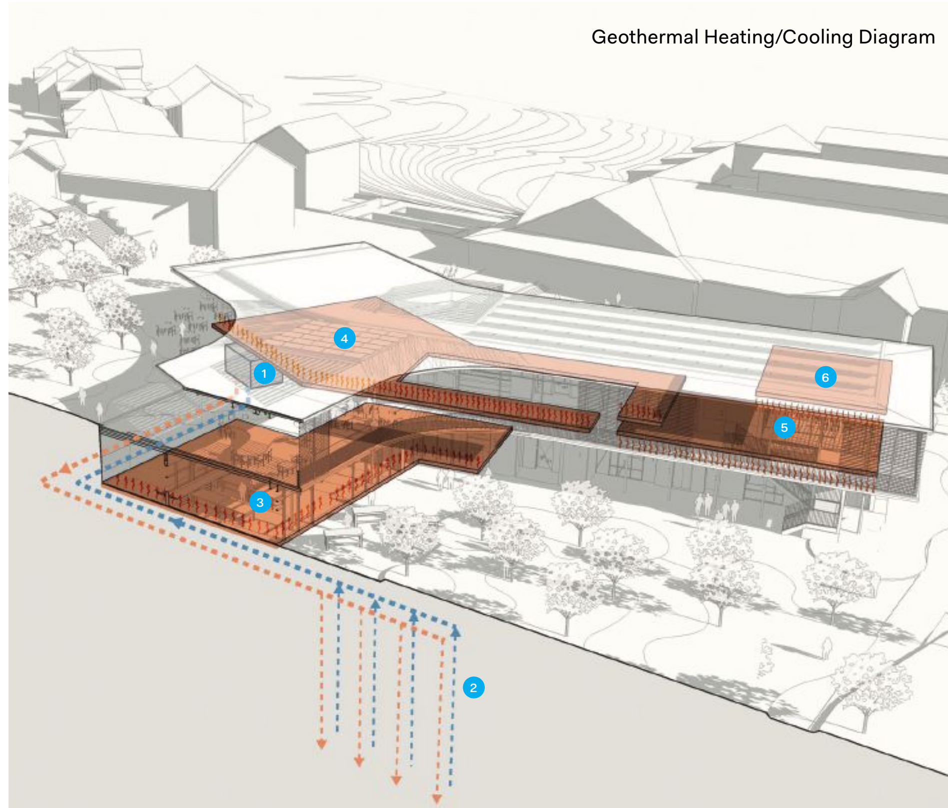
The architects decided to pursue the Living Building Challenge (LBC)'s Materials Petal—which proved difficult: A key strategy was to keep the finish schedule as small as possible—which was consistent with the minimal expression desired for the building and necessitated the vetting of fewer materials. One such example is using the same local ceramic tile in bathrooms and the elevator. "It's about being smart," Souza explains. "Why not use it?"

Using reclaimed wood is one example of using materials that already existed. The architects were able to source quite a bit of wood from a nearby house and a tunnel to the northwest, and the different provenance is obvious. "They tell different stories," she says.

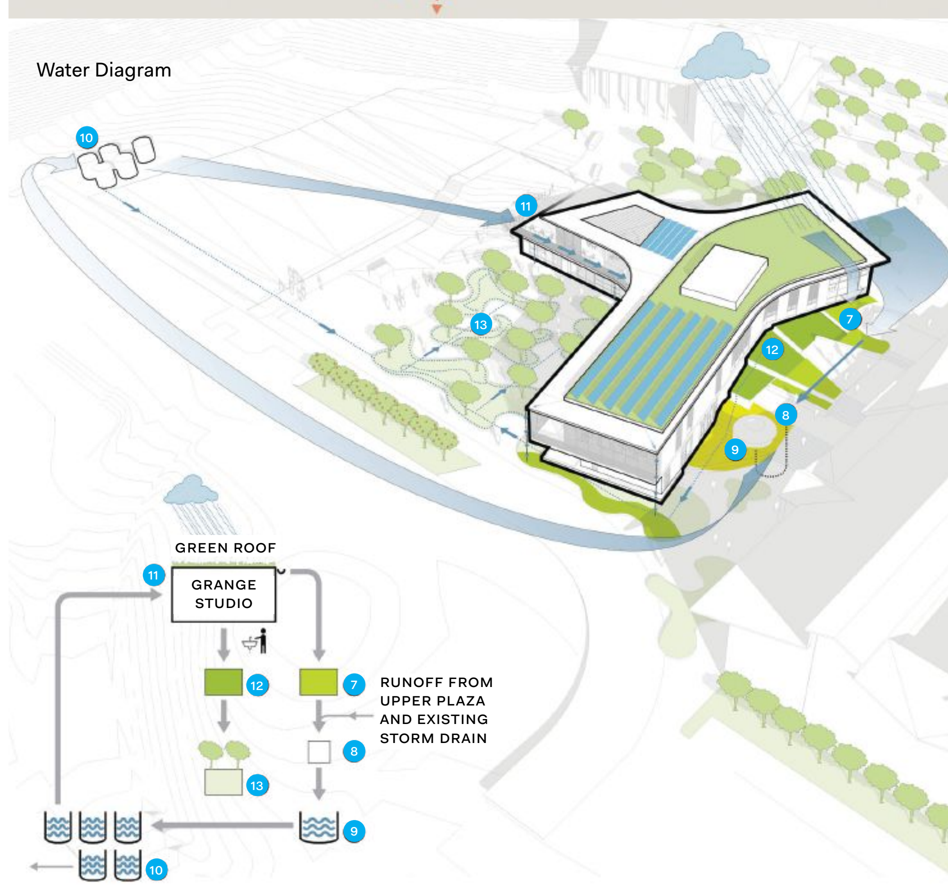
Souza notes the strong relationship between ideas of beauty and sustainability: "They're the same thing—both take time and tenacity." —E.K.

MICHAEL DAVID ROSE





WRNS Studio's sustainable strategies included materials (above), a geothermal heating and cooling system (above, right), and using stormwater runoff filtered by a 58 percent increase in site vegetation (and gathered in a cistern) for 88 percent of the building's nonpotable water use (right).



1. Ground source heat pump in mechanical room
2. Geoexchange closed-loop heat-exchange piping
3. Radiant slab, maker space
4. Radiant slab, dining
5. Radiant ceiling, students services
6. Radiant ceiling, teaching kitchen
7. Flow through stormwater planter
8. Filtration unit
9. 5,000-gallon cistern
10. Five existing 5,000-gallon cisterns
11. Water treatment in building
12. Graywater planter
13. Overflow graywater to tree mulch basin

COURTESY WRNS STUDIO

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2016
Year of Substantial Project Completion	2017
Gross Conditioned Floor Area	19,000 square feet
Gross Unconditioned Floor Area	22,000 square feet
Number of Stories	2
Project Climate Zone	ASHRAE 3C
Annual Hours of Operation	2,860
Site Area	1,481,040 square feet
Project Site	Previously developed land
Project Site Context/Setting	Rural
Cost of Construction, Excluding Furnishing	$17 million
Number of Occupants or Visitors	350

Integration

How did the approach towards sustainability inform the design concept?

Sonoma Academy created guiding principles that spoke to equity, community, and exploration. The building and site attempt to stretch out and reflect the site and community. Sited at the base of Taylor Mountains, the landscape rushes down the hill and over the building. It integrates into the land and contributes back in native plantings that invite pollinators. Exposing the materials, the radiant manifolds, the structure and the systems, invites the user into the daily functions of the building.

Community

Community Engagement	Stakeholders were involved throughout most of the process.
Walk Score	5

Ecology

Percentage of the site area designed to support vegetation	87%
Percentage of site area supporting vegetation before project began	28%
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	100%

Water

Predicted annual consumption of potable water for all uses, including process water	15 gallons
Is potable water used for irrigation?	No
Percentage of water consumed on-site comes from rainwater capture	88%

Percentage of water consumed on-site comes from graywater/blackwater capture and treatment

Zero (Due to a city regulation, the graywater from lavatories was not allowed to be reused back into the building. It is discharged below plantings. The campus stormwater and rainwater is collected from the paving and roofs to be used and stored [in a cistern] for plantings. This minimized the amount of bioswales and allowed for continued reuse of stormwater that was originally running off the site.)

Percent of rainwater that can be managed on-site	85%
Is rainwater captured for use by the project?	Yes
Is graywater or blackwater captured for reuse?	Yes

Economy

Cost per square foot	$588
Comparable cost per square foot for other, similar buildings in the region	$485–$550

Life Cycle Analysis (LCA) of the costs associated with measures taken to improve performance (e.g. energy cost payback, water savings, measured productivity gains)

LCA for the geoexchange was balanced against the PV cost against the net-zero or net-positive energy target and operations. An excerpt is as follows: An energy analysis was conducted to determine the energy savings of the geoexchange system versus a traditional air cooled heat recovery heat pump as well as the total quantity of photovoltaics that would be offset by installing geoexchange.

Energy

Predicted consumed energy use intensity (EUI)	43 kBtu/sq ft/yr
Predicted net EUI	−4.85 kBtu/sq ft/yr
Predicted net carbon emissions	Zero
Predicted reduction from national average EUI for building type	62%
Predicted lighting power density	0.45 W/sq ft
Actual net carbon emissions	Zero

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	95%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	99%
Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	95% >300 lux at 3 p.m. March 21
Is this project a workplace?	No
Annual daylighting performance	98% of regularly occupied area achieving at least 300 lux at least 50% of the annual occupied hours.
Percentage of materials, by value, incorporating health criteria such as HPD or Red List compliances	100%

Resources

CO_2 intensity	88 lbs of CO_2 (10.9 lbs/sq ft)
Estimated carbon emissions associated with building construction	60 lbs/sq ft

Environmental product declarations (EPDs) summary

EPDs and HPDs were collected for a majority of the materials selected. Registration and intended certification through ILFI for the LBC Materials Petal was a major driver. Expectations for Preliminary Audit for project.

Percentage (by cost) of materials with comprehensive third-party certifications (Declare, Cradle-to-Cradle, etc.)	15%
Were other life-cycle assessments conducted?	Analysis for geoexchange through engineers analysis

Change

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	3
Percentage of power needs supportable by on-site power generation	105%

Discovery

Has a post occupancy evaluation, including surveys of occupant comfort, been performed?	No

Albion District Library
Toronto
Perkins+Will

This new neighborhood library shows that sustainable design can have as much to do with influencing communities as it does with energy reduction.

The Perkins+Will–designed Albion District Library in Toronto may be pretty energy efficient, but that's not the building's greatest environmental innovation, according to Toronto-based principal and design director Andrew Frontini, ASSOC. AIA. Its greatest sustainability impact can be found in the social and societal issues that it addresses.

Located in Toronto's Rexdale neighborhood—about 12 miles northwest of downtown—Albion is one of the busiest public libraries in the city and serves a diverse community, including many recent immigrants who are frequent users. "We wanted to create social cohesion around the library," Frontini says. The early results are quite positive: Use of the library is up 65 percent to 82,000 annual visitors and teen use is up by 75 percent, which speaks not only to the attractiveness and "coolness" factor of the design but to the building's easy access by means other than car.

The site sits on six-lane Albion Road, with strip-style development to the north and a residential neighborhood to the south. Renovating the library that once stood on the east side of the lot may have seemed more sustainable, but consultation with users revealed that the two-year closure would have been detrimental the local community. Thus, the original structure remained in operation while the 29,000-square-foot new building was constructed. Then the old library was razed for the new parking lot, which features permeable paving and abundant landscaping.

Local zoning mandated lots of surface parking, but the designers negotiated with zoning officials to provide only 60 percent of the previous library's parking spaces. That resulted in a much greener site plan—increasing vegetation from 49 percent to 62 percent of the site—and allows the entire parking area to serve as a public space surrounded by tall branching shade trees for markets and other events. A landscape buffer between the parking lot and street creates a sense of place within the open lot.

A polychrome terra-cotta screen wraps the exterior, providing a bright and memorable civic presence. The shell is essentially a box, its roof rising towards each of the four corners to reveal an open "porch" at the northeast that provides a clear public entry. On the interior, the single-story volume is defined by four pavilions configured around three courtyard gardens.

While social sustainability may be the focus at Albion Branch Library, its 40 percent energy reduction isn't exactly shabby. The designers achieved this by limiting the building envelope to just 40 percent glazing—a figure which initially seems suspect as the structure appears quite glassy. That impression is in part due to the clever deployment of the colorful terra-cotta scrim—which reads as a playful brise-soleil—but, in fact, camouflages solid wall in many locations. The building is not a passive structure, Frontini says. Rather it employs conventional systems that rely on an efficient envelope with a low glazing ratio and considerable insulation: R40 walls containing 125 millimeters (nearly 5 inches) of mineral wool insulation and a 200-millimeter (nearly 8-inch) layer at the roof.

The designers initially conceived the building as a timber structure, but a hybrid steel-and-timber design was eventually developed to lower construction costs. "There's a hierarchy of materials," Frontini explains—with steel defining the building's geometries and FSC-certified timber decking (as well as wood finishes on surfaces from walls to millwork) used for infill. The locally sourced wood provides acoustical benefits, and wood purlins conceal the conventional mechanical system. Five percent of the building's energy needs are supplied by photovoltaic panels that cover about half of the roof. The other half is a green roof, and the shallow slopes obscure these elements from view.

Colorful and inviting, the Albion District Library's "welcoming presence," as the COTE jury put it, promises to be an active gathering space, and accessible resource, for all area residents. —E.K.

MICHELLE DE MARCO

By working with local urban planning and zoning officials, the team at Perkins+Will was able to reduce the number of parking spaces required for the new library by 60 percent—a dramatic step for a building in a car-centric, suburban neighborhood. When not being used for parking, the lot serves as an active gathering space for public festivals and events.

