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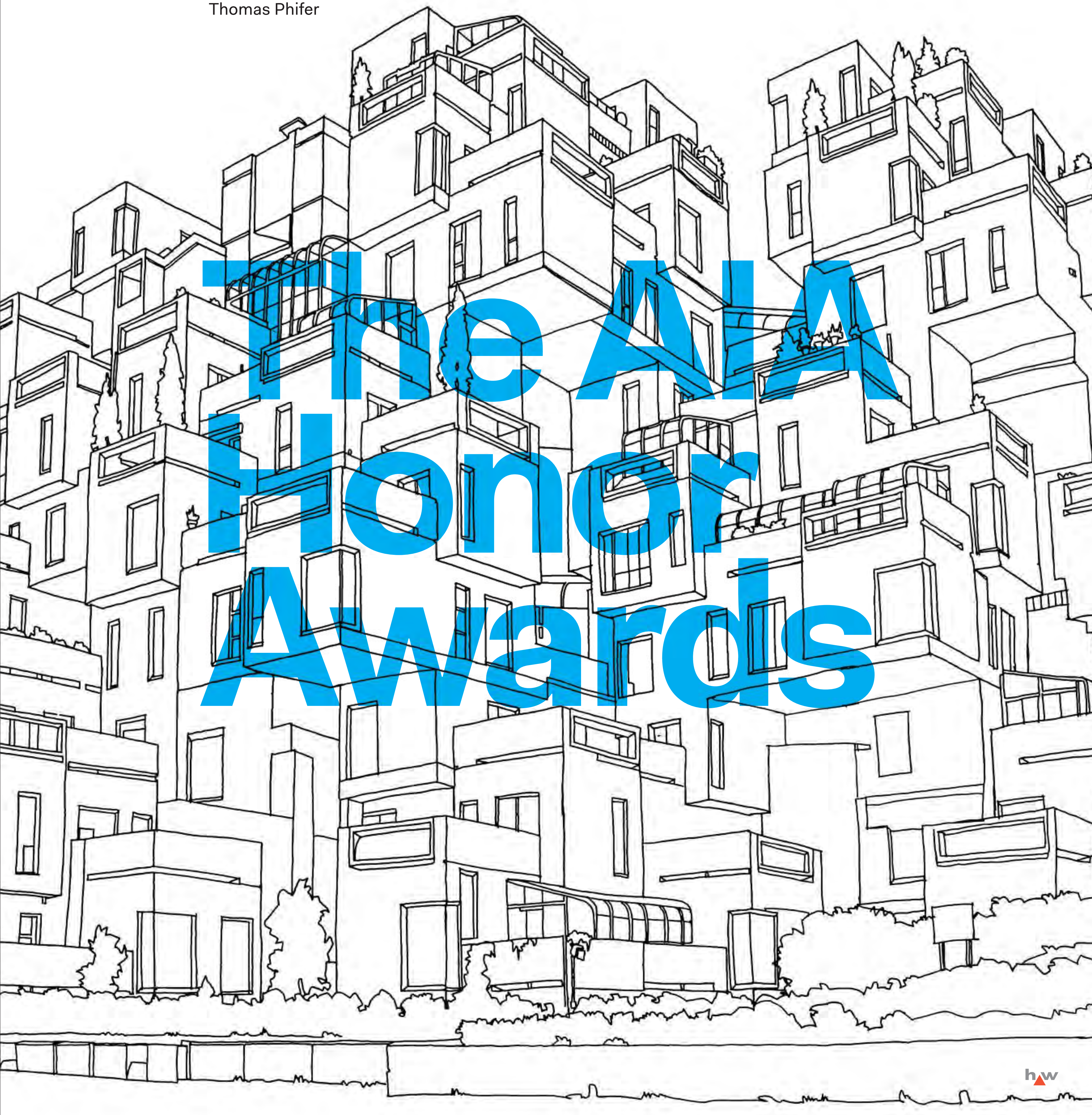


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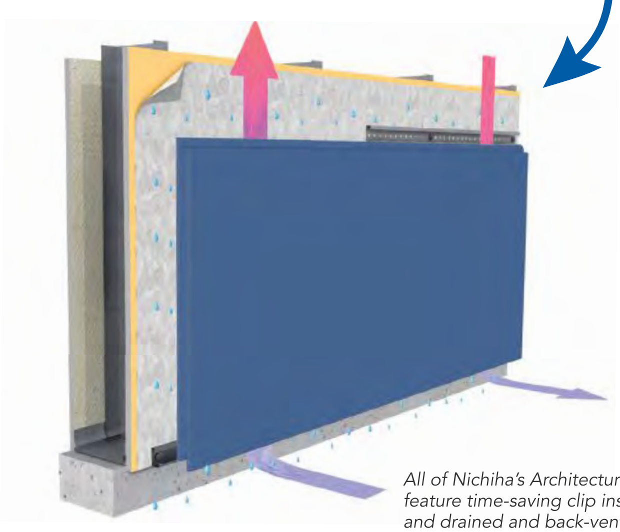

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ARCHITECTURE THAT ELEVATES AND INSPIRES.
Discovery Center in the Discovery Park of America, Union City, TN
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Contractor: Allen Searcy Builder-Contractor, Inc.
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Conservator: Western Pennsylvania Conservancy

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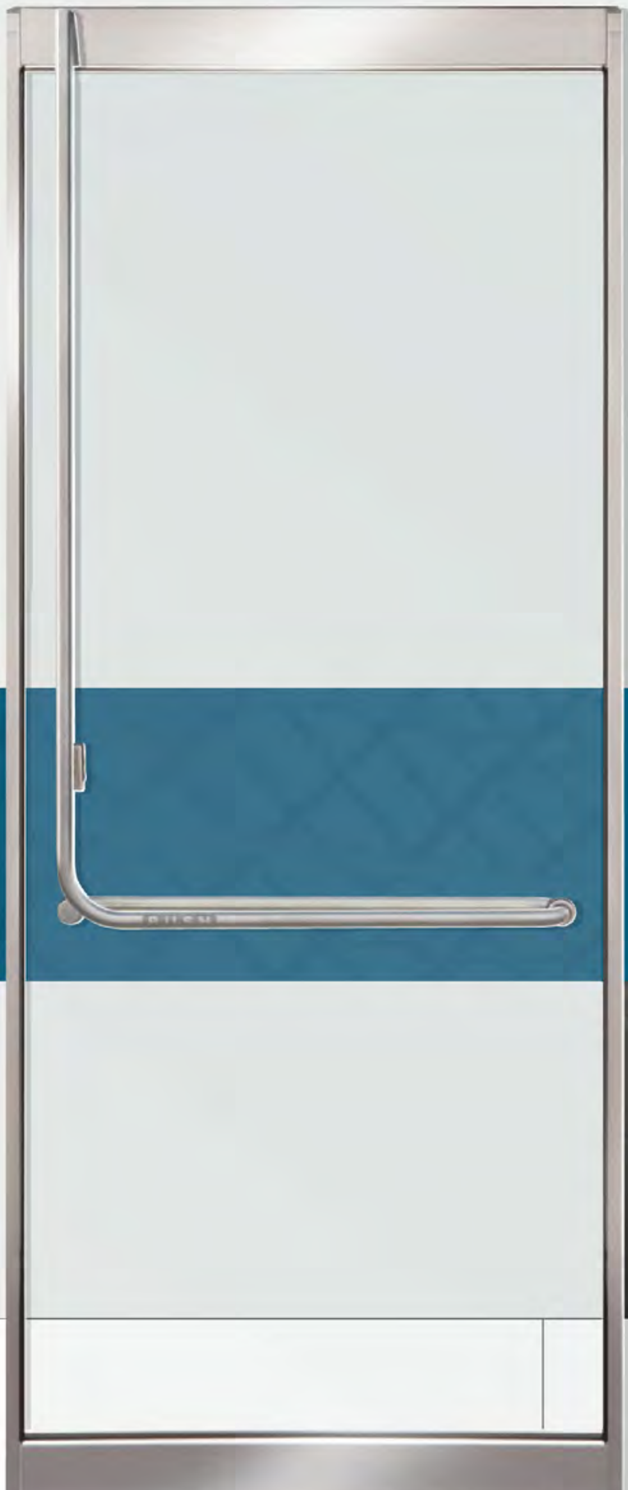

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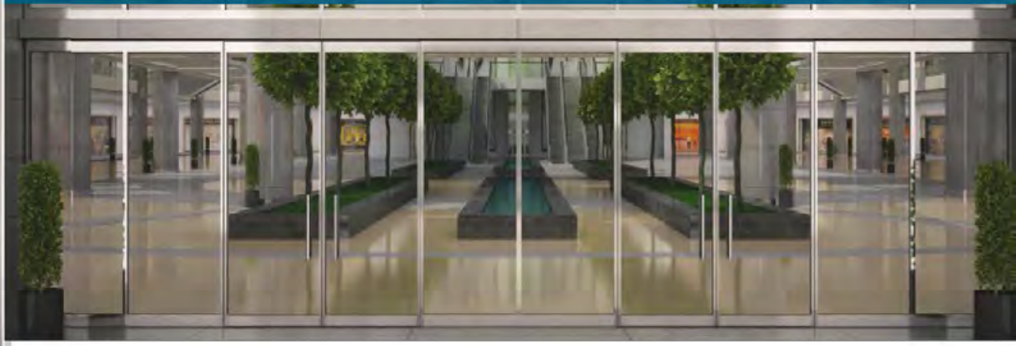

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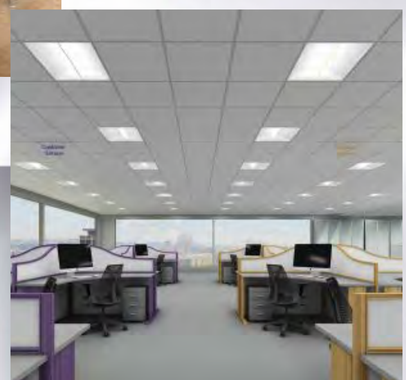