1. Public/animated library program facing street front
2. Building forecourt and seating areas
3. Pedestrian routes to building
4. Generous landscape buffer along parking lot edge
5. Parking lot doubles as urban plaza (market/event space)
6. Tree planting along street
7. Community garden plots
8. Planting of new trees provides landscape buffer for residents
9. Well-lit pedestrian routes to building

RODRIGO CHAVEZ

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes	Year of Design Completion	2015
	Year of Substantial Project Completion	2015
	Gross Conditioned Floor Area	29,000 square feet
	Gross Unconditioned Floor Area	Zero
	Number of Stories	1
	Project Climate Zone	CWEC Toronto Climate Zone - Ontario Region A
	Annual Hours of Operation	3,500
	Site Area	112,290 square feet
	Project Site	Previously developed land
	Project Site Context/Setting	Suburban
	Cost of Construction, Excluding Furnishing	$11.8 million
	Number of Occupants or Visitors	82,000
Integration	*How did the approach towards sustainability inform the design concept?* Located in Toronto's Rexdale neighborhood at the northwest edge of the city, Albion Library is one of Toronto's most well-used public libraries. As well as providing standard lending services, Albion is a critical social resource for the neighborhoods diverse and high-needs community. The community's desire for a safe urban oasis inspired the concept of a walled garden defined at its perimeter by a polychrome screen of terra-cotta louvers. The richly textured façade lifts at the corners articulating the entry and key program areas. Identity and territory within an open and welcoming framework echoes a vision of Canadian society for newcomers.	
Community	*Community Engagement* Stakeholders were involved throughout most of the process	
	Walk Score	84
	Estimated occupants who commute via alternative transportation (biking, walking, mass transit)	57%
	Estimated annual carbon emissions associated with the transportation of those coming to or returning from the building	708 metric tons/yr
Ecology	Percentage of the site area designed to support vegetation	62%
	Percentage of site area supporting vegetation before project began	49%
	Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	50%
Water	Predicted annual consumption of potable water for all uses, including process water	26% reduction in potable water use
	Is potable water used for irrigation?	No
Economy	Cost per square foot	$332.69
	Comparable cost per square foot for other, similar buildings in the region	$350
	Estimated annual operating cost reduction	40%
Energy	Predicted consumed energy use intensity (EUI)	74.8 kBtu/sq ft/yr
	Predicted net EUI	64.9 kBtu/sq ft/yr
	Predicted net carbon emissions	32.7 lbs/sq ft/yr
	Predicted reduction from national average EUI for building type	40%
	Predicted lighting power density	0.46 W/sq ft
Wellness	Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	70%
	Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	Zero
	Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	80% >300 lux at 3 p.m. March 21
	Is this project a workplace?	No
Resources	CO_2 intensity	44 metric tons
Change	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	Zero
Discovery	Has a post occupancy evaluation, including surveys of occupant comfort, been performed?	No

San Francisco Art Institute at Fort Mason
San Francisco
Leddy Maytum Stacy Architects

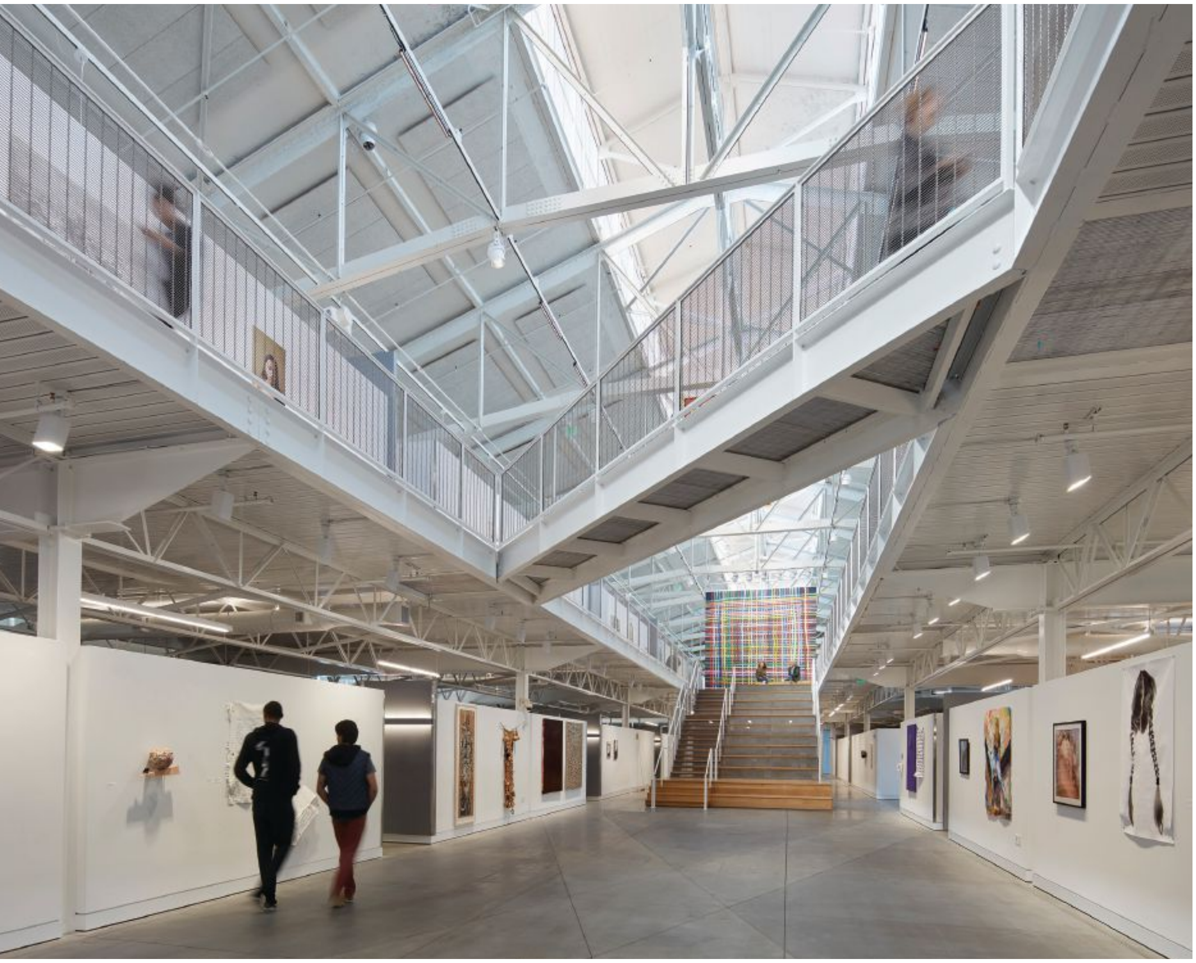
Leddy Maytum Stacy Architects (LMSA) have transformed a historic 1909 concrete-and-steel structure on Pier 2 at the city's Fort Mason Center into a new campus for the San Francisco Art Institute (SFAI). "The most sustainable strategy is reusing and adapting to new use," principal Marsha Maytum, FAIA, says.

Fort Mason served as a United States Army facility for more than a century and was the principal supply port for the Pacific theater during World War II. Following its decommissioning in the 1970s, Pier 2 was renovated as part of the complex's transformation into a cultural, educational, and recreational facility. The current project reimagined the single-story, open-space structure as a two-story, 69,422-square-foot art school.

Maytum notes that many competing interests had a hand in the project, with design input and review from the Fort Mason Center for Arts & Culture, the National Park Service, and California's State Historic Preservation Office—in addition to SFAI. The most important preservation goal was maintaining the overall character of the full-height indoor volume with its exposed truss structure.

Adding 160 individual studio spaces necessitated the addition of a new mezzanine level, which was kept a few inches away from the historic envelope. Drawing on the original trusses, the new steel-frame insertions were kept as light as possible.

The existing concrete wall worked well as a thermal mass, but the architects weren't allowed to replace the windows with better insulated units, as their industrial character was a protected element. The single most effective addition from an energy standpoint was the



A crumbling, landmarked former Army warehouse was transformed into a light-filled, energy-efficient art school.

installation of a new, high-efficiency insulated radiant concrete slab. Using THERM for 2D thermal imaging, the firm's designers evaluated the efficacy of adding rigid insulation and a new radiantly heated slab over the existing concrete deck of the pier, says LMSA associate Gwen Fuertes, AIA.

Having an open layout under the historic clerestories facilitates daylighting, and perforated stairs at each end of the atrium keep these necessary circulation elements from blocking light. Daylight is available to all instructional and public spaces, as well as 71 percent of all regularly occupied spaces.

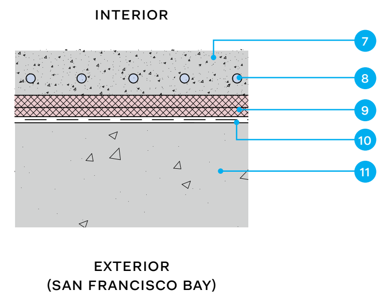
But supporting the programmed art studios requires a high rate of ventilation, due to the use of paints and other materials. How to mitigate the fumes while keeping the atrium space as open as possible "was one the great design puzzles," Maytum says. Studio pods and brush-washing stations keep the most noxious activities contained to areas where low-level exhaust systems can capture fumes and particulates. The architects located the ducts toward the perimeter of the structure and added destratification fans into each structural bay between the historic trusses.

A rooftop photovoltaic system provides 100 percent of the building's electricity, and the project already exceeds 2030 Challenge targets: The measured EUI is less than half of what was predicted, and net measured EUI is 83 percent less than the average for the building type. The designers believe the renovation will extend the life of the building by another century—resulting in a 74.9 percent reduction in greenhouse gas impact versus new construction. —E.K.

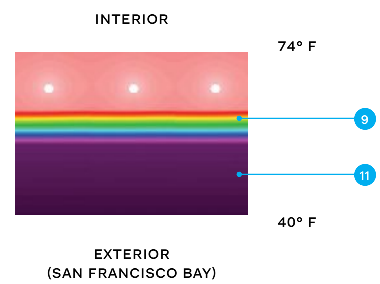
LEFT: NATIONAL PARK SERVICE; RIGHT: BRUCE DAMONTE

Pier 2 was deteriorating before the renovation, with crumbling concrete exterior walls (above). The structure had to be repaired, and a new, insulated radiant floor slab was added to help keep floor temperatures more than 30 degrees higher than they were with the previous conditions (right).

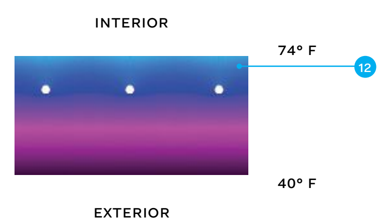
New Concrete Floor Diagram



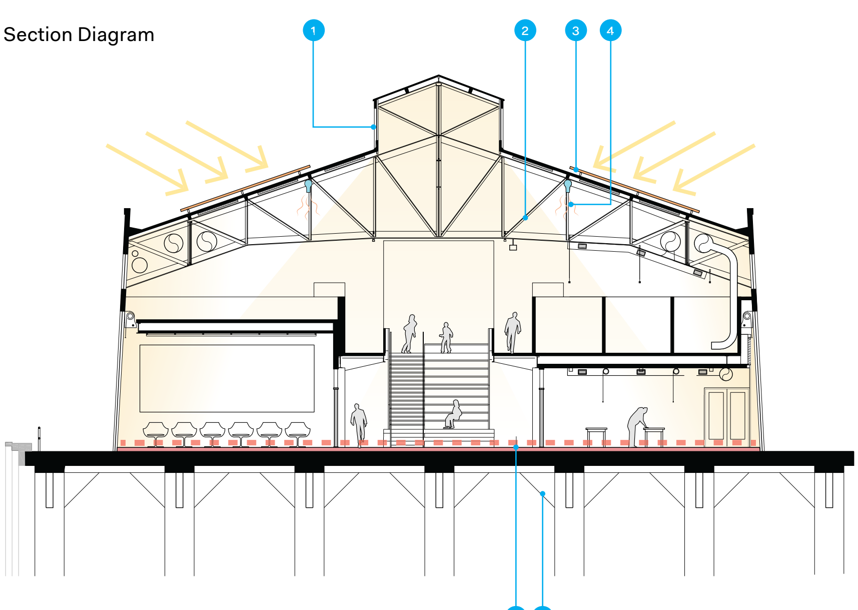
THERM Analysis—New Insulated Topping Slab



THERM Analysis—Comparison Without Insulation



Section Diagram



1. Clerestory light monitor
2. Historic structural trusses
3. 255-kilowatt photovoltaic array
4. Efficient destratification fans
5. Hydronic radiant slab
6. Historic pier structure
7. Reinforced concrete topping slab
8. Radiant heating tube
9. Rigid insulation
10. Vapor barrier
11. Existing concrete deck
12. Topping slab on existing concrete deck

COURTESY LEDDY MAYTUM STACY ARCHITECTS

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2015
Year of Substantial Project Completion	2017
Gross Conditioned Floor Area	69,422 square feet
Gross Unconditioned Floor Area	Zero
Number of Stories	2
Project Climate Zone	California climate zone 3 (Title 24)
Annual Hours of Operation	8,760
Site Area	53,750 square feet
Project Site	Historic structure or district
Project Site Context/Setting	Urban
Cost of Construction, Excluding Furnishing	$26.5 million
Number of Occupants or Visitors	75,000

Integration

How did the approach towards sustainability inform the design concept?

Located at the edge of San Francisco Bay, the historic U.S. Army warehouse Pier 2 at Fort Mason has been transformed into a new campus for San Francisco Art Institute (SFAI) creating a dynamic new hub for arts education and public engagement. The adaptive rehabilitation of the pier shed preserves the industrial integrity of the landmark structure, integrates advanced sustainable strategies, reuses existing building resources, supports SFAI's pedagogical and environmental goals, and forges new community connections.

Community

Community Engagement

A partnership is formed with stakeholders to share in the decision-making process including development of alternatives and identification of the preferred solution.