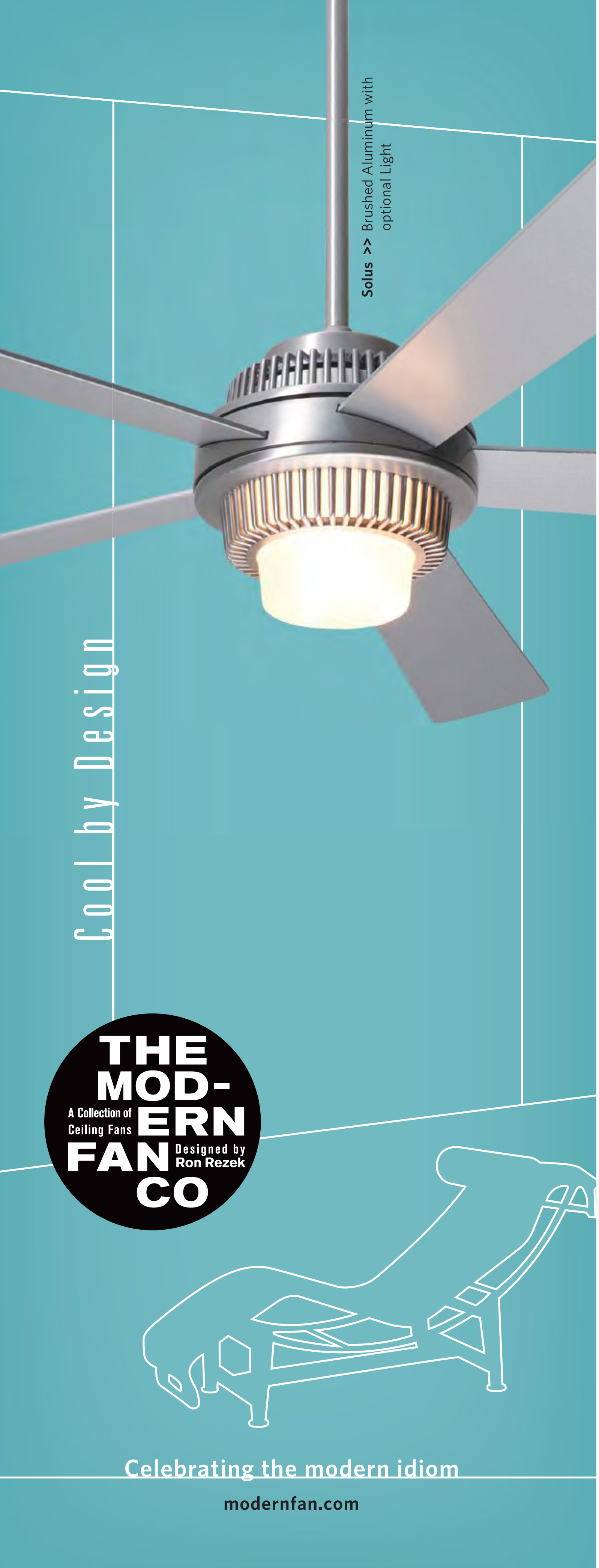

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JUSTIN DILES

One Word

Designer Justin Diles aims to actualize plastic's unfulfilled vision. An assistant professor of architecture at Ohio State, Diles recently exhibited his "Plasticity Pavilion" in Houston at the nonprofit Tex-Fab Digital Fabrication Alliance's annual event. Composed of black and white pieces of fiber-reinforced plastic, the gracefully undulating form suggests both fluidity and change. The pavilion conjures philosopher Roland Barthes' characterization of plastic in *Mythologies* (Farrar, Straus & Giroux, 1972): "More than a substance, plastic is the very idea of its infinite transformation … it is less a thing than the trace of a movement." —BLAINE BROWNELL, AIA

> *Read the rest of Brownell's essay, "The Future of Plastics in Architecture," at bit.ly/futureofplastics.*


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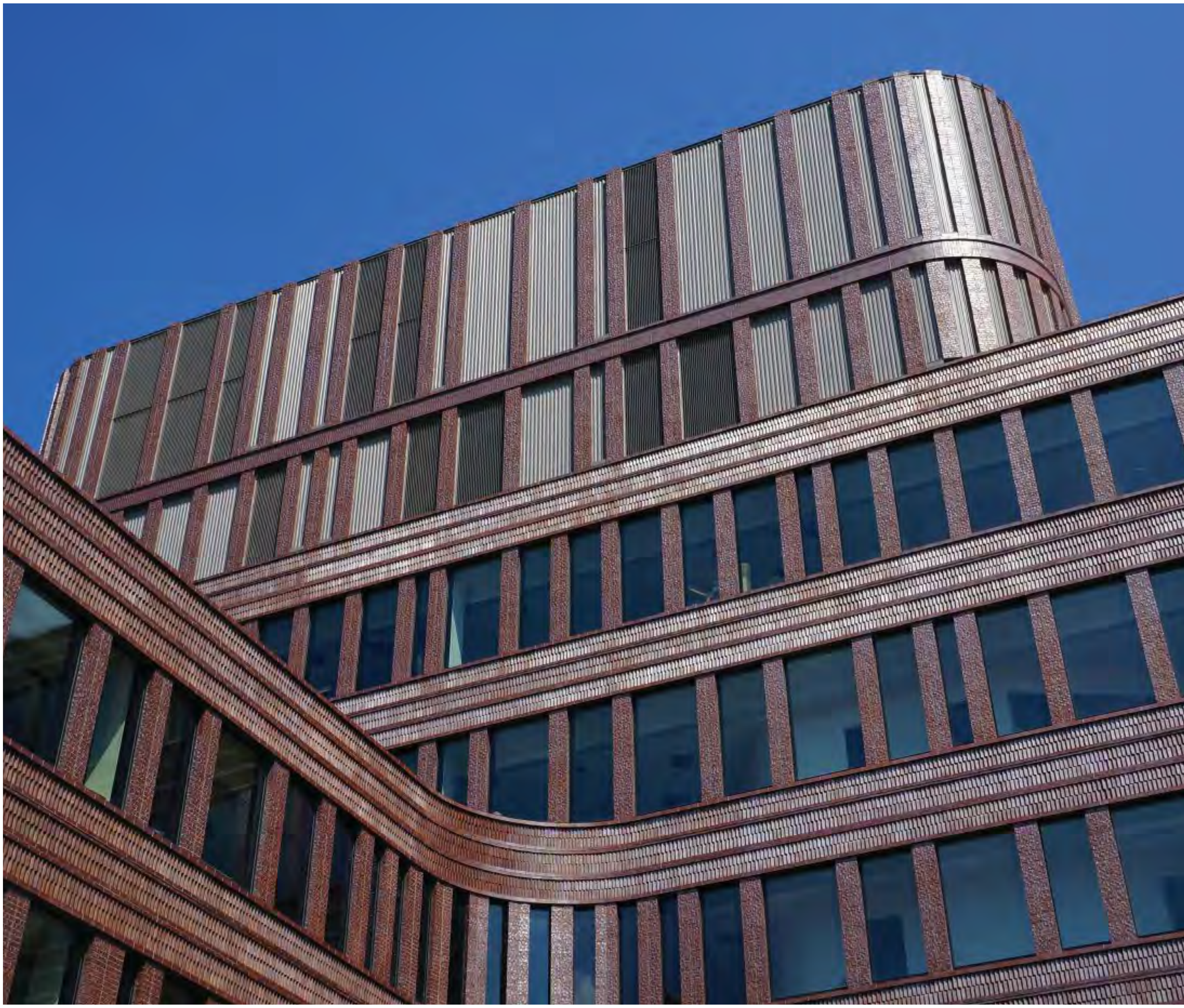

Boston's Public Triumph

The effect of the brick, both close-up and far away, is hypnotic. I originally spotted the top of the Bolling building on a trip to Marcel Breuer's nearby 1978 Madison Park High School and was drawn toward it. Handsome and solid, it is clearly the product of thoughtful design without being showy or fancy or corporate—all characteristics the city and the Boston Redevelopment Authority wanted to avoid. The aluminum window frames are held behind the brick and are visible only on the interior—a detail that helps the reading of the exterior and its rounded corners as a continuous fabric, punctuated by rhythmic, not repetitive, rectangles. —ALEXANDRA LANGE

> *Read the rest of Lange's review of Mecanoo and Sasaki Associates' Bruce C. Bolling Municipal Building in Boston at bit.ly/Bolling.*

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A VISITOR SIGNS IN WHILE A DEVELOPER RUSHES TO A STATUS MEETING AND A FEW FOLKS GRAB A QUICK WORKOUT BETWEEN CONFERENCE CALLS.

Good Enough to Eat

Snøhetta and Envelope A+D have released designs for an expansion to chef Thomas Keller's renowned French Laundry, in Yountville, Calif. The Napa Valley restaurant—which won the James Beard Foundation's "Outstanding Restaurant Award" in 2005 and has earned three stars from Michelin every year since 2007—occupies a stone cottage that operated as a steam-powered laundry in the 1920s. The expansion, designed in collaboration with kitchen designer Harrison & Koellner, will increase the size of the kitchen by 25 percent, while renovations to the courtyard will create a layered entry sequence for arriving guests. —DEANE MADSEN

> *For more images and information on the French Laundry expansion, visit bit.ly/SnohettaFrenchLaundry.*


OCEAN HOUSE

AARON MAHLER

Sad-but-Sweet Briar

Virginia's Sweet Briar College, a liberal-arts college for women founded in 1901, has announced that it will close this August due to insurmountable financial challenges. The fate of the 3,250-acre campus is unclear. Its master plan and many buildings were designed by Ralph Adams Cram (1863–1942), who went on to shape West Point, Princeton University, and Rice University, among other institutions. Cram became known as a master of the Gothic Revival, but at Sweet Briar—his first collegiate commission—he took his cues from Virginian tradition and produced a picturesque campus in the Neo-Georgian style. —AMANDA KOLSON HURLEY

> *For the rest of the story and images of the campus, visit bit.ly/SweetBriarCampus.*