Walk Score	72

Ecology

Percentage of the site area designed to support vegetation	Zero
Percentage of site area supporting vegetation before project began	Zero
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	Zero

Water

Predicted annual consumption of potable water for all uses, including process water	1,615,400 gallons
Is potable water used for irrigation?	Yes
Actual annual consumption of potable water for all uses	1,670 gal/yr/grad student; 32% reduction
Is rainwater captured for use by the project?	No
Is graywater or blackwater captured for reuse?	No

Economy

Cost per square foot	$352
Comparable cost per square foot for other, similar buildings in the region	$500–$700 per square foot
Life Cycle Analysis of the costs associated with measures taken to improve performance (e.g. energy cost payback, water savings, measured productivity gains)	A life cycle cost report for the PV array for the Office of Energy Efficiency & Renewable Energy/U.S. Department of Energy cited an annual savings of $45,000.

Energy

Predicted consumed energy use intensity (EUI)	75.7 kBtu/sq ft/yr
Predicted net EUI	62.3 kBtu/sq ft/yr
Predicted net carbon emissions	14.3 lbs/sq ft/yr
Predicted reduction from national average EUI for building type	53%
Predicted lighting power density	0.72 W/sq ft
Actual consumed energy use intensity (Site EUI)	31.5 kBtu/sq ft/yr
Actual net EUI	14.5 kBtu/sq ft/yr
Actual net carbon emissions	2.67 lbs/sq ft/yr
Actual reduction from national average EUI for building type	83%

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	72%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	71%
Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	100% >300 lux at 3 p.m. March 21
Is this project a workplace?	No

Resources

CO_2 intensity	756,460 lbs of CO_2 (10.9 lbs CO_2/sq ft)
Estimated carbon emissions associated with building construction	10.9 lbs/sq ft
Percentage of materials reused from existing buildings by volume	91%
Were other life-cycle assessments (LCAs) conducted?	No

Change

Percentage of project floor area, if any, that represents adapting existing buildings	100%
Anticipated number of days the project can maintain function without utility power	1
Percentage of power needs supportable by on-site power generation	37%

Carbon emissions saved through adaptive reuse vs new construction

Using the Athena Impact Estimator, the project demonstrated a 74.9% reduction of greenhouse gas impact from a reference building (standard metal frame new construction, identical footprint, size, and equivalent area of openings). Operational energy results (gathered from actual utility bills) also demonstrate carbon savings from both a Title 24 equivalent new construction baseline (78%) and a national baseline (83%).

Discovery

Post-occupancy evaluation summary

A post-occupancy evaluation of operational energy use, renewable energy monitoring and daylighting performance has been completed. An occupant and staff survey is currently in progress and being administered by SFAI; the results are pending.

Mundo Verde Bilingual Public Charter School John F. Cook Campus
Washington, D.C.
Studio 27 Architecture

The design for the renovation and addition to a public elementary school brings green space—and food production—back to the city.

In 2013, when Studio 27 Architecture interviewed for the job of designing Mundo Verde Bilingual Public Charter School John F. Cook Campus in Washington, D.C., principal Todd Ray, FAIA, was energized by the question, "How can this project teach our students to be global stewards of our environment?" A follow-up, however, caught him by surprise: "How can we make a school that becomes more sustainable each year?" Since buildings decay over time, he says, "it was a paradigm shift to imagine it improving over time."

The resulting $15 million project encompassed the rehabilitation and renovation of a 1925 brick public school building, Cook Elementary, which Studio 27 found abandoned and in a state of "amazing disrepair," Ray says, as well as the construction of a new three-story annex and the greening of the property to include an edible garden where students cultivate crops such as tomatoes, basil, and broccoli—and compost the scraps they don't eat. Today, the campus accommodates almost 600 students from pre-K through fifth grade. As the COTE jury noted, "The building and the curriculum integrate sustainability into the occupants' daily lives. … This is a great example of high performance achieved within constrained costs."

Overhauling the existing, 36,148-square-foot elementary school involved installing all new mechanical systems. Studio 27 took inspiration from the energy efficiency of the building's original ventilation system, which pulled fresh air through the basement and a series of vertical shafts. The new air-cooled variable refrigerant flow system allows for localized climate control and energy savings from not having to push conditioned air around the building. And the old ventilation shafts now serve as one-on-one tutoring niches. The heart of the school is the refurbished, double-height multipurpose space called the "Zócalo" (after the main public square of Mexico City), which combines the functions of auditorium and gymnasium. Positioned just inside the school's main entrance, it boasts restored round-arched windows and disc-like LED pendants.

The newly constructed, 10,963-square-foot annex, home of the kindergarten and pre-K programs, also has a Spanish name: *la casita*, or the small house. It fronts the street, at once addressing the neighborhood and creating a garden court in the space between the new and old structures. "We kept the fences low and the gates wide," Ray says. The building is certified LEED Platinum and achieves solid performance metrics, but its most popular feature may be the elevated deck overlooking the campus.

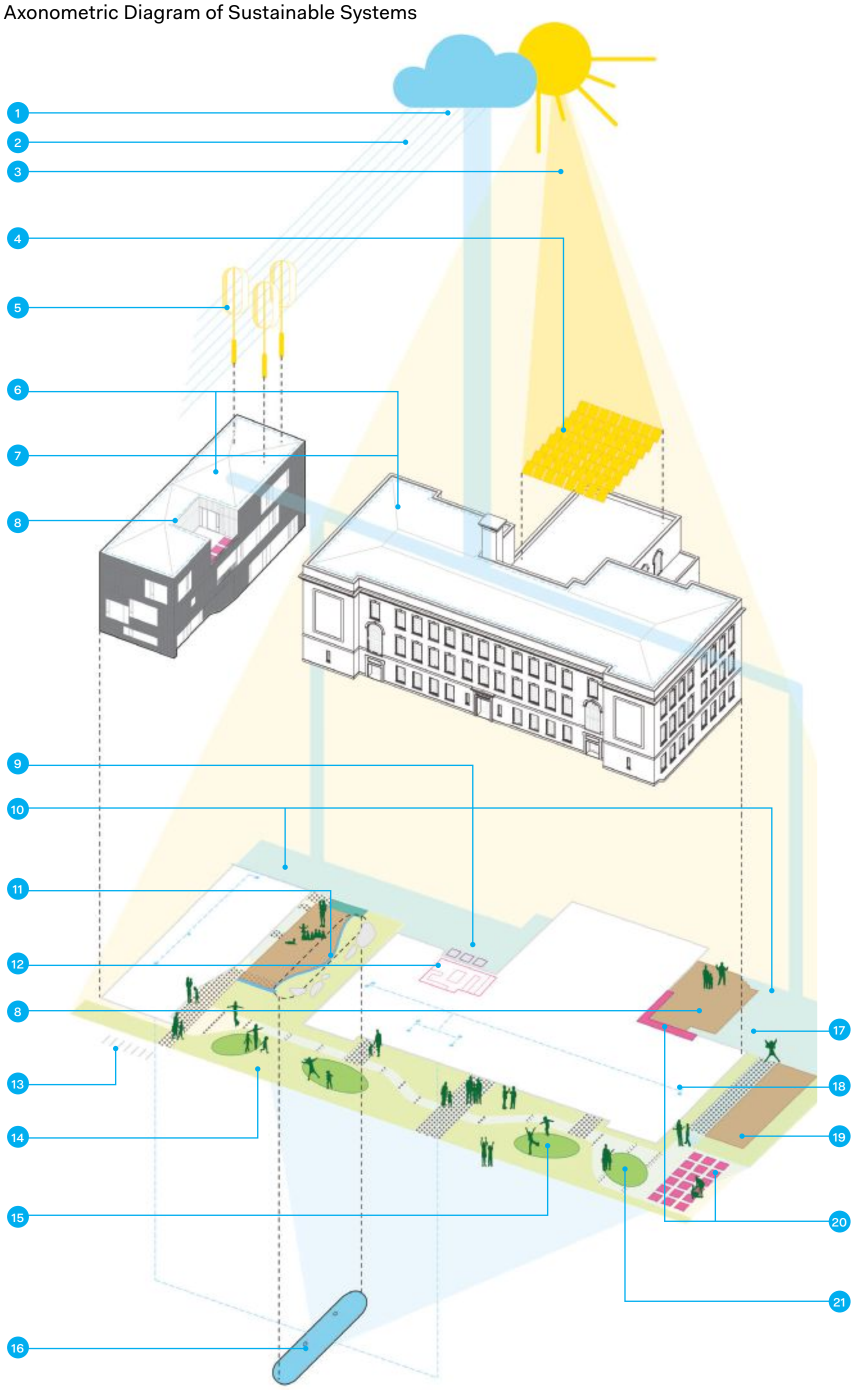
Working closely with school administrators, Studio 27 created a sustainability master plan to determine "what could and could not be afforded immediately," Ray says. The architecture supports the educators' ambition to further reduce the school's carbon footprint year over year, for example, by anticipating one day installing solar and wind energy systems. Students learn all about this vision in a fourth-grade learning unit on energy, which introduces them to photovoltaic technology and gives them a chance to speak with neighbors about the benefits of going solar.

Water conservation was also important to the school's mission. So Studio 27 designed a rainwater harvesting system to capture runoff from the roofs and store it in a 25,000-gallon cistern beneath the main garden court, providing enough water to irrigate the gardens and flush the toilets. A central water plant in the basement of the old building pumps both potable and nonpotable water throughout the campus.

"Our school needed to be beautiful and sustainable; it also needed to codify and support our approach to learning—active, challenging, meaningful, public, and collaborative," says Kristin Scotchmer, co-founder and executive director of the school. "Mundo Verde's impact will be greener each year and the children walking out of our building will extend that greener footprint beyond our immediate community." —G.F.S.

HOACHLANDER DAVIS PHOTOGRAPHY

Axonometric Diagram of Sustainable Systems



1. Rainwater
2. Wind
3. Sunshine
4. Photovoltaic array (future)
5. Windmill power (future)
6. Rainwater catchment area
7. Highly reflective Energy Star roof
8. Outdoor classroom
9. Compost and recycling
10. Porous concrete paving
11. Rain garden and stream
12. Kitchen
13. Bicycle parking
14. Living/learning landscape
15. Migratory bird way station/classroom
16. Cistern/graywater system
17. Hybrid car parking
18. Low-flush toilets
19. Explorative urban gardens
20. Edible gardens
21. Native meadow and pollinator garden

Studio 27 Architecture brought the percentage of the site designed for landscaping from zero to 40 percent, accommodating everything from edible gardens to rainwater cisterns that provide for the building and students, and enrich the curriculum.

COURTESY STUDIO 27 ARCHITECTURE

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2014
Year of Substantial Project Completion	2015
Gross Conditioned Floor Area	45,100 square feet
Gross Unconditioned Floor Area	Zero
Number of Stories	3
Project Climate Zone	ASHRAE 4A
Annual Hours of Operation	42,253
Site Area	142,052 square feet
Project Site	Historic structure or district
Project Site Context/Setting	urban
Cost of Construction, Excluding Furnishing	$11,501,000
Number of Occupants or Visitors	851

Integration

How did the approach towards sustainability inform the design concept?

Mundo Verde is a bilingual, sustainability focused public charter school located in the District of Columbia. From the earliest planning for its permanent home, the school sought to build a sense of place and belonging within the broader community, meet an unparalleled demand for the unique education for sustainability model, increase high-quality education available to high-need neighborhoods, and revitalize a derelict urban site as a demonstration of green, sustainable practices, operations, and education. The project extends beyond LEED through numerous sustainable performance matrices, but most specifically with rigors and intensity with which the sustainability curriculum is inextricably interwoven to the buildings and campus. With relative cost effectiveness and targeted investments, the site maximizes positive impact on the environment; counters assumptions that green school projects are costlier and therefore less cost effective; and pushes each investment to have the highest impact on learning and student wellness with a focus on light, water harvesting, outdoor and indoor air quality, and the ability to grow and serve healthy foods on-site.

Community

Community Engagement	Stakeholders were involved throughout most of the process.
Walk Score	93
Estimated occupants who commute via alternative transportation (biking, walking, mass transit)	70%

Ecology

Percentage of the site area designed to support vegetation	40%
Percentage of site area supporting vegetation before project began	Zero
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	50%

Water

Predicted annual consumption of potable water for all uses, including process water	132 gal/year/occupant (0.66 gal/day/occupant)
Is potable water used for irrigation?	No
Percentage of water consumed on-site comes from rainwater capture	50%
Percentage of water consumed on-site comes from graywater/blackwater capture and treatment	Zero
Percent of rainwater that can be managed on-site	41%
Metrics of water quality for any stormwater leaving the site	The runoff will be treated and infiltrated through a variety of methods including rain gardens, permeable concrete, and a cistern.
Is rainwater captured for use by the project?	Yes
Is graywater or blackwater captured for reuse?	No
If project has substantial process water loads (e.g. cooling towers), estimate annual water consumption	Zero

Economy

Cost per square foot	$255
Comparable cost per square foot for other, similar buildings in the region	$670/sq ft (D.C. Department of General Services published construction cost for two recent D.C. public schools)
Estimated annual operating cost reduction	58%

Energy

Predicted consumed energy use intensity (EUI)	61 kBtu/sq ft/yr
Predicted net EUI	61 kBtu/sq ft/yr
Predicted net carbon emissions	6 lbs/sq ft/yr
Predicted reduction from national average EUI for building type	58.8%
Predicted lighting power density	0.76 W/sq ft

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	95%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	92%
Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	75% >300 lux at 3 p.m. March 21
Is this project a workplace?	Yes
How many occupants per thermal zone or thermostat	22
Occupants who can control their own light levels	100%

Resources

CO_2 intensity	1,193 metric tons
Estimated carbon emissions associated with building construction	57.48 lbs/sq ft
Percentage (by weight) of construction waste diverted from landfill	75.71%
Percentage of materials reused from existing buildings by volume	96.23%

Change

Percentage of project floor area, if any, that represents adapting existing buildings	100%
Anticipated number of days the project can maintain function without utility power	260
Percentage of power needs supportable by on-site power generation	15%

Discovery

Has a post occupancy evaluation, including surveys of occupant comfort, been performed?	No

Sawmill
Tehachapi, Calif.
Olson Kundig

For Bruce Shafer and Carol Horst, designing their vacation home to be off the grid wasn't a choice. They had purchased a 36-acre plot in California's forbidding Tehachapi Mountains—deep in the Mojave Desert, 5,000 miles above sea level, 5 miles from the nearest road, and nearly as far from utility hookups."It's not just off the grid, it's off off the grid," Shafer said.