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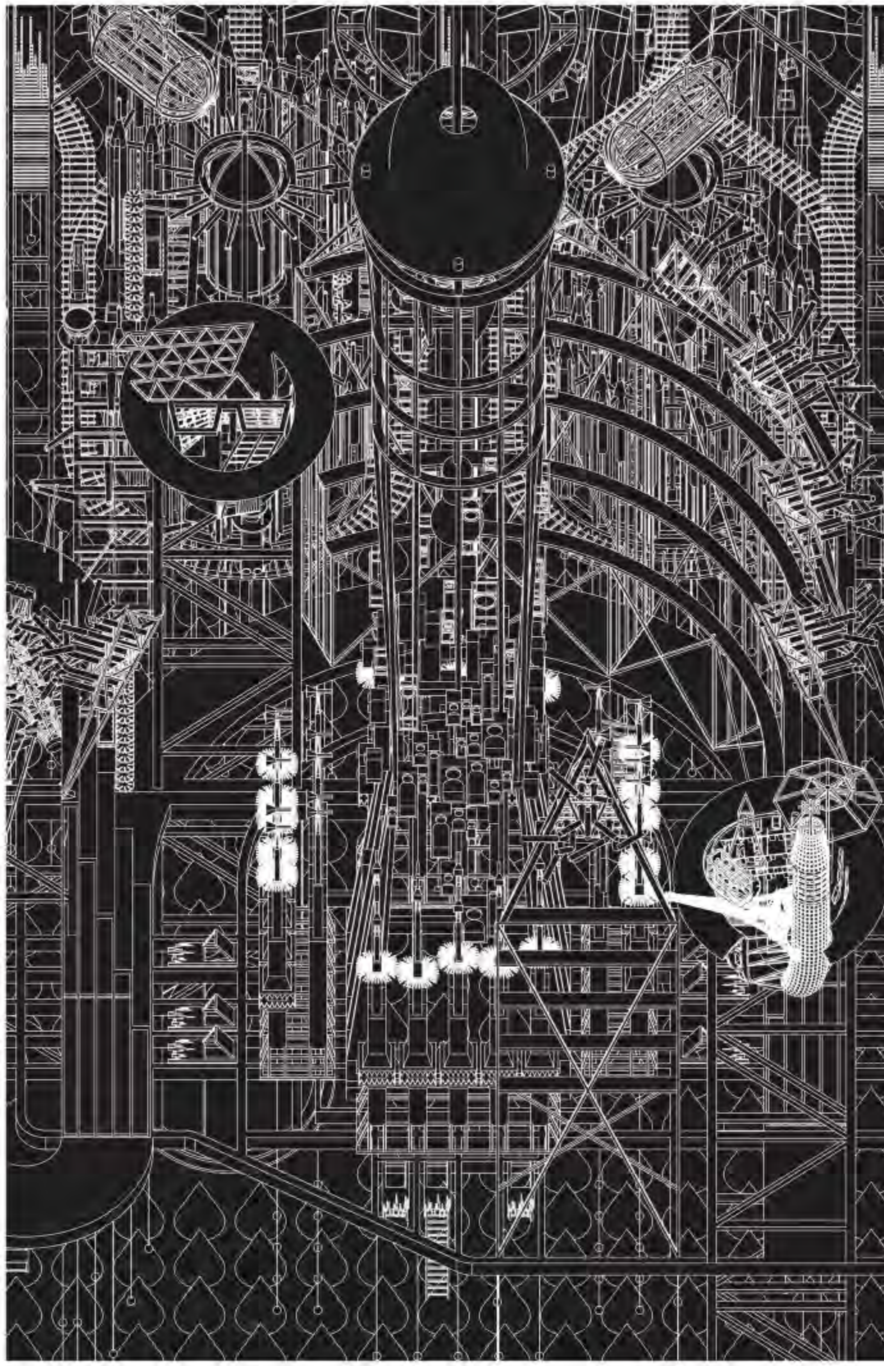
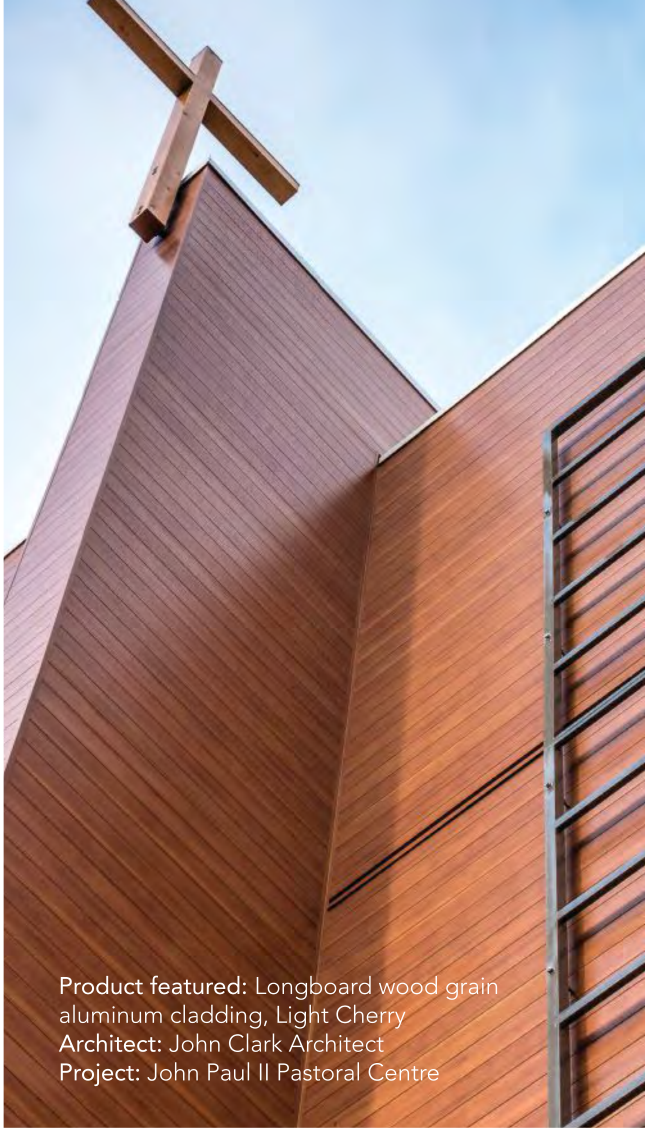


Ceci n'est pas une ville

Londoners Pascal Bronner and Thomas Hillier of FleaFollyArchitects describe themselves as "spatial storytellers." In 2012, to mark the 200th anniversary of *Grimm's Fairy Tales*, the duo conducted a five-week workshop in Germany's Black Forest and produced white-on-black diagrams of "Grimm City" (above), which critic Geoff Manaugh calls "carnivalesque, monochromatic yet fizzing with lively detail." This summer, they will be giving a class at the Tate Modern museum, in which participants will create a miniature village based upon surrealist paintings and etchings by Soviet architects Alexander Brodsky and Ilya Utkin. —NED CRAMER

For more on this course and others given by all branches of the Tate, visit tate.org.uk/whats-on.


Product featured: Longboard wood grain aluminum cladding, Light Cherry
Architect: John Clark Architect
Project: John Paul II Pastoral Centre

City Under Siege

For the past 43 years, Earth art pioneer Michael Heizer has been constructing "City" in the Nevada desert, an astonishing artscape of geometric concrete forms some 1¼ miles long and more than a quarter mile wide. Heizer owns the land on which the piece stands, but its ecologically and archaeologically rich surroundings could be developed for a missile site, oil-and-gas drilling, or a nuclear-waste rail line. A consortium of major museums are calling for the area, called Basin and Range, to be protected as part of the Bureau of Land Management's National Conservation Lands program. —CHELSEA BLAHUT

> *Learn more at bit.ly/MichaelHeizerCity, and get involved at protectbasinandrange.org.*

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Let's go back a few hundred years.
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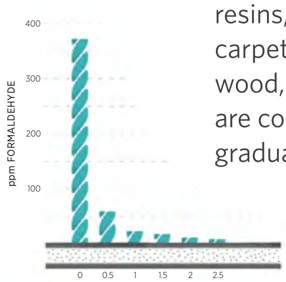
Used in producing plastics, synthetic resins, upholstery, carpet and pressed wood, aldehydes are compounds that gradually "off-gas", resulting in emissions. Mold and mildew can irritate skin, eyes and respiratory tracts and cause staining, rotting, and bacterial odors. And while odors from pets, cooking, smoke and other sources may not pose health problems, they can make indoor spaces unpleasant.



Aldehydes are emitted from carpet and other products over time.†

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*Formaldehyde Reducing Technology is currently available in flat and eg-shel sheens. The length of time Harmony actively reduces odors and formaldehyde depends on the concentration, the frequency of exposure and the amount of painted surface area.

†Based on methods:
ISO 17226 Determination of formaldehyde content in leather by High Performance Liquid Chromatography
ISO 16000-3 Determination of formaldehyde and other carbonyl compounds in indoor air and test chamber air

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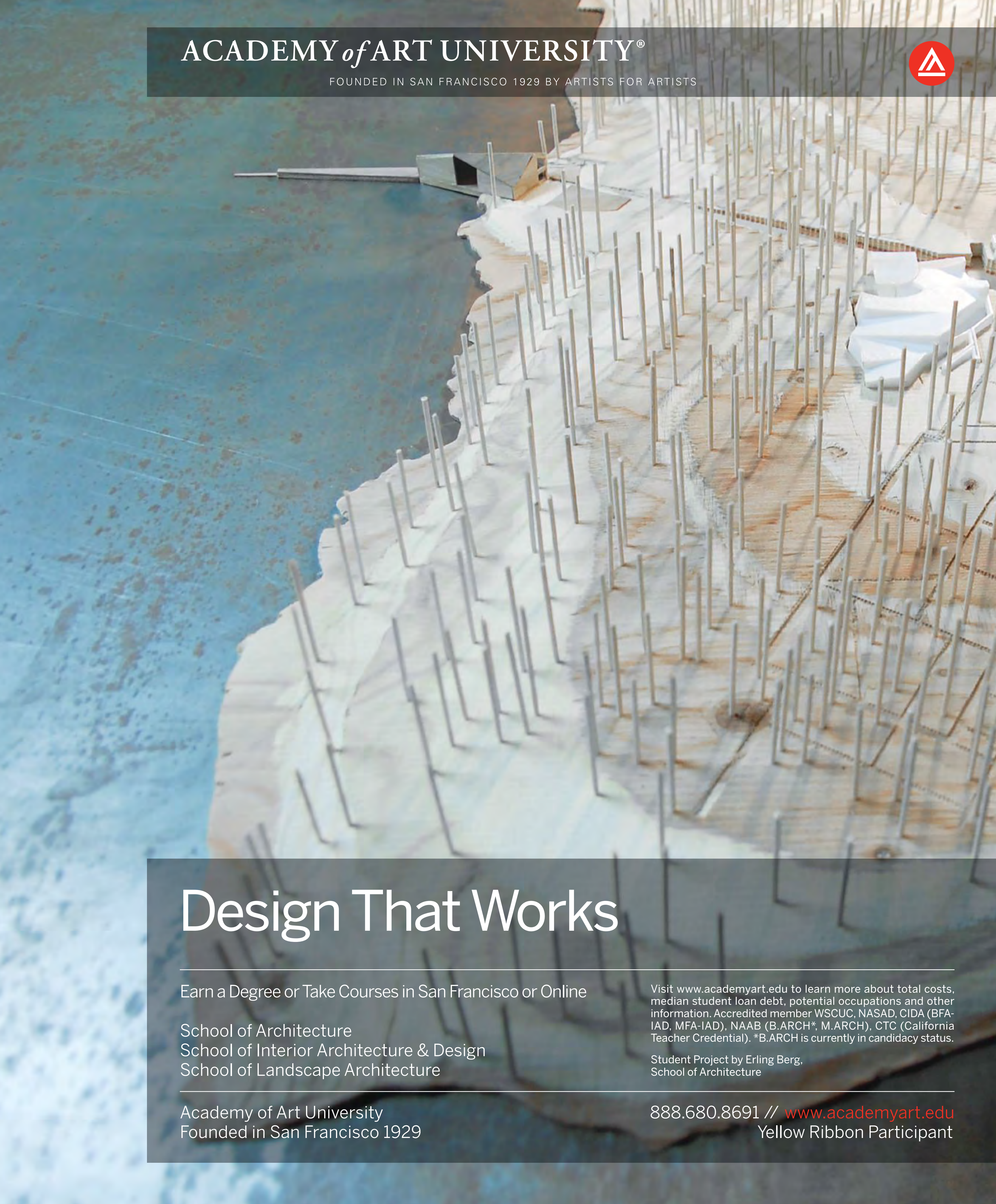
Move Over, Zumthor

Morphosis Architects has revealed designs for the reflective-glass-skinned 7132 Hotel, a 107-room tower in Vals, Switzerland. The 1,250-foot tower, for which the firm won a competition in February, will be a close neighbor of the Therme Vals spa, designed by Peter Zumthor, HON. FAIA, and of the upcoming Valser Path park by Tadao Ando, HON. FAIA, which is slated for completion in 2017. Morphosis principal Thom Mayne, FAIA, says, "As much as possible, the hotel is a minimalist act that reiterates the site and offers to the viewer a mirrored, refracted perspective of the landscape." The 7132 Hotel is scheduled for completion by 2019. —LEAH DEMIRJIAN

> *For additional renderings of the hotel, visit bit.ly/Morphosis7132.*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SANDY FELSENTHAL

Pullman, for Better for Worse

What does architecture embody? How does it speak to us of history? Those are the questions raised by the recent designation of Pullman, Ill., as a National Park. I am glad that Pullman—a collection of red brick structures designed by Solon Beman with a keen eye to translating a variety of not only uses, but also of social classes, into distinct, but related forms—is being preserved, but I am bothered by the fact that there is little recognition that the place is a monument to oppression and violence, not just to urban planning with coherence and a certain measure of benevolence. The place, quite simply, looks too good. —AARON BETSKY

> Read the rest of Betsky's essay on the preservation of railroad magnate George Pullman's quintessential 19th century working town at bit.ly/BetskyOnPullman.


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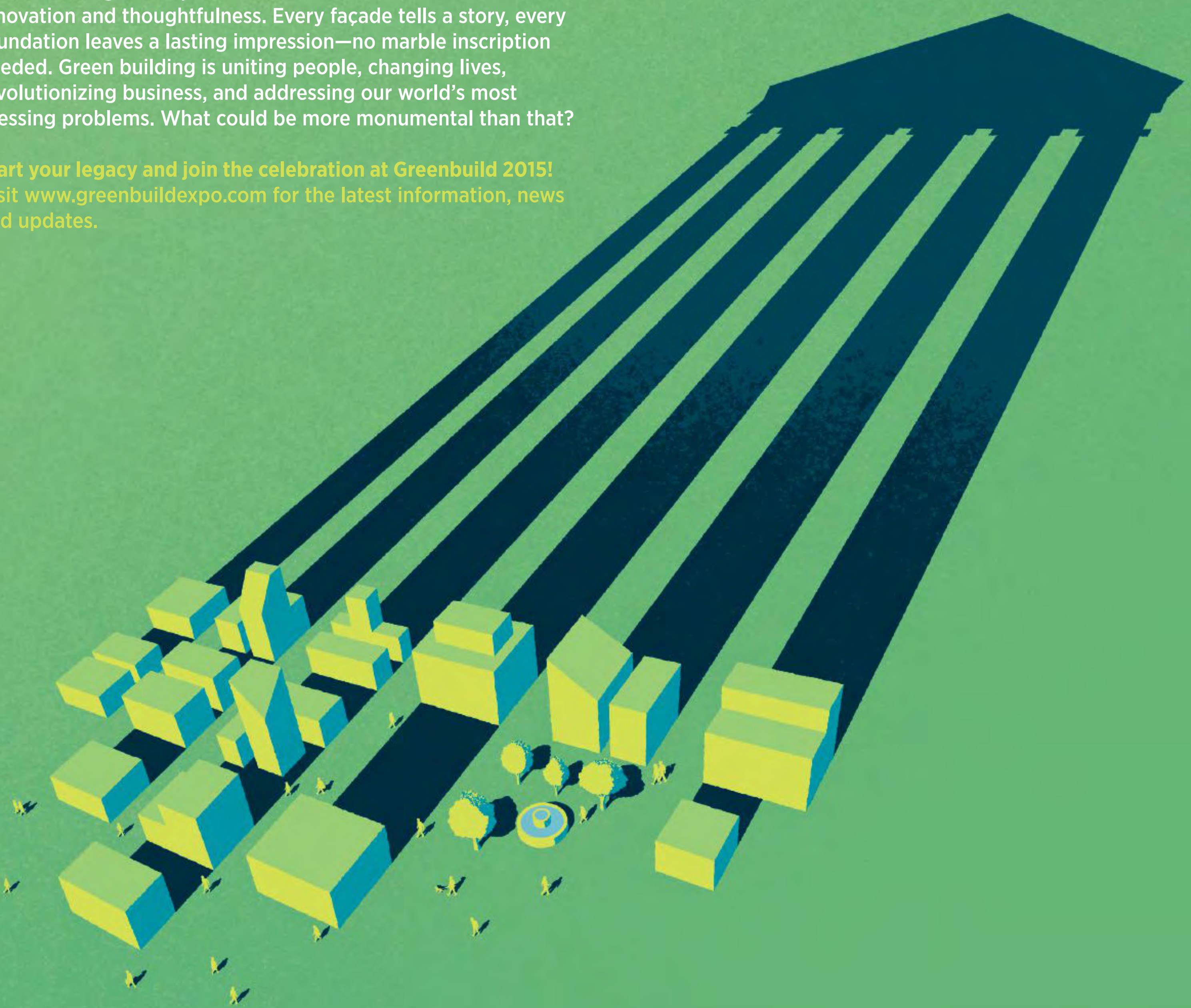


Best Practices: Gain Appreciation for Your Work

TEXT BY BRIAN LIBBY

In February, the AIA began the public awareness campaign "I Look Up," which highlights architects as problem solvers and visionaries who offer unique perspectives in solving global issues. "We look up to see limits, and ways around them, to pursue possibility," says the narrator in the campaign's television commercial. But in your own daily practice, you need to use a combination of marketing, technological advantages, partnerships, and continual learning to get the recognition you deserve.

"Our research shows a majority of the public appreciates architects but doesn't engage them."

—Sandra Coyle, managing director of public relations and outreach for the American Institute of Architects

Engage the Community

Being an architect isn't just a matter of producing designs or erecting buildings, but rather of making connections. "Our research shows a majority of the public appreciates architects but doesn't engage them," says Sandra Coyle, the AIA's managing director of public relations and outreach. "Everyone admires an architect, but they're not top of mind." She believes that simple, even informal conversation can change that. "It may be at a meeting or a reception," she says, "but it's about having more of that outreach in the community."

Incorporate All Team Members

For clients to value architects' work, University of Illinois at Urbana-Champaign associate professor Randy Deutsch, AIA, suggests Integrated Project Delivery (IPD), which involves the entire team, from owner to contractor to subcontractors, early in the design process. "We often say in the industry, 'Cost, time, quality: Pick any two.' With IPD, owners can have all three," Deutsch says. "Owners gain the most from collaborative work. Architects need to make that clear that we are willing to put in the extra effort IPD requires." Deutsch also disputes that IPD takes decision-making power from the designer, a common concern. "The architect on an integrated team is still the orchestrator, who can recognize and welcome the input from members of the team," he says.

Get Technical

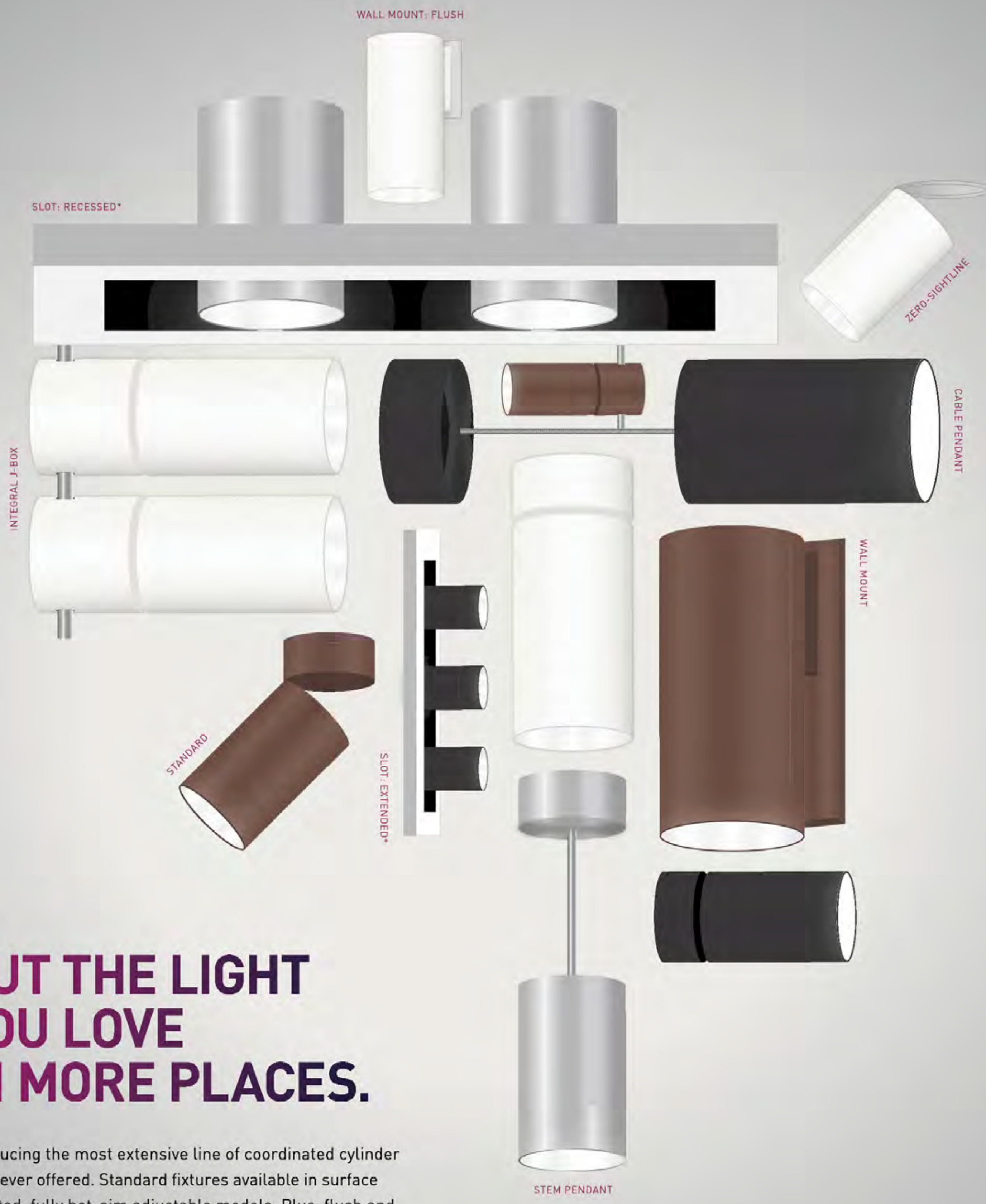
Technology doesn't change the architect's role, says Deutsch, who is also the author of *Data-Driven Design and Construction* (Wiley, 2015). "But data may challenge architects to be better at it," he says. "If a client comes to you for an addition, and the data says the client doesn't need to extend the property after all, [you can share that] with the client, even if the expansion is put on ice." Owners will appreciate the transparency. Deutsch adds that using BIM as a database for designs may be especially key in the future, as an archive tool. "It will not only provide a documentation tool but will also empower architects in terms of how they're perceived," he says. "That's a game changer."