Shafer, an engineer, had long admired the work of Seattle's Olson Kundig, especially its rational, detailed approach to sustainable domestic architecture. When he approached the firm, they jumped at the challenge.

"It's a relentless climate that is going to try to break down anything you do," says design principal Tom Kundig, FAIA. Together, the couple and the firm designed a home that is not only energy and water neutral, but is built to last in the high desert hills with little maintenance—underlining the importance of durability in sustainable design.

In such an environment—the mountains get just 12 inches of rain a year—water is a scarce but vital commodity. But rather than draw from a faraway main or rely on a cistern, the 3,390-square-foot house pulls all of its water from the ground, depositing it in a tank located uphill from the house to ensure constant pressure. It then returns the wastewater to the ground, via a septic tank and leach field.

"The idea is to recharge the groundwater rather than capture the rain that hits the roof," Kundig says. The water pump, along with everything else electrical in the house, is powered by an 8.4-kilowatt photovoltaic array. But Olson Kundig kept energy needs to a minimum by siting the building to take

A single-family house in the Mojave Desert is located miles from the nearest utility hookup.

full advantage of cooling cross breezes and morning and evening light. According to the firm's estimates, Sawmill, despite its size, generates 96 percent less CO_2 than the typical single-family house.

At Sawmill, passive and hand-operated functions dominate. For example, heat from the fireplace is directed into an 840-square-foot basement, where it can radiate across the underside of the main level's floors.

The walls are made with concrete masonry units, reinforced with rebar and filled with concrete grout. The weathered, rusty roof beams are steel—25 tons total—salvaged from sites where Shafer, who operated a cement factory nearby, had contacts. Much of the house's massing owes to the serendipity of finding large steel components. "They told me, 'Bruce, get a list of all the steel available,' and then they made use of the steel they had on hand," Shafer says.

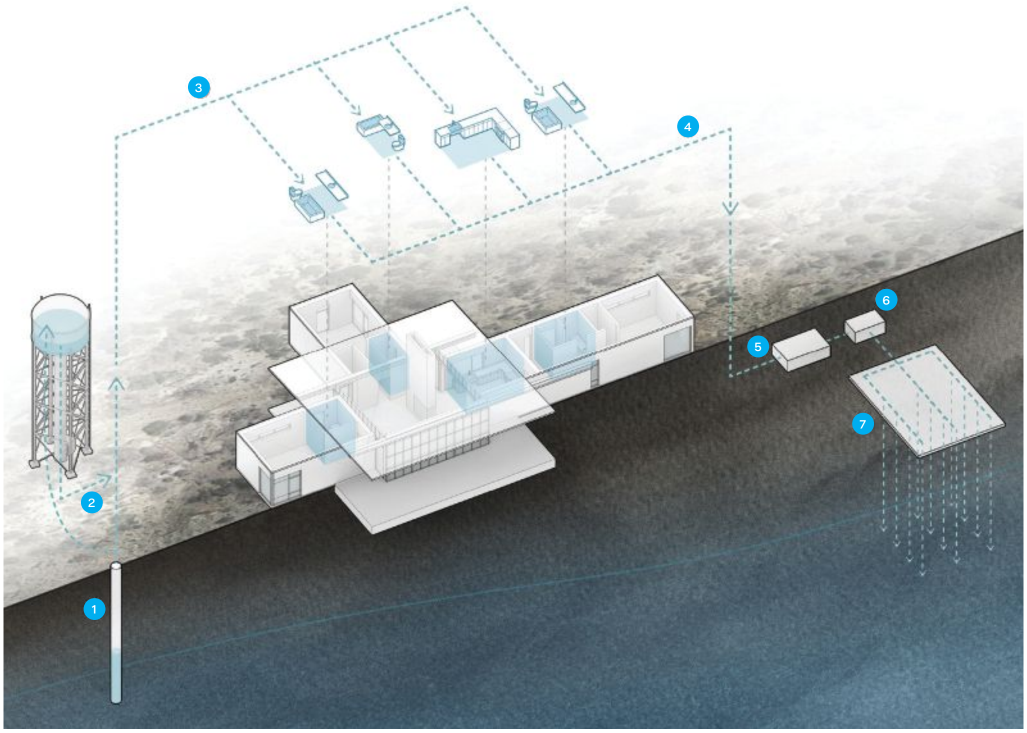
The building was easy enough to assemble that Shafer was able to act as general contractor, and, with the help of his sons, do some of the work themselves on weekends. "We laid the tubing for the radiant floors and milled the dining room table, which was a door Tom had salvaged from nearby," he says.

For all its monumentality outside, the house is surprisingly intimate: Inspired by a campground, the it is split into three wings around a central hearth; the fourth side is a 12-by-26-foot glass wall that can open onto a patio with a few turns of a large metal wheel, which the firm salvaged from a nearby scrapyard.

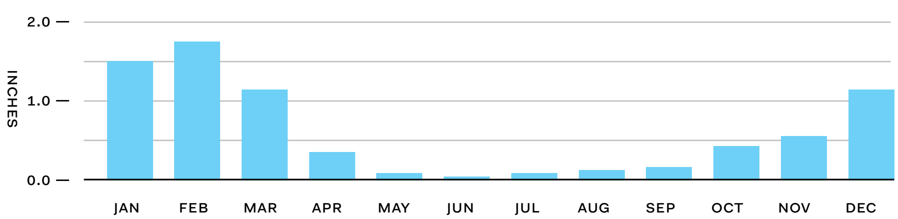
So far, Sawmill has exceeded Shafer's expectations. "We wanted a low-maintenance structure that would last, and that's what it is," he says. More than that, Sawmill shows that sustainable domestic architecture doesn't need to be fancy to work wonders. —C.R.

KEVIN SCOTT/OLSON KUNDIG

Water System Diagram



Monthly rainfall

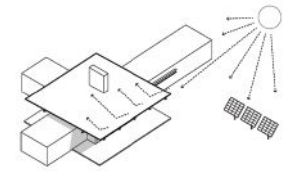


AVERAGE ANNUAL PRECIPITATION 11.51 INCHES

In a desert climate, water is at a premium, and at Sawmill, Olson Kundig did not want to pipe water in from far away. Instead, the house's potable water is drawn from the ground via a solar-powered pump, stored in a cistern, and, after use, filtered and dispersed back to the ground table from the house's septic system via a leach field.

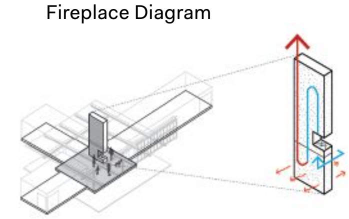
1. Potable water is pumped from the ground using solar energy and stored in an elevated tank
2. Water is distributed at applicable pressures and rates per fixture (gravity fed)
3. Low-flow fixtures are incorporated throughout the home (54,129.5 gallons)
4. Wastewater is distributed to septic tank
5. Septic tank digests organic matter and separates solids from wastewater
6. Dispersion tank discharges effluent from septic into leach fields
7. Water is filtered through leach fields and eventually returns to water table

Sun Protection Diagram



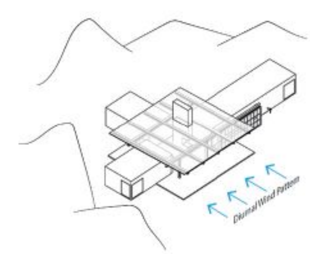
8.4-KILOWATT PHOTOVOLTAIC ARRAY WITH BATTERY BACKUP ENABLES THE HOUSE TO BE TRULY OFF-GRID.

Fireplace Diagram



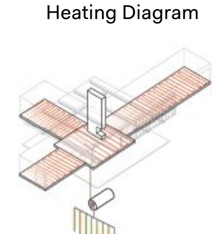
THE FIREPLACE WORKS AS LATERAL BRACING FOR STRUCTURE. AIRFLOW MAXIMIZES HEAT EXTRACTION AND PROVIDE HEAT TO THE BASEMENT. THE CONCRETE MASS STORES HEAT FOR MANY HOURS.

Passive Cooling Diagram



THE HOUSE IS ORIENTED TO TAKE ADVANTAGE OF CANYON WIND PATTERNS AND DIURNAL TEMPERATURE CHANGES.

Heating Diagram



THERMAL LOADS ARE MET WITH A GROUND-SOURCE HEAT PUMP THAT SUPPLIES WATER TO A RADIANT FLOOR.

COURTESY OLSON KUNDIG

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2013
Year of Substantial Project Completion	2014
Gross Conditioned Floor Area	3,458 square feet
Gross Unconditioned Floor Area	808 square feet
Number of Stories	2
Project Climate Zone	Title 24 - Area 14
Annual Hours of Operation	4,400
Site Area	1,677,060 square feet
Project Site	Greenfield (previously undeveloped land)
Project Site Context/Setting	Rural
Cost of Construction, Excluding Furnishing	$166.70 per square foot
Number of Occupants or Visitors	6

Integration

How did the approach towards sustainability inform the design concept?

Set in California's harsh Mojave Desert, Sawmill offers a new model for the sustainable single-family home. The residential sector in the U.S. continues to be the highest consumer of energy. More than any other building type, creating a new model for the single-family home has the potential to dramatically shift the energy landscape in the U.S., demonstrating that high design can also be high performance. Sited to minimize disturbance to its remote environment, Sawmill acknowledges that while the desert is harsh, it is also fragile. Historically, the valley had been used for mining, ranching, and logging—hence the name "Sawmill." Recognizing this past exploitation of the site, the homeowners wanted their house to give back to the land, rather than take from it. Sawmill stands as a testament to high design as an environmental ethic—a building that connects people to place.

Community

Community Engagement

A partnership was formed with stakeholders to share in the decision-making process including development of alternatives and identification of the preferred solution.

Walk Score	1

Ecology

Percentage of the site area designed to support vegetation	98%
Percentage of site area supporting vegetation before project began	98%
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	100%

Water

Predicted annual consumption of potable water for all uses, including process water	9,022 gallons
Is potable water used for irrigation?	No
Percent of rainwater that can be managed on-site	100%
Is rainwater captured for use by the project?	No
Is graywater or blackwater captured for reuse?	No

Economy

Cost per square foot	$166.70
Comparable cost per square foot for other, similar buildings in the region	$158
Estimated annual operating cost reduction	96% (Baseline Title24). Reduction would be 100% because of the PV, but there is a propane grill that has an annual cost of between $200–$300.

Energy

Predicted consumed energy use intensity (EUI)	13.6 kBtu/sq ft/yr
Predicted net EUI	Zero
Predicted net carbon emissions	Zero
Predicted reduction from national average EUI for building type	100%
Predicted lighting power density	0.521 W/sq ft

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	100%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	100%
Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	87% >300 lux at 3 p.m. March 21
Is this project a workplace?	No
Annual daylighting performance	84.5% achieving at least 300 lux at least 50% of the annual occupied hours

Resources

CO_2 intensity	63.62 lbs/sq ft (28.86 kgs)
Estimated carbon emissions associated with building construction	65 lbs/sq ft

Change

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	365
Percentage of power needs supportable by on-site power generation	100%

Discovery

Post-occupancy evaluation summary

We provided the client with a simple thermal comfort and air quality survey that asked him to rate the level of satisfaction, rate the thermal scale (-3=too cold, +3= too hot) in both hot weather and cold weather. The response was that they were very satisfied and were comfortable in both hot and cold weather. We also asked if there were any particular part of the day or week where they experienced discomfort, and the response was that there weren't. Regarding air quality, there was also a high level of satisfaction, with the response that the air quality improves the occupant productivity. With the open-ended questions, it was mentioned that the house had good passive characteristics, and that the open air pavilion in temperate conditions in the center of the house was important to them.

Georgia Tech Krone Engineered Biosystems Building
Atlanta
Cooper Carry and Lake|Flato Architects

This lab building at Georgia Tech is a case study in how to turn a resource-intensive typology into a resource producer.

Most students at the Georgia Institute of Technology probably spend their entire academic careers unaware that their university, on the northern edge of downtown Atlanta, sits at the headwaters of the city's water system. In fact, when Atlanta–based Cooper Carry and Texas-based Lake|Flato Architects began work on the new Engineered Biosystems Building for the campus, the firms discovered that part of the system originates as an underground stream located in what would someday be the project's basement.

Rather than deal with the stream as an inconvenience, the team incorporated it into an innovative approach to sustainability, capturing water from the stream for the building's water system. As a result of this influx, the structure, whose laboratories concentrate on cell therapies and chemical biology and use an enormous amount of water, actually produces a net surplus of water—making the building an active participant in sustainability for the larger campus. "We had the luxury of leveraging the ecological characteristics of the site and the area adjacent to it to create a story about how it all relates to the rest of the campus," says Ryan Jones, AIA, an associate partner at Lake|Flato.

Indeed, finding a sustainable solution to the building's water challenges was part of the team's mandate: As part of a 2004 master plan, the university had called for an "Eco-Commons" approach to new development, which included a "50 percent reduction in stormwater runoff entering the Atlanta sewer system." That mandate informed how the team approached every aspect of the design of the building, which was completed in 2014.

The found stream literally reshaped the architects' plan for the building: "The original design was intended to take up an entire block on campus," Jones says. "When we uncovered the stream, that gave us the inspiration to create a thinner footprint, one that created daylit spaces and common areas."

A conventional solution would have been to simply redirect the stream around the building and into the city's storm drains. Instead, the firm created a system to collect the water and convey it, via pipes, to a 10,000-gallon clean-water cistern; overflow from the cistern feeds a fountain and a runnel alongside the building. That runnel then passes through a rain garden and into two adjacent wetlands.