Form a Partnership

Portland, Ore.'s GBD Architects has designed more than 20 buildings for developer Gerding Edlen, but don't use the word "client" with GBD president Phil Beyl, AIA. "I'd go for the term 'partner' right off the bat," he says. The idea of a partnership could be a literal one, Beyl says, as in the case of performance-based contracts that legally tie architect compensation to energy-efficiency goals. Or it could be a partnership in spirit, as in the research trips GBD and Gerding Edlen have taken to seek new design ideas. The important thing, Beyl says, is that the client—err … partner—knows your firm will invest time or money necessary to forge a lasting collaboration.

Continue Training

Key to GBD Architects' 14-year relationship with Gerding Edlen has been continuing education and training. "When we began, they'd never done a LEED building before," Beyl says. "Neither had we. But we figured out a way to do it. Every time an opportunity came for the team to get better and become more aware and smart, we took it mostly at our own expense." For example, all GBD staff are LEED accredited. Today Gerding Edlen has built more than 60 LEED-certified projects, nearly half of them designed by GBD.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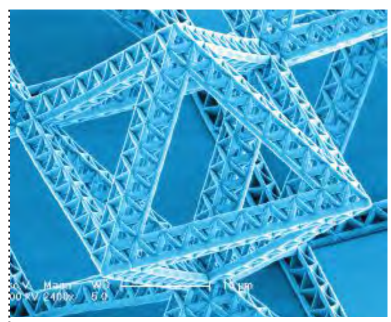
Products: The Promise of Nanomaterials

TEXT BY HALLIE BUSTA

The building blocks of the future are being developed in research labs today. From graphene production en masse to metamaterials that rethink the form and function of conventional construction mediums, here are five innovations with the potential to change architecture today, tomorrow, and beyond.



Unbreakable Materials

Julia Greer, a materials science and mechanics professor at the California Institute of Technology (Caltech), uses two-photon lithography to create precise polymer nanotrusses that can be coated in materials like metal or ceramic, hollowed out to remove the polymer, and then stacked in a fractal construction—essentially a nanotruss made of nanotrusses. The newly created material couples the structural and material properties of its medium, such as metal or ceramic, to possess previously unheard of characteristics including flaw-tolerance and shape memory. The lab is trying to scale the process from its current millimeter size to that of a sheet of letter-sized paper. But don't expect to see the metamaterial used in structural members or cladding, Greer says. Rather, likely uses in the built space include battery cells, smart windows, heat exchangers, and wind turbines. "You can make paper that is un-wettable, thermally insulating, and untearable," she says. "You can let your imagination go wild."

Resilient, Self-Cleaning Finishes

For application to glass, steel, paper, and other materials, a new coating from researchers at the University College London resists moisture even after being scratched or exposed to oil—typical weak spots for conventional repellent coatings. Made from coated titanium dioxide nanoparticles, the finish rejects water, oil, and even red wine by bouncing the invasive substances off its surface and removing dirt in the process. Although the coating is currently applied in 20-centimeter-square areas, "we see no reason why this couldn't be scaled up," says Ivan Parkin, head of the university's chemistry department and corresponding author of a paper on the research in the journal *Science*. Parkin's team has talked about automobile paint and moisture-resistant coatings as possible applications for the technology. It could eventually be used to create a durable, self-cleaning façade that can better withstand the elements than current options on the market.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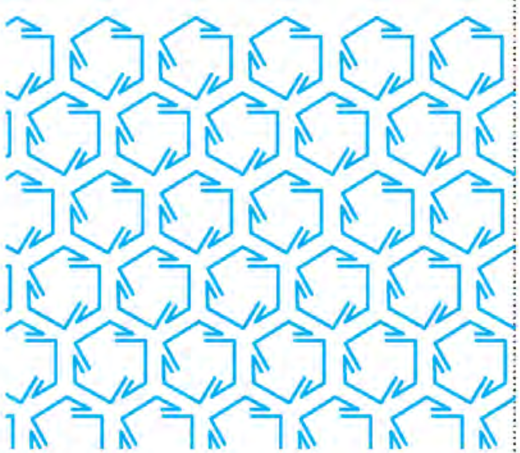
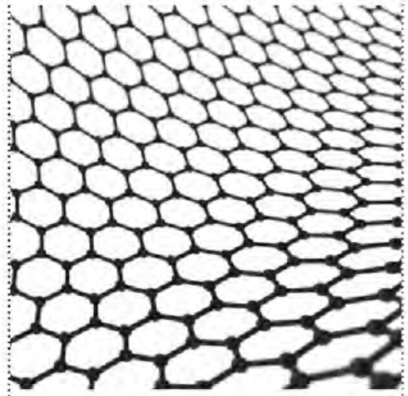
Products:
The Promise of Nanomaterials

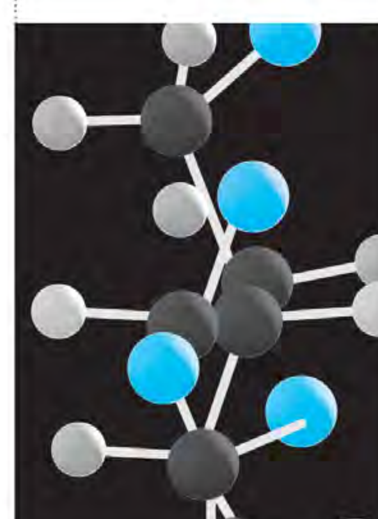


Wave Benders
Researchers at the University of Missouri have developed a new way to control elastic waves—which can travel through materials without altering their composition—that could protect structures from seismic events. The team developed and engraved a geometric microstructure pattern into a steel plate to bend or refract elastic and acoustic waves away from a target. "By redirecting the shock waves carrying massive energy around the important infrastructures or residential buildings through a metamaterial cloak, civilian lives and common properties can be saved from catastrophic earthquakes or tsunamis," says Guoliang Huang, an associate professor of mechanical and aerospace engineering. The team chose steel for its ubiquity but Huang says other metals and plastics can be engineered to have similar functionality.



More (and Better) Graphene
Caltech researchers say they've found a faster way to mass-produce graphene—the ultrathin and superstrong nanomaterial discovered at the University of Manchester in the U.K. in 2004—and at a higher quality than was previously possible. Their batch-processing method allows for the growth of smoother and stronger graphene sheets than do conventional thermal processes, while cutting production time from hours to minutes and increasing sample sizes from millimeters to—soon—inches. The process doesn't require the development of new processing equipment or infrastructure, says David Boyd, a Caltech staff scientist and first author of the related paper published in the journal *Nature Communications*. "It's process-compatible," he says. Still, the most likely applications for graphene in architecture are in small-scale products such as coatings, solar cells, and electronics.

Stronger Concrete
At Purdue University, researchers are adding cellulose nanocrystals derived from wood fiber to concrete. Nano-reinforced materials typically outperform conventional alternatives across a range of mechanical and chemical properties—among them strength, impact resistance, and flexibility. When applied to construction materials like concrete, they help to reduce a structure's environmental footprint by requiring less material to achieve a similar effect. The nanocrystal additive can be extracted as a byproduct of industrial agriculture, bioenergy, and paper production. Its addition enhances the concrete-curing process, the researchers say, allowing the concrete to use water more efficiently and without impacting its weight or density significantly. Construction materials are among the target applications for the additive, Purdue associate professor Jeffrey Youngblood says, but the team is still working to scale it up from current dimensions of 1 foot tall by 6 inches in diameter, assessing data to standardize and optimize the material's behavior. "We hope to be at a large test scale in a few years," he says.



> *For more of the latest in materials and technology news, visit architectmagazine.com/technology.*

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Technology: When to Use a Drone

TEXT BY HALLIE BUSTA

There is more than one way to use a drone—some with, others without, the federal government's blessing. The Federal Aviation Administration (FAA), which has been tasked with regulating the technology, has been slow to deliver comprehensive rules and is currently evaluating commercial drone use on a case-by-case basis. Final regulations aren't expected until 2017, which means it's (more or less) open season for firms that want to use them now. We talked with drone experts and companies using the technology to determine whether the following uses—from shooting marketing videos to moving equipment—would likely pass muster with the FAA today.

1. Shooting Aerial Photos and Video
This is the top use for the technology today, although the FAA has typically applied restrictions on items such as the airspace in which the drones can fly and how close drones can get to buildings and people not affiliated with the job.

2. Moving Objects Around a Jobsite
Because the FAA views items affixed to a drone as an external load, it forbids the practice under rules proposed earlier this year for devices up to 55 pounds. Even if the FAA was OK with this use—don't hold your breath—project teams would likely be limited to moving small tools and parts, or taking too many trips.

3. Inspecting Hazardous Spaces
The FAA has allowed the use of drones in the oil, gas, and infrastructure sectors to survey hard-to-access areas, such as flare stacks and pipes, reducing the need to send people to work in potentially dangerous or remote environments.

4. Using "Micro" Drones
Drones that weigh less than 3 pounds have the same likelihood of getting FAA approval as those weighing up to 55, but advocates have petitioned to move these smaller ones to a category with more lax rules to encourage innovative uses by small and midsize companies, which tend to be put off by high regulatory costs.

> *For more drone do's and don'ts, read the full story at bit.ly/dronesinarchitecture.*


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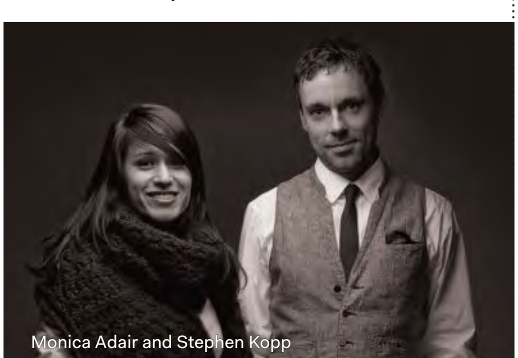
Next Progressives: Acre Architects

AS TOLD TO NATE BERG
PORTRAIT BY MARK HEMMINGS

Monica Adair and Stephen Kopp want architecture to tell a story. Finding narratives and developing identities have become a specialty of their firm, Acre Architects, based in Saint John, New Brunswick. "We want people to be able to not only be satisfied with what is in front of them, but to think about what is the story they ultimately want to live," says Adair, who recently received the Royal Architectural Institute of Canada's 2015 Young Architect Award.

Founded in 2010, Acre has built this type of storytelling into private residences along the Atlantic Seaboard. The seven-person practice recently branched out into commercial projects, with a new microbrewery under construction in their hometown, and a boutique hotel in the design phase in the Williamsburg neighborhood of Brooklyn, N.Y. Acre has worked with its clients to build out the identities of these projects, adding new dimensions along the way. Here, Adair and Kopp discuss their firm's story with ARCHITECT.


Monica Adair and Stephen Kopp

Collective Identity

Acre started on a rooftop in Brooklyn, as a collective. Stephen and I went to architecture school together at the University of Toronto. There was a job in New York that we both went for, and they gave it to both of us. I don't think we'd be married today if they didn't.

When we were in Brooklyn, we were fortunate to have one of those apartments with rooftop access. We'd often go up with a bunch of our friends, who are also architects and designers. We got really excited, like a lot of young designers do, about the potential to work with our friends. You want to work with people that you really love.

We were the de facto group coordinators at the time and we always said that, depending on the project, we'd bring the right team. We left New York two years later and went to New Brunswick to open our own firm. But we've had some opportunities to work with the initial people from the Acre Collective on little projects. We still pitch ideas and try to find projects that would get all of us together.

Realizing Narratives

We generally like projects where the client hasn't given us a clean brief and wants us to just draw it up—projects in which the client hasn't quite figured it all out and is looking to us to help craft that story. Architecture really is about building identity and helping people, in a way, to create their own myths. That's especially true here in Atlantic Canada, where there's a lot of dependence on our past. We say that we're more than lighthouses and dories, and that we can rely not just on the stories that came before us, but also on the stories that we help people tell. Stories have the ability to reveal strong and deeply held emotions that are the key to the structure of our lives. Architecture can convey these stories. In the end, it's not just a building; it's something that rethinks the way we see ourselves. We take our clients' needs and deliver executable dreams.

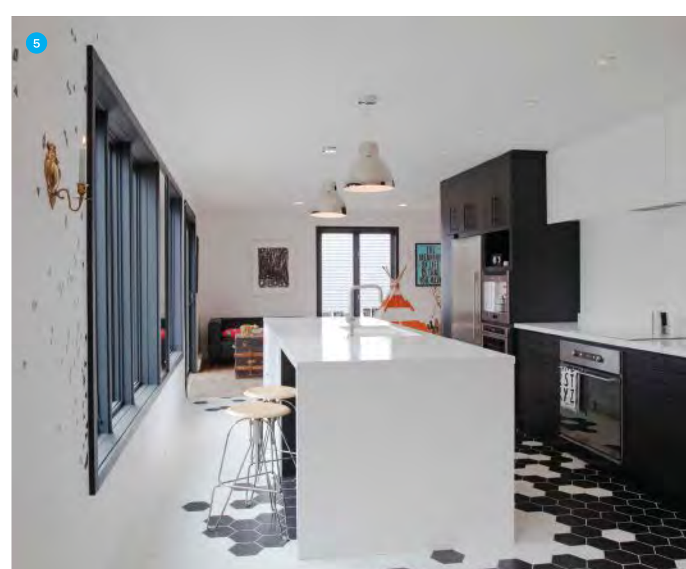
Beer, with a Mission

We're doing a microbrewery in Saint John for Picaroons, a craft brewer that emphasizes all things local. We tried to make a project that helps celebrate that, but can also be a catalyst for other projects. They came to us with one project, and since then we've proposed different satellite buildings all over the province.

Adding a Community Element

The Hekla Hotel clients in Williamsburg wanted only a hotel on the site, which was a former ironworks factory. We said that it has to be more than that—we're not interested in a project that just gentrifies. We proposed a "filmworks" component—a screening area—so that it could belong to the community, which has a big art movie scene. Adding it to the hotel ended up being a really good pairing. And we wanted it to become a venue to tell new stories.

Next Progressives:
Acre Architects

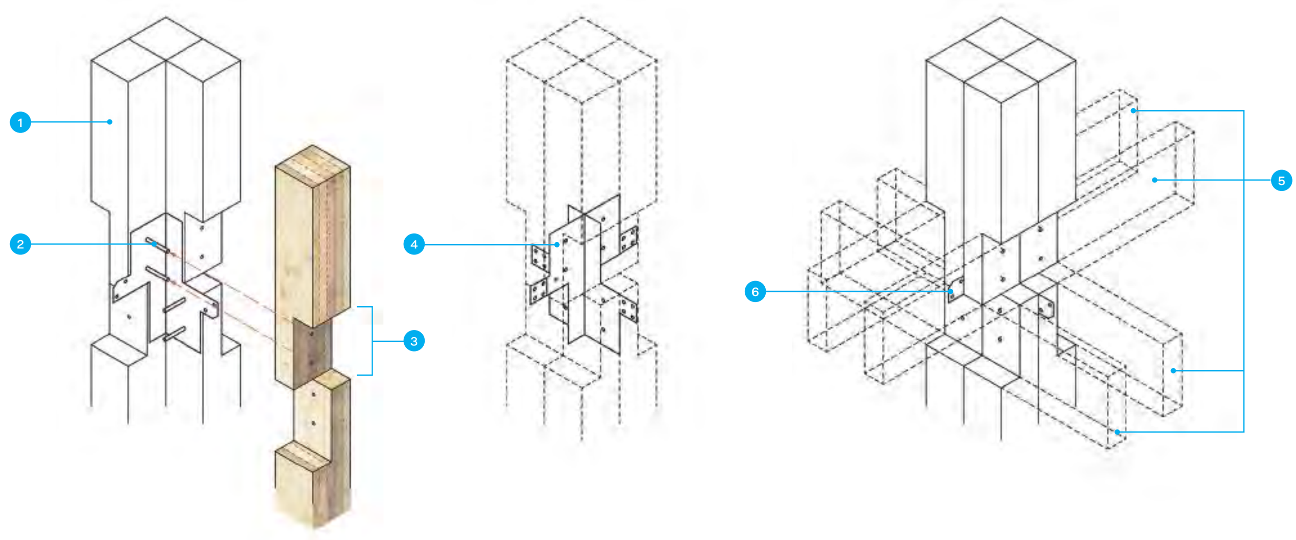


ACRE ARCHITECTS (1,4); MARK HEMMINGS (3); KELLY LAWSON (5)

1. Majumder Manor was the focus of a 2013 W Network television series by the same name. Actor Shaun Majumder invited Acre Architects to envision a luxury inn where visitors to his native Newfoundland town of Burlington (pop. 350) could interact with the locals in a communal restaurant, wine cellar, and campfire lounge. **2.** An 1885 railway roundhouse finds new life as Picaroons, a microbrewery in Devon, New Brunswick. **3.** Reclaimed wood from snowfences and Cor-Ten steel clad Into the Wild, an urban retreat for a poet-and-designer couple in Saint John. **4.** The Hekla Hotel, now underway in Williamsburg, N.Y., will offer luxury accommodations and a boutique feel in a former ironworks factory. **5.** The designers' own residence, RoBe House, allowed the pair to experiment with monochromatic finishes in a kitchen that features white Corian countertops, black oak cabinets, and white and black hexagonal tiles that intermingle in a playful pattern. **6.** Tinker's Orchard, a popular New Brunswick cider house and residence for its owners, features tasting and living rooms overlooking the fruit-bearing trees that surround them. **7.** For Gothic Arches, an adaptive reuse project in Saint John, Acre Architects plans to blend an early 19th century church structure with a terraced condo tower.

ACRE ARCHITECTS (2,7); MARK HEMMINGS (6)

Detail:
Nest We Grow Moment Connection



TEXT BY JENNY JONES

Inspired by the character of Japanese larch forests, students from the College of Environmental Design (CED) at the University of California, Berkeley, designed a timber grid structure for their winning entry, Nest We Grow, in the fourth Lixil International University Architectural Competition. An elegant, recurring moment connection detailed by the team with Kengo Kuma and Associates and Oak Structural Design Office, both in Tokyo, ensures the rigidity of the four-story, 919-square-foot facility.

Nine larch timber columns provide the primary structural support. To save money, each column is a composite of four 6×6 glulam timbers, which sandwich steel connecting plates.

At each floor level, two perpendicular pairs of glulam larch timber beams intersect each column and nest into 3-inch-wide-by-10-inch-deep notches.

"We knew we needed to make a deep enough notch in those columns to fit the beams [and] generate that moment connection," says Baxter Smith, an M.Arch. candidate and design team member. Classmate Yan Xin Huang adds, "The notches are the size of the beams ... so the surface is flush."