Preliminary calculations found significant sources of excess water in air-conditioning condensate, foundation dewatering, and rainwater. The firm created a separate system for capturing that as well—all water that, in a conventional design, would likewise be sent into the city's storm drains. The collected water is used to flush toilets, which feed into a dirty-water cistern, where it is filtered. That water, and any surplus, is then fed toward the larger of the two adjacent wetlands.

Because so much of the system depends on the natural flow of water from the site, in the form of rainwater collection and overflow from the stream, the water level in the runnel varies significantly—sometimes, after a storm, it surges; at other times, it is just a trickle. "The fluctuation communicates how the building is working," Jones says.

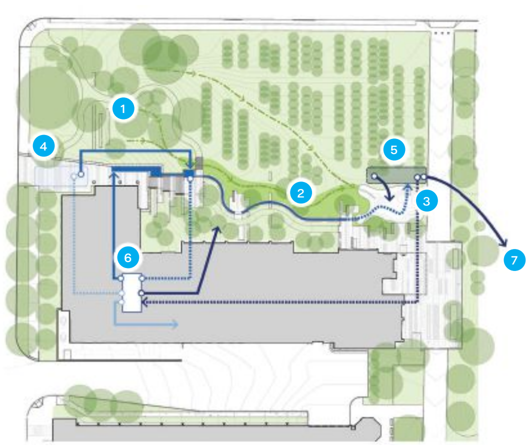
Such variation is a fact that Lake|Flato and Cooper Carry welcome—it makes visible the building's relationship to the environment. "Our goal is to create something so contextual, so welcome in its community, that you can't imagine the site without it, even just a few years after it is completed," Jones says.

Even though only 3 percent of the building is public, Jones said the open space in front of it, because it sits along the runnel and the wetlands, has become a gathering spot for members of both the campus and the general public. "Every time I go there," he says, it "is filled with people who have no need to go into the building. The other day it was a mom's group, drinking coffee"—proof, if needed, that sustainable design is not just good for the climate, but for the community. —C.R.

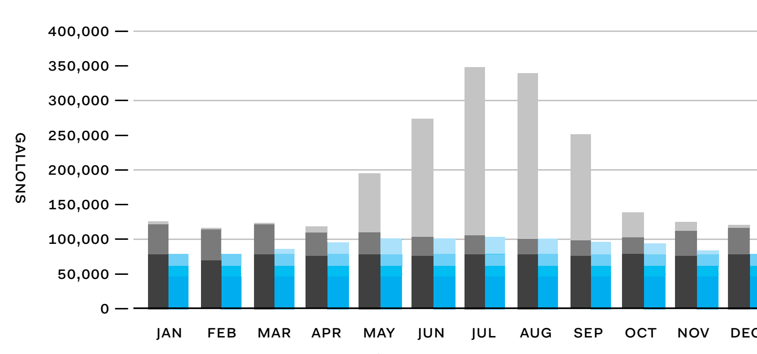
CHRIS COOPER

Section Diagram

Water Flow Diagram



Water Balance



The buiding's water system collects more water from an underground stream and other collected stormwater than it uses (right) for chilled beams and other nonpotable uses (top). Overflow moves through a rain garden and into engineered wetlands to be returned to the water table (above).

1. Historic spring and drainage
2. Rain garden
3. Engineered wetland
4. Clean water cistern
5. Dirty water cistern
6. Central plumbing room
7. Campus wetland

- External shading
- Solar array
- Heat recovery
- Lighting controls
- Chill beams
- Low air exchange rate
- Radiant slabs

- Foundation dewatering
- Harvested rain
- Cooling coil condensate
- Toilet flushing
- Wash downs
- Potable water
- Irrigation

COURTESY COOPER CARRY AND LAKE|FLATO ARCHITECTS

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2013
Year of Substantial Project Completion	2014
Gross Conditioned Floor Area	207,790 square feet
Gross Unconditioned Floor Area	4,676 square feet
Number of Stories	6
Project Climate Zone	ASHRAE 3A
Annual Hours of Operation	2,920
Site Area	142,052 square feet
Project Site	Brownfield
Project Site Context/Setting	Urban
Cost of Construction, Excluding Furnishing	$91.6 million
Number of Occupants or Visitors	582

Integration

How did the approach towards sustainability inform the design concept?

Georgia Tech's Engineered Biosystems Building (EBB) provides nearly 200,000 square feet to serve as a core bio-technological research building for Georgia Tech, as well as a model for further development of that section of the campus. Daylight, views to the outdoors, and other biophilic elements are used throughout the program to encourage interaction. Integrative design process was used to bring together all project stakeholders at the beginning of design to set performance goals and metrics for the building.

Discovery

Post-occupancy evaluation summary

The design team is performing extensive commissioning and post-occupancy evaluation on the EBB, and has identified and addressed several performance issues through this rigorous process. For example, EBB uses fume hoods with an "auto-close" function to manage energy consumption. The design team identified many hoods in the project with auto-close function issues or where users had disabled the feature. It was also discovered during a post-occupancy visit that the weather station installed at EBB was not operating. The design team monitors energy and water use remotely, and makes post-occupancy visits to measure air quality and daylight levels. Results and resolution to issues are discussed regularly with Georgia Tech. User experience has also been studied through occupant surveys and post-occupancy visits.

Community

Community Engagement

A partnership was formed with stakeholders to share in the decision-making process including development of alternatives and identification of the preferred solution.

Walk Score	58

Ecology

Percentage of the site area designed to support vegetation	61.9%
Percentage of site area supporting vegetation before project began	43.1%
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	58.9%

Water

Predicted annual consumption of potable water for all uses, including process water	520.5 gal/FTE or 79.43% reduction over LEED 2009 baseline
Is potable water used for irrigation?	No
Percentage of water consumed on-site comes from rainwater capture	11%
Percentage of water consumed on-site comes from graywater/blackwater capture and treatment	10%
Percent of rainwater that can be managed on-site	23%
Metrics of water quality for any stormwater leaving the site	80% of total suspended solids removed from stormwater runoff
Is rainwater captured for use by the project?	Yes
Is graywater or blackwater captured for reuse?	Yes

Economy

Cost per square foot	$414.96
Comparable cost per square foot for other, similar buildings in the region	$491.73 (from general contractor)
Estimated annual operating cost reduction	33.36% over ASHRAE 90.1-2007

Energy

Predicted consumed energy use intensity (EUI)	136.1 kBtu/sq ft/yr
Predicted net EUI	134.3 kBtu/sq ft/yr
Predicted net carbon emissions	7,495,447.2 lbs/sq ft/yr
Predicted reduction from national average EUI for building type	69%
Predicted lighting power density	0.66 W/sq ft
Actual consumed energy use intensity (Site EUI)	182.06 kBtu/sq ft/yr
Actual net EUI	180.67 kBtu/sq ft/yr
Actual net carbon emissions	9,427,148 lbs/sq ft/yr
Actual reduction from national average EUI for building type	49%

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	90.2%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	Zero
Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	15% >300 lux at 3 p.m. March 21
Is this project a workplace?	Yes
How many occupants per thermal zone or thermostat	5
Occupants who can control their own light levels	97.2%
Peak measured CO_2 levels during full occupancy	588 ppm
Annual daylighting performance	35% of regularly occupied area achieving at least 300 lux at least 50% of annual occupied hours.

Resources

CO_2 intensity	82.9 metric tons
Percentage (by weight) of construction waste diverted from landfill	99.7%

Change

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	1
Percentage of power needs supportable by on-site power generation	1.43%

Ortlieb's Bottling House
Philadelphia
KieranTimberlake

Using an online survey system and a sensor network developed in-house, the COTE Top Ten Plus winner finds the balance between energy efficiency and user comfort.

For years, Stephen Kieran, FAIA, and James Timberlake, FAIA, the founders of the Philadelphia-based firm KieranTimberlake, had wanted their own office building to accommodate their growing workforce. Finally, after the Great Recession, they got their chance: the owners of the Henry F. Ortlieb Co. Bottling House, an old brewery facility in Philadelphia's Northern Liberties neighborhood, had dropped the building's price in half. They pounced.

Built in 1948 in the International Style, the building had laid "fallow" since the 1980s. The firm saw the site's potential for something else: not just a space for its 100 employees, but a test bed for some of its latest thinking about sustainable design. "As architects, if we're not willing to experiment on our own building, who are we to tell a client what to take up?" asks Billie Faircloth, AIA, a partner at the firm who oversees KieranTimberlake's transdisciplinary research.

Above all, the firm wanted to know if it was possible to operate an office environment without air conditioning in a climate like Philadelphia's, which alternates between freezing cold winters and hot, humid summers. "If you can make it work in Philadelphia, you can make it work anywhere," says principal Roderick Bates.

The firm incorporated a variety of targeted strategies to achieve its goal, including localized fans, dehumidification, and night flushing. The building already had ample skylights and big open spaces inside, all of which helped with ventilation. Whether these interventions could add up to a sufficient alternative approach to cooling was just a guess; the firm then had to test it against data.

"Once we had the hypothesis, we needed to design an experiment to test it," Bates says. To collect that data, the firm first installed more than 300 wireless, networked Pointelist sensors around the building. KieranTimberlake had developed the sensors for previous projects, but never used them to test such a complicated question. The system takes temperature and other readings every five minutes, which it then feeds into a computer program that matches the data with outside temperature and weather information. That way, if it's a cloudy day, analysts will know why the internal temperature suddenly dropped.

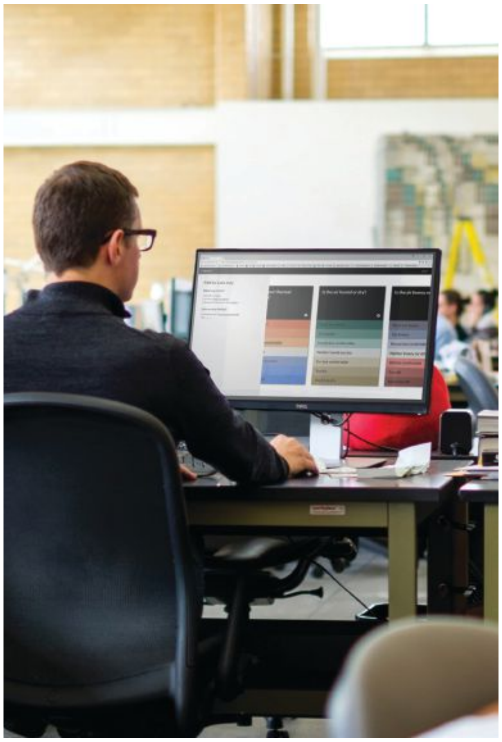
Gathering quantitative data was only half the answer; the more important information was qualitative: namely, how did people feel inside the building? For that, KieranTimberlake devised an online survey program called Roast (a commercial version debuted in October). Through a customized set of questions, employees gave feedback about their thermal comfort.

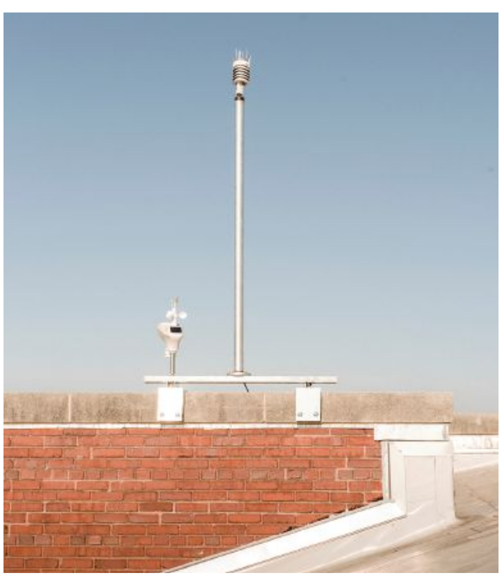
KieranTimberlake moved into the building in 2014, and for the next two summers it had employees answer surveys in Roast multiple times each day. The questions were simple—"Are you comfortable? Are you warm but comfortable?"—to encourage participation. In all, 10,000 individual survey sets provided a wealth data to pair with information gleaned from the sensor network.

After those two summers, the results were disappointing: the data clearly pointed to the need for some sort of artificial air conditioning. "It was painful to realize it was not going to work," Kieran says. But the lessons learned were worth it: For one thing, the firm was able to install a smaller air chiller than its engineers had recommended—a 45-ton unit instead of a 60-ton unit. Overall, the firm was able to lower its use of mechanical systems by 75 percent.

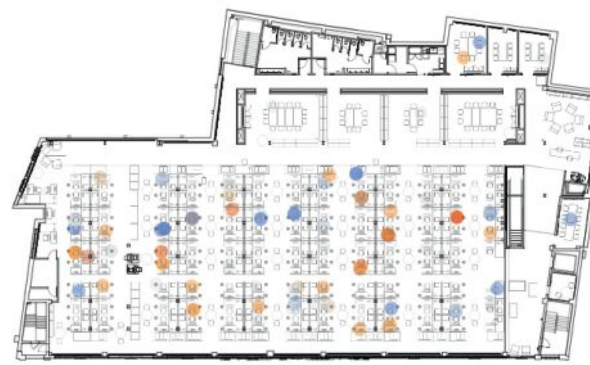
The firm also learned that the industry-accepted thresholds for thermal comfort are often much different from people's actual thresholds. "Our perceived set point does not match our actual set point," Faircloth says. The combination of Pointelist and Roast, Kieran says, had allowed the firm to take a more nuanced, data-informed approach, and to see design not as something that ends when a building opens, but that continues to inform and shape it afterward. —C.R.