The bolts that hold the composite column together also secure the beams, completing the moment connection, Smith says.

Hokkaido, Japan–based Takahashi Construction Co. locally sourced the wood for the glulam members, notched the timbers for the moment connections, and assembled the composite columns in its workshop. Double-decker trailer trucks transported the columns and glulam beams to the project site, five minutes away.

Construction began in September 2014. Local craftsmen hoisted the structural members into place with cranes and secured the components together by hand.

SHINKENCHIKU-SHA

1. 6×6 glulam larch timber (typ. 4)
2. ø16mm, 330mm bolts (40 per column)
3. 12" × 3" × 10" notch (typ. 4 per moment connection)
4. 0.24" steel plates, 11" × 16.5" or 11" × 17" (typ. 2)
5. 3" × 10" glulam larch timber beam (typ. 4)
6. 0.24" steel plate tab for cross-bracing

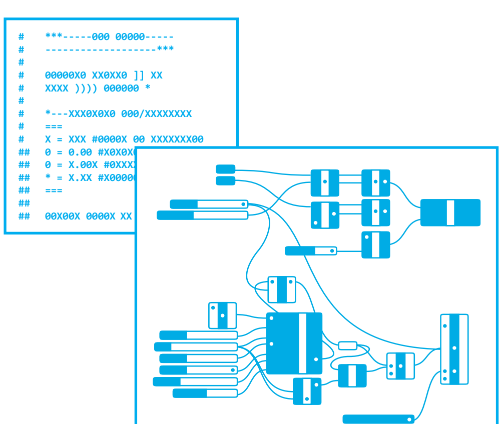
Career Development: The 21st-Century Skill Set

TEXT BY ALICE LIAO

As the design process goes digital and clients demand more value from their projects, architects should consider diversifying their knowledge base to stay relevant. While the core competencies—design, planning, drafting, rendering, and BIM—remain invaluable, the following skills can give you an edge.

Automation

Knowing what tasks can and should be automated boosts productivity. Architects who understand basic programming concepts and algorithmic thinking can communicate more effectively with programmers, says David Fano, principal of Case Inc., in New York. Try taking introductory courses at universities or online through sites such as EdX and Udemy.



Coding

Although visual programming languages can work without text commands, a designer who can code can extend the functionality of any software and catch on to new programs more easily, says Michael Kilkelly, AIA, principal of Space Command, in Middletown, Conn., and author of the blog ArchSmarter. Coding trains one to think in a structured way, which also helps in problem solving, he says. Greg Papay, FAIA, managing partner at Lake|Flato, in San Antonio, Texas, notes that the demand for architects who code may grow as more of a building's value resides in areas "tunable by software." Some programming languages to explore: Python, VB.net, C#, and Ruby.

Data Mining

Buildings and businesses generate vast amounts of data. Translating this into spaces that perform better and support the success of occupants is critical. It's "incredibly valuable now to understand [the architectural] program in a quantified way," Fano says. "Ask a client for their profit-and-loss sheet to see how the building is going to help run their business better." And master Microsoft Excel, which can become powerful with a little coding, Kilkelly says.

Building Science

Although the architecture curriculum includes building science, more rigorous coverage of the fundamentals is needed, says Daniel Lemieux, AIA, principal and unit manager at Wiss, Janney, Elstner Associates, in Fairfax, Va. Because buildings are energy intensive, architects with a grasp of "climate-specific building design and whole-building performance" will be sought by owners and developers, he says. Topics to study: heat transfer, moisture storage and transport, and building-enclosure behavior and material selection.

People Savvy

Empathy for a client's business forms the foundation for a good working relationship. Steve McConnell, FAIA, managing partner at NBBJ, in Seattle, says that architects should consider themselves as "partners in [a client's] business strategy" who can enable change, shape culture, and grow an enterprise through architectural programming and design. Engaging a client requires solid communication skills, which can be honed through a public speaking course or by practicing how to present and listen, Papay says. Exposure to entrepreneurship and real estate development helps too, Fano says.

Business Savvy

Real-world commissions come with uncertainty. Replicating the unknown in the classroom will better prepare students for the workplace, Fano says. Helping find funding for projects challenges the conventional notion of architecture as a passive profession, Kilkelly says. McConnell recommends also learning about fee structures to help understand compensation as the role and value of architects evolve.

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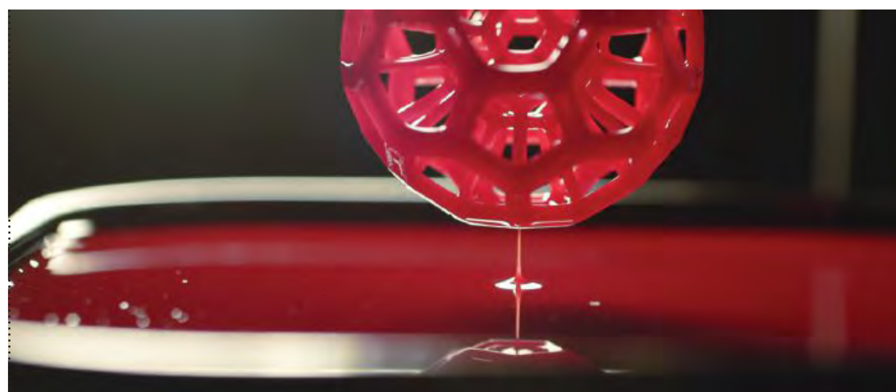
Technology: The Next Generation of 3D Printing

TEXT BY WANDA LAU

Silicon Valley startup Carbon3D thinks that conventional 3D printing is actually more like 2D printing, over and over again. The process is also slow, creates objects with limited strength, and can use only a few mediums, with thermoplastic being most common.

So the company set out to redefine 3D printing the way it envisioned it: modeled after scenes from the movie *Terminator 2*, in which the T-1000 robot assassin grows from a pool of liquid.

After two years of development, Carbon3D debuted continuous liquid interface production (CLIP) on the TED2015 stage and in the journal *Science*. This technology may be the breakthrough 3D printing needs to become truly useful to designers.



Carbon3D's prototype CLIP machine has a 4-inch-by-3-inch-by-12-inch build area, but the capacities of the forthcoming commercially available printers may vary.

How CLIP Works

Similar to stereolithography (SLA), CLIP prints an object by chemically accumulating micron-thick layers through photopolymerization, or the hardening of a liquid polymer into a solid state using ultraviolet (UV) light.

The prototype CLIP machine consists of an upward-facing digital projection system, a composite window, a reservoir of photopolymer resin, and a build platform. The projector shines a movie made from cross-sections of the desired object—composed by Carbon3D's software using a standard STL file—through the window into the reservoir. The resin solidifies where the UV light hits it. Meanwhile, the build platform lifts the growing object from the reservoir.

Better Than SLA

The key to the CLIP machine is the transparent, oxygen-permeable Teflon window. By maintaining a flow of oxygen (which inhibits the resin from curing) through this window, CLIP creates a dead zone of liquid resin in the reservoir.

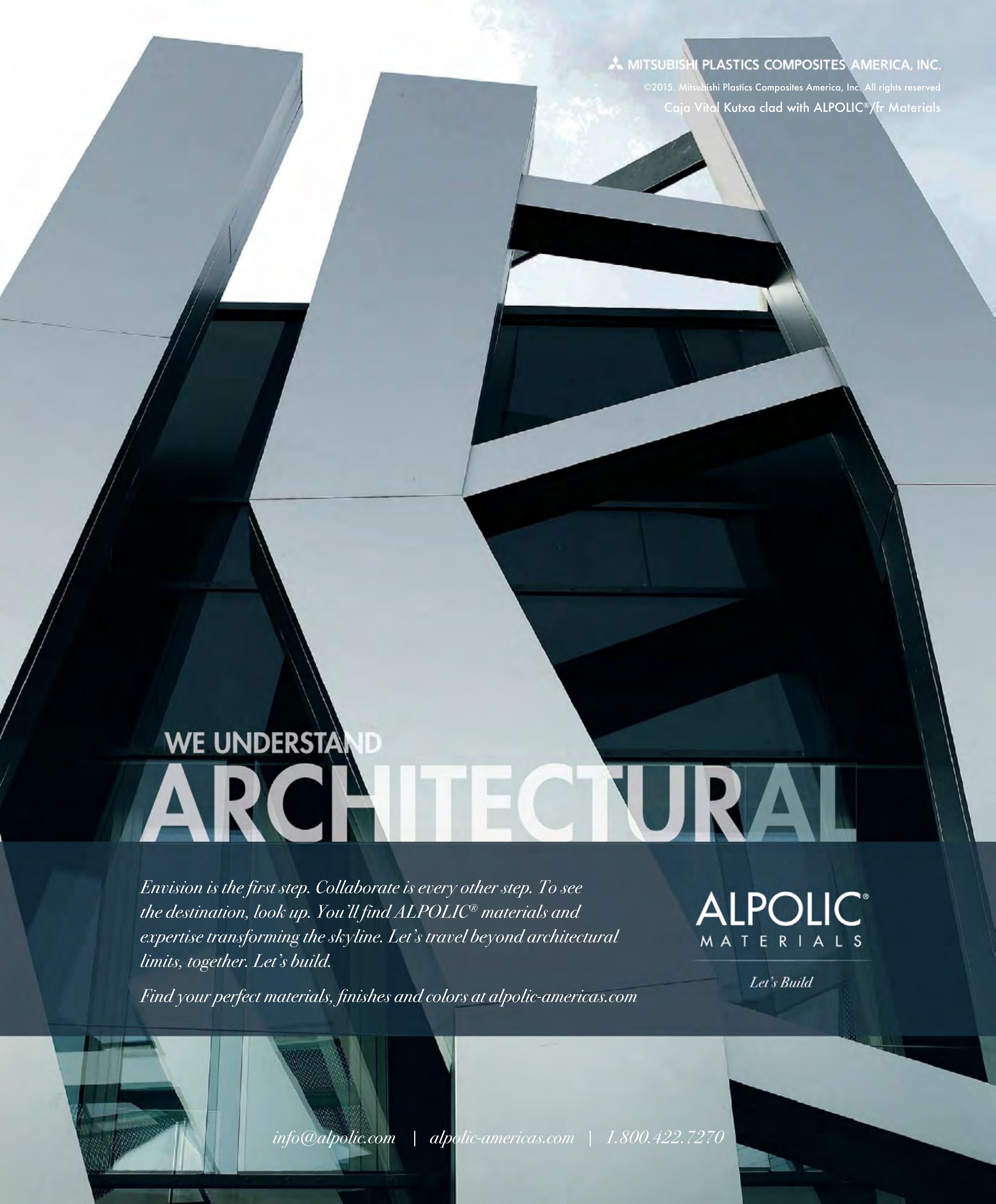
Whereas a typical SLA machine must delaminate the object after a new layer is added (in order to refresh the resin) and then reset the build platform, the CLIP machine can print nonstop. That is, it doesn't need to re-dip the quill in the inkwell.