MICHAEL MORAN/OTTO

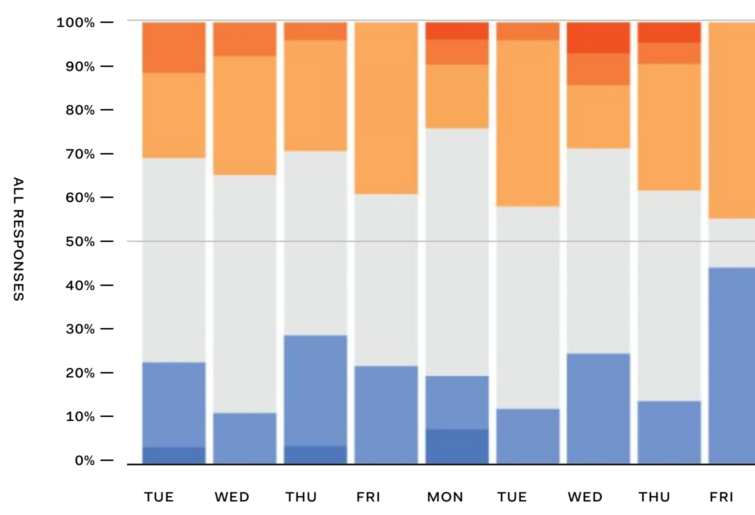




Second-Floor Plan with Survey Data



Mid to Late July Thermal Comfort Survey Data



- Much too hot
- Too hot
- Warm but comfortable
- Comfortable
- Cool but comfortable
- Too cold
- Much too cold

A network of Pointelist sensors inside and roof-mounted sensors outside (above) captured qualitative data about temperature and humidity within the KieranTimberlake office. Using the online platform Roast, employees answered questions (top) about thermal comfort (and noise and light levels) multiple times a day to compare actual perceived physical comfort against the hard data. Those survey responses were overlaid on a floor plan (top, right) to track trends.

COURTESY KT INNOVATIONS; BOTTOM: MICHAEL MORAN/OTTO

MANDATORY METRICS

ENCOURAGED METRICS

Project Attributes

Year of Design Completion	2014
Year of Substantial Project Completion	2015
Gross Conditioned Floor Area	46,000 square feet
Gross Unconditioned Floor Area	20,000 square feet
Number of Stories	2
Project Climate Zone	ASHRAE 4
Annual Hours of Operation	3,120
Site Area	24,300 square feet
Project Site	Historic structure or district
Project Site Context/Setting	Urban
Cost of Construction, Excluding Furnishing	Withheld
Number of Occupants or Visitors	130

Integration

How did the approach towards sustainability inform the design concept?

Built in 1948, the industrial building was transformed into an open plan office for 100+ people with conference rooms, fabrication shops, and breakout spaces. The goal for the renovation was to achieve a comfortable, energy-efficient, and flexible working environment and retain the building's original International Style characteristics. Natural light and ventilation, together with the thermal mass of the concrete structure, provided an ideal test bed to experiment with various combinations of passive and active ventilation and dehumidification for heating and cooling. The experimentation was scrupulously tracked with 400 data sensors and daily occupant surveys to arrive at a new model for energy-efficient thermal comfort. The renovation highlights and preserves the best attributes of a midcentury building, while incorporating novel approaches to office design to create a flexible, collaborative space that enhances creative pursuits.

Community

Community Engagement	Potential stakeholders were informed about the project
Walk Score	98
Estimated occupants who commute via alternative transportation (biking, walking, mass transit)	56%
Estimated annual carbon emissions associated with the transportation of those coming to or returning from the building	51.3 metric tons/yr (EPA Center for Corporate Climate Leadership GHG Emissions Calculator)

Ecology

Percentage of the site area designed to support vegetation	Zero
Percentage of site area supporting vegetation before project began	Zero
Percentage of landscaped areas covered by native or climate-appropriate plants supporting native or migratory animals	Zero

Water

Predicted annual consumption of potable water for all uses, including process water	1,200 gallons per person annually
Is potable water used for irrigation?	No
Percent of rainwater that can be managed on-site	Zero
Is rainwater captured for use by the project?	No
Is graywater or blackwater captured for reuse?	No

Economy

Cost per square foot	$106.80
Estimated annual operating cost reduction	36%

Energy

Predicted consumed energy use intensity (EUI)	59 kBtu/sq ft/yr
Predicted net EUI	59 kBtu/sq ft/yr
Predicted net carbon emissions	15.1 lbs/sq ft/yr
Predicted reduction from national average EUI for building type	35%
Predicted lighting power density	0.52 W/sq ft
Actual consumed energy use intensity (Site EUI)	38 kBtu/sq ft/yr
Actual net EUI	38 kBtu/sq ft/yr
Actual net carbon emissions	11.2 lbs/sq ft/yr
Actual reduction from national average EUI for building type	58%

Wellness

Percentage of floor area or percentage of occupant workstations with direct views of the outdoors	100%
Percentage of floor area or percentage of occupant workstations within 30 feet of operable windows	55%
Percentage of floor area or percentage of occupant workstations achieving adequate light levels without the use of artificial lighting	98% >300 lux at 3 p.m. March 21
Is this project a workplace?	Yes
How many occupants per thermal zone or thermostat	15
Occupants who can control their own light levels	100%
Peak measured CO_2 levels during full occupancy	360–480 ppm, 70% of the time. Only 8% of the time does the CO_2 exceed 600 ppm.
Annual daylighting performance	92% of regularly occupied area achieving at least 300 lux at least 50% of the annual occupied hours.

Resources

CO_2 intensity	Carbon emissions associated with full building life cycle, including manufacturing, transportation, use and end of life (A1-4, B2-4, C& D): 806,214 kg CO_2
Estimated carbon emissions associated with building construction	579,827 kg CO_2. This is the equivalent of 18.26 lbs/sq ft
Percentage of materials reused from existing buildings by volume	84%

Change

Percentage of project floor area, if any, that represents adapting existing buildings	100%
Anticipated number of days the project can maintain function without utility power	2
Percentage of power needs supportable by on-site power generation	10%

Discovery

Post-occupancy evaluation summary

Occupant comfort, energy assessment, lighting commissioning, checking our ventilation volumes. A TRNSYS dynamic simulation model was built using post-occupancy sensor data for calibration and used to optimize modes of operation. Occupant thermal comfort surveys are ongoing during the cooling season. The most significant discovery is an occupant comfort level of 82 degrees for 70% of occupants, allowing less mechanical cooling in the building.

Known Unknowns:
Dead Ends Aren't Dead

Students: Bianca Lin, ASSOC. AIA,
Joshua Park, and Wilson Fung
Faculty Sponsor: Janette Kim
School: California College of the Arts

By retrofitting existing structures and adding public amenities and infrastructure, this plan seeks to increase the flood and seismic resistance of, and enrich the social experience in, suburban East Palo Alto, Calif.

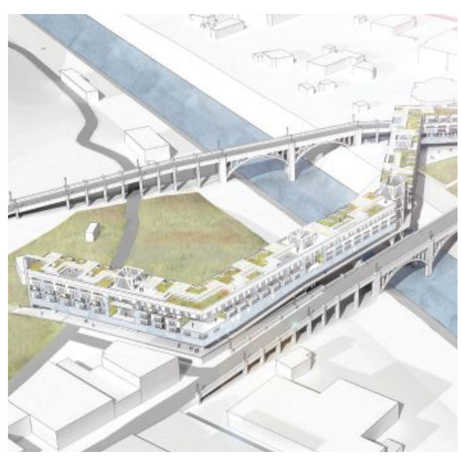
2018 COTE FOR STUDENTS

Each year, a jury selected by AIA COTE and the Association of Collegiate Schools of Architecture chooses 10 winners from schools in North America who have designed class projects that best express COTE's 10 measures. In this year's program, run in collaboration with Architecture 2030, winners received a cash prize and the opportunity for a paid summer internship at one of dozens of firms that are leading the charge in sustainable design.

Interconnect: Connecting Paths,
Connecting Programs,
Connecting People

Students: Harrison Polk, Madison Polk
Faculty Sponsors: Ulrike Heine, Ufuk Ersoy,
David Franco
School: Clemson University

Powered in part by a solar array, a bank building in Madrid becomes a refugee integration center that connects to the city's pedestrian paths.



Prescriptive Hydrologies

Student: Brie Jones, ASSOC. AIA
Faculty Sponsor: Pablo La Roche, ASSOC. AIA
School: California State Polytechnic
University, Pomona

Examining the intersection of habitable space and infrastructure in Los Angeles, this project provides amenities such as parks and a concert venue on top of watershed management facilities, which filter water and offer flood control.

Dis/Placement

Students: Nicholas Scribner, Clare Hacko
Faculty Sponsors: Evan Jones,
Margaret Ikeda
School: California College of the Arts

This design for floating communities addresses the realities of sea level rise in the low-lying Maldives, and also prioritizes freshwater catchment and storage to provide uncontaminated drinking water for residents.

City Centre Glassworks: An Adaptive Reuse Workshop and Experimentation Facility

Student: Justin Yan
Faculty Sponsors: Sheryl Boyle, ASSOC. AIA, Claudio Sgarbi
School: Carleton University

In this proposal, an abandoned factory in Ottawa, Canada, becomes a new glassworks, where the heat from glass-melting furnaces is harnessed for radiant systems to conserve energy.

Studio M: A Template for Sustainability and Wellness in Pittsburgh, Pa.

Student: Austen Goodman, ASSOC. AIA
Faculty Sponsor: Alice Guess, AIA
School: Savannah College of Art and Design

This retail, production, and housing complex for a burgeoning maker community in Pittsburgh prioritizes user wellness, renewable systems, and resilience on a site in a riverfront area.

Fabricating Wellness

Students: Amy Santimauro, ASSOC. AIA, Katelynn Smith, Joel Bohlmeyer, ASSOC. AIA
Faculty Sponsor: Brook W. Muller
School: University of Oregon

This mixed-use multifamily complex has a focus on renewable energy and materials and natural ventilation, and even includes an integrated production cycle: Bamboo harvested from gardens on-site is used to make goods in the building's production spaces.

Energy Commons: A Hypothetical Replacement for Gas Stations

Student: Buddy Burkhalter
Faculty Sponsors: David Strauss, AIA, Louisa Iarocci
School: University of Washington

This proposal rethinks a gas station in Seattle as a hub not only for charging electric vehicles, but also for coworking, cyclist and pedestrian services, and renewable energy generation.

The Fourth Place: Sharing Sustainability

Student: Mary Demro
Faculty Sponsors: Steven P. Juroszek, AIA, Thomas McNab, AIA, Jaya Mukhopadhyay
School: Montana State University

To address the housing crisis in Bozeman, Mont., this plan proposes net-zero mixed-use complexes that combine housing, workspace, and "third places" into a new hybrid serving the community.

Pier 55: South Philadelphia Community Center

Students: Caleb Freeze, Michelle Kleva
Faculty Sponsors: Miguel Calvo Salve, Russell B. Roberts, AIA
School: Marywood University

This community center in South Philadelphia combines renewable systems and wetlands management in the design for a structure that extends over, and into, the Delaware River.

PROJECT
CREDITS

New United States Courthouse—Los Angeles

Page 132
Project: New United States Courthouse, Los Angeles
Client: United States General Services Administration
Architect: Skidmore, Owings & Merrill, Los Angeles and San Francisco · Gene Schnair, FAIA, Michael Mann, FAIA (managing partners, directors);
Craig Hartman, FAIA, Jose Palacios, AIA, Paul Danna, FAIA (design partners, directors); Mark Sarkisian (structural partner, director); Keith Boswell (technical partner, director); Michael Mann, FAIA; Susan Bartley, AIA (project managers); Naomi Asai, Bita Salamat, AIA (senior interior design architects); Garth Ramsey (senior technical coordinator); Eric Long, Andrew Krebs (senior structural engineers); Steven Zimmerman, AIA (technical architect); Lonny Israel (graphic designer)
Interior Designer: Skidmore, Owings & Merrill
M/E Engineer: Syska Hennessy Group
Structural Engineer: Skidmore, Owings & Merrill
Plumbing Engineer: South Coast Engineering Group
Civil Engineer: Psomas
Geotechnical Engineer: Haley & Aldrich
Construction Manager: Jacobs Engineering Group
Design/Build Contractor: Clark Construction Group
Landscape Architect: Studio-MLA
Lighting Designer: Horton Lees Brogden Lighting Design
LEED Consultant: AECOM
Blast Consulting: Applied Research Associates
Fire/Life Safety: Jensen Hughes
Vertical Transportation: Lerch Bates
Acoustics: Newson Brown Acoustics
Accessibility: AA Architects
Graphics: Skidmore, Owings & Merrill
Branding/Graphics: Page/Dyal
Commissioning Agent: Jacobs Engineering Group
Size: 633,000 square feet
Cost: $326 million

Materials and Sources
Acoustical System: Armstrong, PCI, USG Ceilings Plus, CertainTeed, Conved Wall Technologies (ceilings); Rulon International (paneling)
Adhesives/Coatings/Sealants: Miracle Sealants; Dow; Pecora; GE Momentive
Building Management Systems and Services: Otis, Gunderson, City Lift (elevators); T L Shields (accessibility provisions—lifts)
Concrete: Shaw & Sons; Conco
Exterior Wall Systems: Angelus Block Co., Winegardner Masonry Inc. (masonry—CMU); Trenwyth Industries (masonry—glazed block); VNSM (custom metal panels); Henry Co. (moisture barrier—hot rubberized membrane); Grace Construction Products (moisture barrier—below grade); ITW Polymer (moisture barrier—tank); Neogard (moisture barrier—traffic coating); GE Momentive (moisture barrier—fluid applied, sealants); Dow, Pecora (sealants); Benson Industries, C&C Glass, Larson Engineering (custom curtainwall); Indiana Limestone, Carrara Marble Co. (stone cladding); Premiere Tile, Korel Tile (soffit cladding); Construction Specialties, Ohio Gratings (louvers, expansion joints); Shaw & Sons (architectural concrete); Johns Manville (insulation)
Flooring: Mosa, Crossville, Daltile, Schluter (tile); Johnsonite, Mannington, Burke, Static Smart, Forbo, Roppe (resilient); Haworth (raised flooring); Bentley, Tangram (carpet)
Glass: Viracon (exterior curtainwall, skylights); Pulp Studio (elevator cab panels); GlasPro (interior wall panels); Golden Glass (custom assemblies); TSS Armor (ballistic); Arcadia, Trulite (acoustical assemblies); C.R. Laurence (handrail hardware)
HVAC: Price (air diffusers); ACCO (mechanical displacement air system)
Photovoltaics or other Renewables: Solar World, GLO/Helix, Belco (photovoltaic system); Uponor (rainwater collection system, radiant floor system)
Plumbing and Water System: Moen, Chicago Faucets, Lovair (faucets); American Standard, Toto (flush valves, toilet fixtures, lavatories); Kohler (lavatories); Elkay (sinks); Acorn (detention fixtures)

Nancy and Stephen Grand Family House

Page 136
Project: Nancy and Stephen Grand Family House, San Francisco
Client: Family House
Architect: Leddy Maytum Stacy Architects, San Francisco · Richard Stacy, FAIA (principal-in-charge); Gregg Novicoff, AIA (project manager); Jake Aftreth, Andrew Appleton, Gwen Fuertes, AIA, Claudia Merzario, Christine Van Wageneen, AIA (designers)
Interior Designer: Marie Fisher Interior Design
M/E/P Engineer: Engineering 350
Structural Engineer: OLMM Consulting Engineers
Civil Engineer: Luk & Associates
Geotechnical Engineer: Iris Environmental
Construction Manager: Cambridge Group
General Contractor: Nibbi Brothers General Contractors
Landscape Architect: Cliff Lowe Associates
Lighting Designer: Architectural Lighting Design
Acoustic Consultant: Mei Wu Acoustics
Signage Consultant: Keilani Tom Design Associates
Waterproofing Consultant: Simpson Gumpertz & Heger
Corrosion Consultant: JDH Corrosion Consultants
Gas Mitigation: Terra-Petra
Low Voltage: EDesignC
LEED Rater: Bright Green Strategies
Size: 16,143 square feet
Cost: $29.2 million

Materials and Sources
Acoustical System: Armstrong
Adhesives/Coatings/Sealants: Prosoco; Gemini Coatings
Appliances: UniMac; Frigidaire; Danby; GE
Carpet: Interface
Exterior Wall Systems: Georgia-Pacific Gypsum; James Hardie Building Products
Flooring: Forbo; Mannington Commercial; Arizona Polymer Flooring
Glass: Vitro
Gypsum: Georgia-Pacific Gypsum
Insulation: Owens Corning
Plumbing/Water System: Pure Water Systems
Roofing: Johns Manville
Wayfinding: Arrow Sign Co.
Windows/Doors: Allweather, Oldcastle BuildingEnvelope (windows); RACO (storefront); MechSystems (window screens); Republic (metal and wood doors); Special Lite (aluminum doors); Summit Woodworking (custom entry door)

The Renwick Gallery of the Smithsonian Art Museum

Page 140
Project: The Renwick Gallery of the Smithsonian Art Museum, Washington, D.C.
Client: Smithsonian Institution
Architect: DLR Group, Washington, D.C. · Amy Dibner, AIA, Scott Cryer, AIA, Allan Duber, AIA, Monica Green, FAIA, Raymond Kent, ASSOC. AIA
Interior Designer: DLR Group · Fonda Hosta
Mechanical Engineer: DLR Group · Roger Chang
Structural Engineer: Woods Peacock Engineering Consultants
Electrical Engineer: Arlene Parker
Civil Engineer: Wiles Mensch Corp.
General Contractor: Consigli
Fire Protection, Life Safety, Security Consultant: GHD; Protection Engineering Group
Size: 46,800 square feet
Cost: $20 million

Materials and Sources
Building Management Systems and Services: Siemens
Carpet: Bloomsburg; Milliken; Armstrong
Concrete: Say-Core (precast flooring)
Fabrics/Finishes: Crown (window shade)
Flooring: Daltile (ceramic); Vermont Quarries (marble); Armstrong (VCT)
Glass: Cardinal IG
Gypsum: Gold Bond
HVAC: Ventrol (AHU); Evapco (cooling tower); Armstrong (pumps); Enviro-Tec (VAV boxes); Nortec (humidifier); Laars (boiler)
Insulation: Sopra (roof); Proseal (wall)
Lighting Control Systems: WattStopper; Barco Medialon
Lighting: LiteLab; Solais; Lithonia Lighting, an Acuity Brands Co.
Masonry/Stone: Conproco (mortar); Watsontown (brick)
Metal: Reynobond (composite wall panels)
Millwork: CDD Architectural Millwork
Paints/Finishes: Benjamin Moore
Plumbing/Water System: American Standard; Sloan Valve Co.
Roofing: Soprema; North Country Slate
Wayfinding: SMI Sign Systems
Windows/Curtainwalls/Doors: St. Cloud (historic replica windows); Ellison (balanced doors)

Sonoma Academy's Janet Durgin Guild and Commons

Page 144
Project: Sonoma Academy's Janet Durgin Guild and Commons, Santa Rosa, Calif.
Client: Sonoma Academy
Architect: WRNS Studio, San Francisco · Pauline Souza, AIA (partner, director of sustainability); Sam Nunes, AIA, Adam Woltag, AIA (partners); Emily Jones, AIA, Eileen Ong, AIA (associates); Jeremy Shiman, Joel Baumgardner, AIA, Diana Ford (project team)
Interior Designer: WRNS Studio
M/P Engineer: Interface Engineering
Structural Engineer: Mar Structural Design
Electrical Engineer: Integral Group
Civil Engineer: Sherwood Design Engineers
Construction Manager/ General Contractor: XL Construction
Landscape Architect: RHAA Landscape Architects
Green Roof Consultant: Rana Creek
Energy Modeler: Interface
Daylighting Consultant: Integral
Acoustician: Charles M. Salter Associates
Kitchen Design: Vision Builders
Size: 19,500 square feet
Cost: Withheld

Materials and Sources
Acoustical System: Epic Metals (deck); Conwed Designscape (walls); Vitro (acoustical glass)
Adhesives/Coatings/Sealants: Dow (exterior joint sealant)
Carpet: Milliken
Ceilings: Fantoni
Exterior Wall Systems: Heritage Salvage (reclaimed wood); Rockwool (mineral fiberboard); GCP Applied Technologies (membrane air barrier)
Glass: Vitro
Insulation: Knauf Insulation; Owens Corning; Rockwool
Millwork: Pacific Panel Products (perforated wood panels); Quartzstone, Icestone (solid surface); Chemetal (laminate)
Roofing: GCP Applied Technologies; American Hydrotech
Wallcoverings: Marlite; Daltile, Heath Ceramics, Marc Thomas, Sonoma Tile (tile)

Albion District Library

Page 148
Project: Albion District Library, Toronto
Client: Toronto Public Library
Architect: Perkins+Will, Toronto · Andrew Frontini, INTL. ASSOC. AIA (design principal); Aimee Drmic (project architect)
Interior Designer: Perkins+Will
Mechanical Engineer: Hidi Rae Consulting Engineers
Structural Engineer: Blackwell Structural Engineers
Electrical Engineer: Mulvey & Banani
Civil Engineer: MMM Group
General Contractor: Aquicon Construction
Landscape Architect: Dutoit Allsopp Hillier
Cost Consultant: Turner & Townsend
Size: 29,000 square feet
Cost: $12.4 million

Materials and Sources
Carpet: Interface
Ceilings: Geometrik (wood acoustic); USG
Exterior Wall Systems: NBK (ceramic)
Flooring: Centura (tile)
Furniture: Keilhauer, Interna (lounge); Coalesse, Vitra (children's area)
Glass: Aerloc Industries (curtainwall)
Lighting Controls: Fluxwerx; Zaneen; Eurofase
Metal: Triumph Roofing & Sheet Metal
Millwork: Mallet Woodwork Co. (custom millwork)

San Francisco Art Institute at Fort Mason

Page 152
Project: San Francisco Art Institute at Fort Mason, San Francisco
Client/Tenant: Fort Mason Center; San Francisco Art Institute
Master Tenant: Fort Mason Center for Arts & Culture
Property Owner: Golden Gate National Parks, as part of the Golden Gate National Recreation Area
Architect: Leddy Maytum Stacy Architects, San Francisco · Marsha Maytum, FAIA (principal-in-charge); Ryan Jang, AIA (project manager); Christine Van Wagenen (project architect); Gwen Fuertes, AIA (architect)
Interior Designer: Leddy Maytum Stacy Architects
M/E/P/FP Engineer: Integral Group
Structural Engineer: Rutherford & Chekene
Civil Engineer: Moffatt & Nichol Engineers
Construction Manager: Mack5
General Contractor: Oliver and Co.
Lighting Designer: Architectural Lighting Design
Acoustic Consultant: Charles M. Salter Associates
Theater Design: Auerbach Pollock Friedlander
Size: 69,422 square feet
Cost: $26.5 million

Materials and Sources
Conveyance: ThyssenKrupp (elevators)
Energy: Sunpower (photovoltaics); Uponor (radiant heating)
Glazing: Vitro; Pilkington; Safti First
Hardware: Schlage (locksets, pulls, security devices); LCN (closers); Von Duprin (exit devices)
Interior Finishes: Tectum (acoustical ceilings, wallcoverings); Tamalpais Commercial Co., Oliver and Co. (custom millwork); Kelly-Moore, Minwax (paints and stains); Nevamar (plastic laminate); SSI Surfaces, Trespa (solid surfaces); Daltile (tile); Shaw Contract (carpet)
Lighting: Lumenpulse, Pinnacle, Insight Lighting, Ecosense Lighting, Bega, Aion LED, Betacalco (interior ambient); Lithonia Lighting, an Acuity Brands Co., Bartco Lighting, Wellmade Products, Philips, Peerless Lighting, Gotham (downlights); Soraa (gallery)
Lighting Controls: Wattstopper
Plumbing: Zurn (water closets); Elkay, Kohler (sinks); Guardian (eyewash); T&S, Chicago Faucets, Kohler (faucets)
Roofing: CertainTeed (built-up)
Structural System: Epic Metals (acoustic metal deck); Vulcraft (exposed trusses)
Windows/Doors: Arcadia (storefront, entrances); Curries (metal doors); Marshfield (wood doors); Oldcastle BuildingEnvelope (sliding doors); StileLine (fire-control doors, security grilles); Noise Barriers (acoustic doors)

Mundo Verde Bilingual Public Charter School John F. Cook Campus

Page 156
Project: Mundo Verde Bilingual Public Charter School John F. Cook Campus, Washington, D.C.
Client: Mundo Verde Bilingual Public Charter School · Kristin Scotchmer (lead founder and executive director)
Architect: Studio 27 Architecture, Washington, D.C. · Todd Ray, AIA (principal-in-charge); John K. Burke, AIA (principal); Craig Cooke (project manager); Hans Kuhn

(project designer); Soledad Pellegrini (project architect)
M/E/P Engineer: CS Consulting Engineers
Structural Engineer: Ehlert Bryan
Civil Engineer: Christopher Consultants
Geotechnical Engineer: CTI Consulting
Construction Manager: TenSquare
General Contractor: Forrester Construction
Landscape Architects: Carvalho + Good; O'Shea Wilson Siteworks
Lighting Designer: One Source Associates
Commissioning Agent: Interface Engineering
Food Service Consultant: Next Step Design
Acoustical Consultant: Hush Acoustics
Size: 47,229 gross square feet
Cost: $13 million

Sawmill

Page 160

Project: Sawmill, Tehachapi, Calif.
Client/Owner: Bruce Shafer and Carol Horst
Architect: Olson Kundig, Seattle · Tom Kundig, FAIA (design principal); Elizabeth Bianchi Conklin, AIA (project manager)
Interior Designer: Olson Kundig, with furniture selections by the client
Structural Engineer: Monte Clark Engineering
Electrical Engineer: KCM Electric
Geotechnical Engineer: Soils Engineering (SEI)
General Contractor: Bruce Shafer
Lighting Designer: Olson Kundig
Energy Engineer: WSP Flack + Kurtz
Gizmo Engineer: Turner Exhibits—Phil Turner
Master Welder: James Riddle
Corrugated Metal Roofing Consultant: Steelogic
Size: 4,170 square feet
Cost: Withheld

Materials and Sources

Concrete/Flooring/Masonry and Stone: Nibbelink Masonry Co. Commercial Builders
Gizmos: Turner Exhibits
Photovoltaics or other Renewables: OutBack Power
Roofing: Steelogic
Steel Decking: ASC Steel Deck
Windows/Doors: Western Window Systems
Big Door/Steel Details: Mechanical Industries

Georgia Tech Krone Engineered Biosystems Building

Page 164

Project: Georgia Tech Krone Engineered Biosystems Building, Atlanta
Client: Georgia Institute of Technology
Architect: Cooper Carry, Atlanta, and Lake|Flato Architects, San Antonio, Texas · Mark Jensen, AIA, Brent Amos, AIA (Cooper Carry principals); David Thomson, AIA, Rick Fredlund, AIA, Lesley Braxton, AIA (Cooper Carry associate principals); David Lake, FAIA (Lake|Flato partner, founder), Ryan Jones, AIA (Lake|Flato associate partner); Kerry Phillips, AIA (project architect); Heather Holdridge, ASSOC. AIA (Lake|Flato associate, sustainability director); Patrick Burnham, AIA, Sam Vonderau, AIA (Lake|Flato project team)
Interior Designer: Cooper Carry and Lake|Flato Architects
M/E/P/FP Engineer: Newcomb & Boyd
Structural Engineer: Uzun + Case
Security and Fire Alarm: Newcomb & Boyd
Civil Engineer: Long Engineering
Geotechnical Engineer: Geo-Hydro Engineers
General Contractor: McCarthy Building Cos.
Landscape Architect: jB+a (now Barge Waggoner); Nelson Byrd Woltz
Lab Planning Consultant: Research Facilities Design
Deep Green—Daylight: Integrated Design Lab
Deep Green—Energy: TLC Engineering for Architecture
Deep Green—Ecology: Biohabitats
Food Service: Camacho
Building Envelope: Morrison Hershfield
Environmental Graphics: Cooper Carry
LEED: Lake|Flato Architects
Building Commissioning: Heery International; Williamson & Associates
Cost Estimating: Palacio Collaborative
Wind: CPP Wind Engineering & Air Quality Consultants
Furniture: Cooper Carry and Georgia Tech
Size: 218,959 square feet
Cost: Withheld

Materials and Sources

Acoustical System: Architectural Components Group
Adhesives/Coatings/Sealants: Dow
Appliances: Jenn-Air; Whirlpool
Building Management Systems: Johnson Controls
Carpet: Mohawk; Tandus
Ceilings: Armstrong; USG
Concrete: L&M Construction Chemicals
Exterior Wall Systems: Rheinzink; Morin; Alply
Fabrics/Finishes: Mosa Tiles
Flooring: Stonehard; Nora
Furniture: Bernhardt; Geiger; Herman Miller; Lowenstein; Nimbus; Teknion
Glass: Oldcastle BuildingEnvelope; Guardian; 3M
Gypsum: CertainTeed
HVAC: Trox USA (chilled beams); AHU; York (terminal units); Bell & Gossett (pump); Patterson Kelly (hot water boilers); Valcan (fin tubes)
Insulation: Dow (extruded polystyrene)
Lighting Control Systems: Leviton
Lighting: Zumtobel; Architectural Lighting Works; Lucifer; SPI Lighting; Winona; Targetti; Arcos; Litecontrol; nLight; Lithonia Lighting, an Acuity Brands Co.; Selux; Gotham; Edel; Kurtzon Lighting; Rig-A-Light; Wagner
Masonry and Stone: Cherokee Brick (brick veneer)
Millwork: Artisan Millworks
Paints/Finishes: Tnemec (high-performance coating); Sherman-Williams (paint)
Photovoltaics or other Renewables: Radiance Solar
Plumbing and Water System: Kohler; Zurn; Elkay; SyncroFlo (harvest rainwater)
Roofing: Johns Manville (TPO); Pac-Clad (metal roofing); Carlisle (underlayment); CRS (insulation)
Site and Landscape Products: Lithonia Lighting, an Acuity Brands Co. (lighting); LandscapeForms; Derro; Victor Stanley
Sunshades: MechoShade Systems
Walls: ClarkDietrich (studs); Carlisle (waterproofing); Dow (elastomeric coating)
Wayfinding: ASI Signage Innovations
Windows/Curtainwalls/Doors: Kawneer

Ortlieb's Bottling House

Page 168

Project: Ortlieb's Bottling House, Philadelphia
Client: KTRE, LLP
Architect: KieranTimberlake, Philadelphia · Stephen Kieran, FAIA, James Timberlake, FAIA (partners); Laurent Hedquist, AIA (principal); Jason Ciotti-Niebish, AIA (associate); George Ristow, AIA (project architect); Ryan Wall, AIA, David Gale, AIA (architects)
Mechanical Engineer: Elliott-Lewis; Transsolar
Structural Engineer: CVM Professional
Electrical/Plumbing Engineer: Elliott-Lewis
General Contractor: AJ Lewis Corp.
Lighting Designer: Fisher Marantz Stone
Historic Preservation Consultants: Jon Milner, Architectural Research and Cultural History
Size: 60,000 square feet
Cost: Withheld

Materials and Sources

Acoustical System: Tectum; Clipso
Adhesives/Coatings/Sealants: Dow
Building Management Systems: Honeywell; Tridium
Ceilings: Clipso
Flooring: Haworth
Glass: Vitro
Lighting Control Systems: Lutron
Lighting: LSI; I2 Systems; Birchwood; ILP; Bega
Metal: Bill Curran Design; Zahner
Millwork: Pappajohn Woodworking
Paints/Finishes: Benjamin Moore
Plumbing and Water System: Duravit
Roofing: Sika Sarnafil
Windows/Curtainwalls/Doors: Peerless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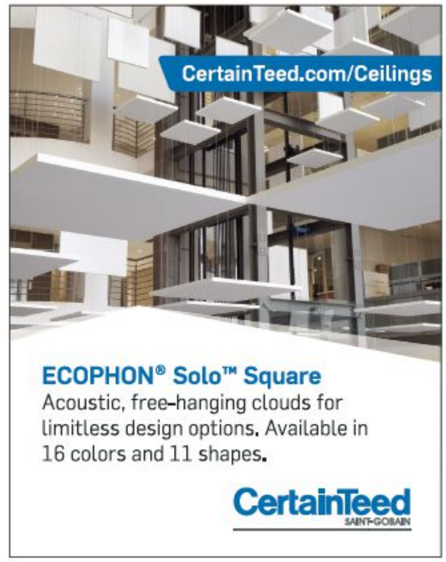
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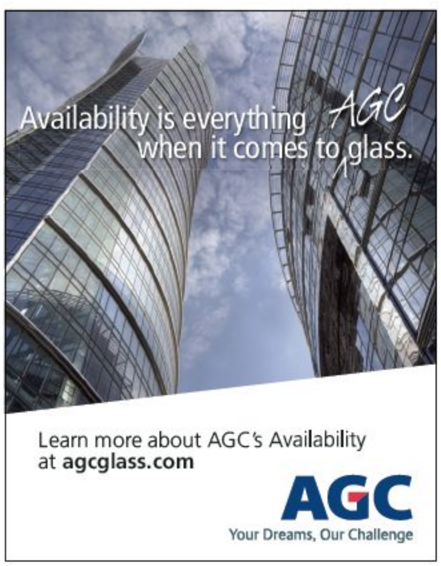
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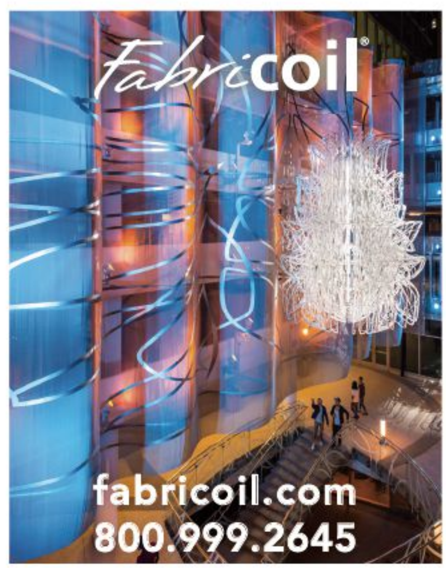
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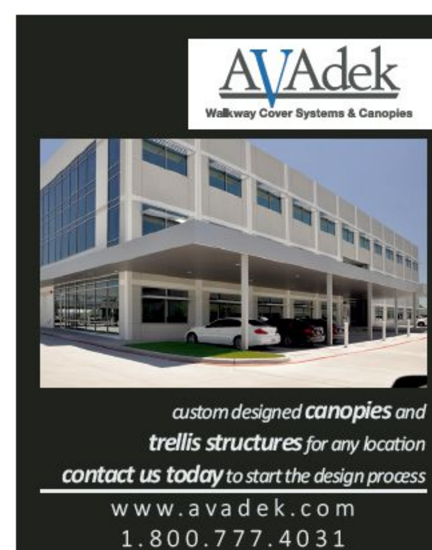
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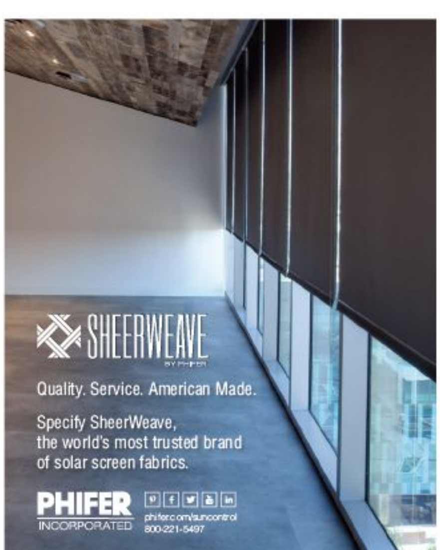
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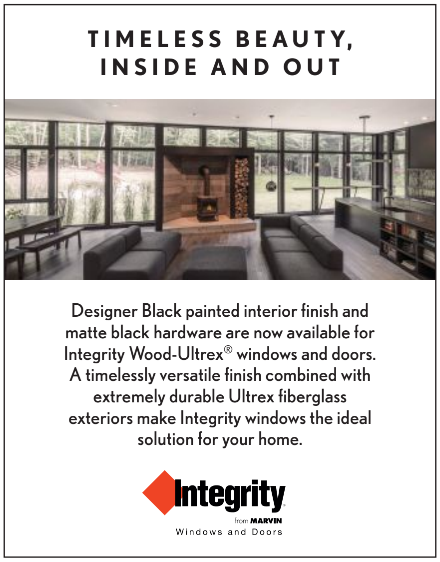
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15. Extent and Nature of Circulation	**Average No. Copies Each Issue During Preceding 12 Months**	**No. Copies of Single Issue Published Nearest to Filing Date**
a. Total Number of Copies (Net press run)	79,800	79,781
b. Legitimate Paid and/or Requested Distribution		
(1) Outside County Paid/Requested Mail subscriptions stated on PS Form 3541.	74,790	74,628
(2) In-County Paid/Requested Mail Subscriptions stated on PS Form 3541.	0	0
(3) Sales Through Dealers and Carriers, Street Vendors, Counter Sales, and Other Paid or Requested Distribution Outside USPS ®	2,325	2,318
(4) Requested Copies Distributed by Other Mail Classes Through the USPS	0	0
c. Total Paid and/or Requested Circulation [Sum of 15b 1, 2, 3 & 4]	77,115	76,946
d. Nonrequested Distribution		
(1) Outside County Nonrequested Copies Stated on PS Form 3541	1,261	1,630
(2) In-County Nonrequested Copies Stated on PS Form 3541	0	0
(3) Nonrequested Copies Distributed Through the USPS by Other Classes of Mail	0	0
(4) Nonrequested Copies Distributed Outside the Mail	551	148
e. Total Nonrequested Distribution ((Sum of 15d (1), (2), (3), and (4))	1,812	1,778
f. Total Distribution (Sum of 15c and 15e)	78,927	78,724
g. Copies not Distributed	873	1,057
h. Total (Sum of 15f and 15g)	79,800	79,781
i. Percent Paid and/or Requested Circulation	97.7%	97.7%
16. Electronic Copy Circulation		
a. Requested and Paid Electronic Copies	29,316	27,898
b. Total Requested and Paid Print Copies (Line 15C) + Requested/Paid Electronic Copies	106,431	104,844
c. Total Requested Copy Distribution (Line 15F) + Requested/Paid Electronic Copies	108,243	106,622
d. Percent Paid and/or Requested Circulation (Both Print and Electronic Copies)	98.3%	98.3%

17. Publication of Statement of Ownership for a Requester Publication is required and will be printed in the November 2018 issue of this publication.
18. I certify that all information furnished on this form is true and complete. Signature and title of Editor, Publisher, Business Manager, or Owner — Ron Spink, Publisher, 9/27/18

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Editorial:
A Positive Net-Zero Attitude

The 2016 Paris Agreement focused on the effects of a 2 C (3.6 F) increase in average global temperature, and gave the world a deadline of 2100 for reducing greenhouse gas emissions to zero. A new U.N. report, undertaken at the behest of island nations concerned about sea-level rise, looks more conservatively at a 1.5 C (2.7 F) increase. The findings are alarming, to put it mildly: The outcomes of even this lower temperature hike will still be disastrous, and we will be all but resigned to that fate in little more than a decade unless we act immediately. To minimize the catastrophic risk, humanity must reduce emissions by 45 percent by 2030, and achieve total carbon neutrality by 2050.

It's net-zero hour, folks.

If you think the internet has been disruptive, just wait until rapid decarbonization takes hold. Of course, we already know that achieving carbon neutrality is technically possible. (The AIA COTE Top Ten projects in this issue of ARCHITECT demonstrate some of the best sustainable design and construction practices. Take time to learn from them, and earn some continuing education credits in the bargain.) The process calls for an estimated clean energy investment through 2035 of 2.5 percent of global GDP. While that's a staggering amount of money—roughly $2.4 trillion per year—financing humanity's survival may seem easy compared to the social and political challenges the task entails.

Current definitions of success have to change, and the prospect inevitably upsets some people—especially the ones who benefit most from the status quo. In a net-zero economy, there's no avoiding the fact that there will be limits on growth. But that doesn't mean there will be limits on opportunity. We'll just have to look elsewhere for it. For true entrepreneurs, the possibilities should be exciting.

Decarbonization isn't about constraints, it's about smarter decision-making, based on better information. In a 2011 study, environmental economist Peter Victor of York University in Toronto calculated that to keep temperature rise within a 2 C limit, his fellow Canadians would have to settle for a GDP per capita on par with that of 1976. More extensive research is needed, but the principle remains: We can accept net-zero and dial ourselves back a few decades, or we can do nothing and risk regressing to about 1000 A.D. Given the option, I'll take "Mad Men" over "Mad Max."

As citizens of a net-zero planet, we may not even notice differences in the day-to-day, as we drive and fly less frequently, eat foods that are in season, and repair broken possessions instead of automatically buying new ones. Barter, collaboration, and sharing will become more commonplace, and on a large scale. The internet will remain a thing, but it will run on power generated in our own houses or in the neighborhood. We'll opt to remodel more readily than we will build anew. Such choices won't feel imposed—they will simply make sense, as feasibility and affordability shift.

Indeed, according to Victor's report, life could actually improve under net-zero conditions: "In this degrowth scenario … there are very substantial reductions in unemployment, the human poverty index, and the debt to GDP ratio." The terrible consequences of inaction are increasingly evident—just ask the residents of the Florida Panhandle. Now we must focus on the essential value of taking action, beyond survival.

STEPHEN VOSS


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