The Results

Currently, the CLIP machine can print at a rate of between 300 millimeters (11.8 inches) per hour to more than 1,000 millimeters (39.4 inches) per hour, which is 25 to 100 times faster than conventional 3D printers. Because the technology resembles injection molding, its printed objects look and act monolithic, exhibiting the same mechanical properties in the x, y, and z directions.

Finally, CLIP can print with a range of mediums, including ceramics, biological materials, and soft elastomers. What makes CLIP most promising, said Carbon3D CEO and co-founder Joseph DeSimone in his TED Talk, is its ability to "make a [commercial-quality] part … that has the properties to be a final part."

In April, Carbon3D received a vote of confidence from software juggernaut Autodesk in the form of a $10 million investment, adding to the $41 million that the startup has already raised in venture capital. Carbon3D is now commercializing the CLIP technology and expects to announce the pricing and availability of an industrial machine within the next 12 months.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AIAVOICES

THE MASTERS | PLACE, CHARACTER, AND CRAFT

Mack Scogin Merrill Elam Architects is one of Atlanta's preeminent firms. Its principals, Merrill Elam, AIA, and Mack Scogin, AIA, have more than 40 years of experience designing a wide variety of buildings across the United States. If there is one hallmark that unites their work, however, it is a slow, deliberate, and methodical investigation into the context of a building's site, circumstances, and purpose.

WHEN WE TALK ABOUT PLACE AND CHARACTER, IT HAS SOMETHING to do with origins. The places you make, then, reflect your formal training and the language of architecture, but they also reflect the places you knew as a child and the experiences you've had as a person. Some of us have more fixity of place than others; some grew up moving around a great deal. But character and place play out every day in our studio, where everyone is themselves, genuinely. We enjoy what each person brings to the team. It's fun and invigorating and adds to the richness of the design process.

We enjoy the challenge of working on new typologies, because it's a learning experience. The curve is steep and you have to, while you're learning, figure a way of improving the situation. Of challenging the status quo for constructive reasons, not just for the sake of being different. To question old patterns, that sort of thing. In that sense, we always find the next project the most challenging.

We can't recall ever having heard anyone use "Atlanta architects" as a way to describe us. Atlanta is a place of energy rather than critical mass. So much of what goes on here is about making. The city is making itself for the first time, unlike other cities where you're carving out, replacing, and inserting. We've also thought that, over time, there might be a school of architectural thought here in Atlanta—like a Bay Area school or a New York school. The good news is that there hasn't been a school of thought here in the same way as those other places. It's very open-ended and free-form in Atlanta—and for us that's a good thing. Everything is up for investigation.

I [Elam] was just out in Arkansas to see Marlon Blackwell, FAIA, and visit some of his projects—and it struck me that it's a fabulous thing when an architect can take a welding shop and a few hundred square feet and make a chapel. That's ethical—to make something in a place and in a way that was otherwise impossible before—where there were so few resources. We're trained to make space and place and make it better than we found it. *—As told to William Richards* AIA

AIANOW

ACROSS ATLANTA

By William Richards
Art Direction by Jelena Schulz

1 *The Windup …* "Applied Research in Architecture Education that Advances Practice" is the inaugural symposium in a series developed jointly by the AIA and ACSA that will explore intersections between architecture's academy and practice. Co-chairs Gregory Kessler, FAIA, and Stephen Vogel, FAIA, will focus on healthy and resilient communities, materials and fabrication, and modes of applied research. The symposium, a pre-convention workshop for the 2015 AIA National Convention in Atlanta, is scheduled for May 13.

↗ Learn more and register at *convention.aia.org/event/schedule.*

2 *… and the Pitch.* Architecture has been described as frozen music, and Atlanta has been described as one of the best cities for live music. If you combine the two, you get the Atlanta Jazz Festival in Piedmont Park (May 22–24). Dozens of acts, old and new, will be spread out over 189 acres of Olmsted-designed meadows and groves. But you don't have to wait until the week after the 2015 AIA National Convention to slip on your dancing shoes; live performances related to the festival take place all over the city all month long.

↗ Learn more at *atlantafestivals.com.*

3 *Sketchy Situation.* Marlon Blackwell, FAIA, and Frank Harmon, FAIA, are architects' architects who, individually, have won countless awards and have nearly a century of experience. If you ask them, they'd probably tell you that the key to it all is looking and drawing. It's how architecture starts and how it lives on in the mind's eye; it's the basis of muscle memory and the juice that fuels design. Join them on May 16 for "Urban Sketching," a half-day workshop that includes a seminar and field excursion to look, sketch, and paint.

↗ Learn about what to bring and register at *convention.aia.org/event/schedule.*

ILLUSTRATION: MICHAEL KIRKHAM

4 ***Circle in the Square.*** Cycloramas were the 3D movies of the 18th century—spectacles that you have to see to really believe—and, like 3D movies, they continue to endure as a singular experience. Roughly 100 years after the debut of the cyclorama-as-art-form, Atlanta's cyclorama opened, depicting the Confederate routing in the Battle of Atlanta on July 22, 1864. Painted by the America Panorama Co. in Milwaukee in 1885, the 400-foot-long tour de force was eventually installed in architect John Francis Downing's Neoclassical cyclorama in 1921. Plans are afoot to move the painting to a new venue, but you still have a chance to catch it in situ.

↗ Learn more at *atlantacyclorama.org.*

5 ***Coke and a Smile.*** There are some analogies that will never change. For example, Atlanta : Coca-Cola :: Boston : Dunkin' Donuts :: Dublin : Guinness :: Providence : Del's Lemonade. But there's something about Atlanta's relationship with that caramel-colored, syrupy soda that transcends glib analogies. Right now, at the High Museum of Art, you can catch "The Coca-Cola Bottle: An American Icon at 100" or, situated on the northeast corner of Pemberton Place, you can check out the World of Coca-Cola, designed by Rosser International (with a master plan by Venice, Calif.'s Jerde Partnership)—perhaps the largest building dedicated to a single beverage.

↗ Learn more at *high.org* and *worldofcoca-cola.com.*

6 ***Design Collective.*** When the original Georgia World Congress Center in Atlanta—designed by tvsdesign (when they were Thompson, Ventulett, Stainback & Associates)—opened in 1976, it was the first state-owned convention center in the United States. Three expansions later, it's the fourth-largest convention center in the U.S., at 3.9 million square feet—which is more than 68 football fields combined. It's also the site, for the third time in the Institute's history, of the AIA National Convention and Design Expo (May 14–16), for which thousands of architects, product manufacturers, and allied industry representatives will converge.

↗ Register on site or online at *convention.aia.org.*

I AM AIA

Devanne Pena, Assoc. AIA
Member since 2012

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ILLUSTRATION: MICHAEL GLENWOOD

FOR DONNA SINK, AIA, INSPIRATION CAME IN THE FORM OF 13 ACRES worth of Teflon-coated fiberglass. In late 2008, when the former home of the Indianapolis Colts—the RCA Dome—was slated for demolition, People for Urban Progress (PUP), the nonprofit design organization where Sink is a board member, saw a chance to create salable products from the dome's fabric air-supported roof. "We're selling goods so that we can do good work in the city," says Sink, who also serves as the campus architect at the Indianapolis Museum of Art.

PUP's line of products includes fashionable handbags, wallets, and dopp kits. In addition to diverting the massive amount of material from landfills, sales have raised over $70,000 to fund the nonprofit's community design initiatives, like shade structures for local parks.

It's civic engagement initiatives like this that Sink will present as the key to modern architecture and urban design at the AIA National Convention in Atlanta during her session "Cities Cleave: Social Action in Practices Both Traditional and Non."

While teaching professional practice at Ball State University as the recession hit, Sink saw the fretting among her students as the architecture job pool continued to drain. She believes young architects will need to forge a less-traditional career path but, despite their employment status, young architects are equipped with skills to create small-scale interventions that can demonstrate thought leadership and have significant impact on the citizens of their city. They are more than capable, Sink says, of creating simple solutions, like seating and shelters at bus stops that sorely need them or drawing maps detailing the best biking routes through their city.

"For my students, I started researching people who had found a new path in architecture using their skills, even if they couldn't find a job in a firm," Sink says. "I want young architects—and all architects, actually—to look at their world and their communities and say, 'I see a problem. What can I do to solve this problem?'"

Instilling architects with the drive to provide solutions, rather than waiting for clients with existing problems to appear, carries with it the added bonus of demonstrating the profession's value to a public that may not fully understand its importance. And where those social strategies intersect with resilience, there's a real opportunity for architects to create uniform policy on a national stage, says Sherry-Lea Bloodworth Botop, executive director of the Architects Foundation. To help further that cause, the foundation is on course to launch the National Resilience Initiative. A part of the Clinton Global Initiative's Commitments to Action, the program is envisioned as a network of five regional resilience design studios that will provide opportunities for collaboration and innovative solutions.

"If there is a seismic incident in San Francisco, for example, we would engage the Midwest studio that is also working on seismic resilience that could jump in and help if the city is overwhelmed," she says. "To me, this demonstrates the value of architects by involving them in creating design solutions."

David Dixon, FAIA, a senior principal at Stantec and leader of the firm's Urban Places Group, oversaw the master plan for post-Katrina New Orleans. He sees an opportunity for architects to leverage their knowledge and compete for dollars in the federal government's discretionary budget to fix the infrastructure issues in U.S. cities.

"I don't think we pay enough attention to how much leadership potential and influence we can have when people start thinking about how they can reshape the built environment," Dixon says. "One of the things that the profession really needs to do is develop a resilience agenda that is not just about protecting places but also about building quality of life."

Regardless of where the path leads, it begins with architects working in their communities, says Sink, who notes that while most would define "cleave" as a verb that means to split or sever, it also has a secondary meaning of attachment.

"As architects … we're poets and we're pragmatists. We occupy this world of being two things at the same time, and we need to embrace that," Sink says. "There's this word, 'cleave,' that means two things at once and that, to me, really defines what architects are in many, many ways." *—Dominic Mercier* AIA


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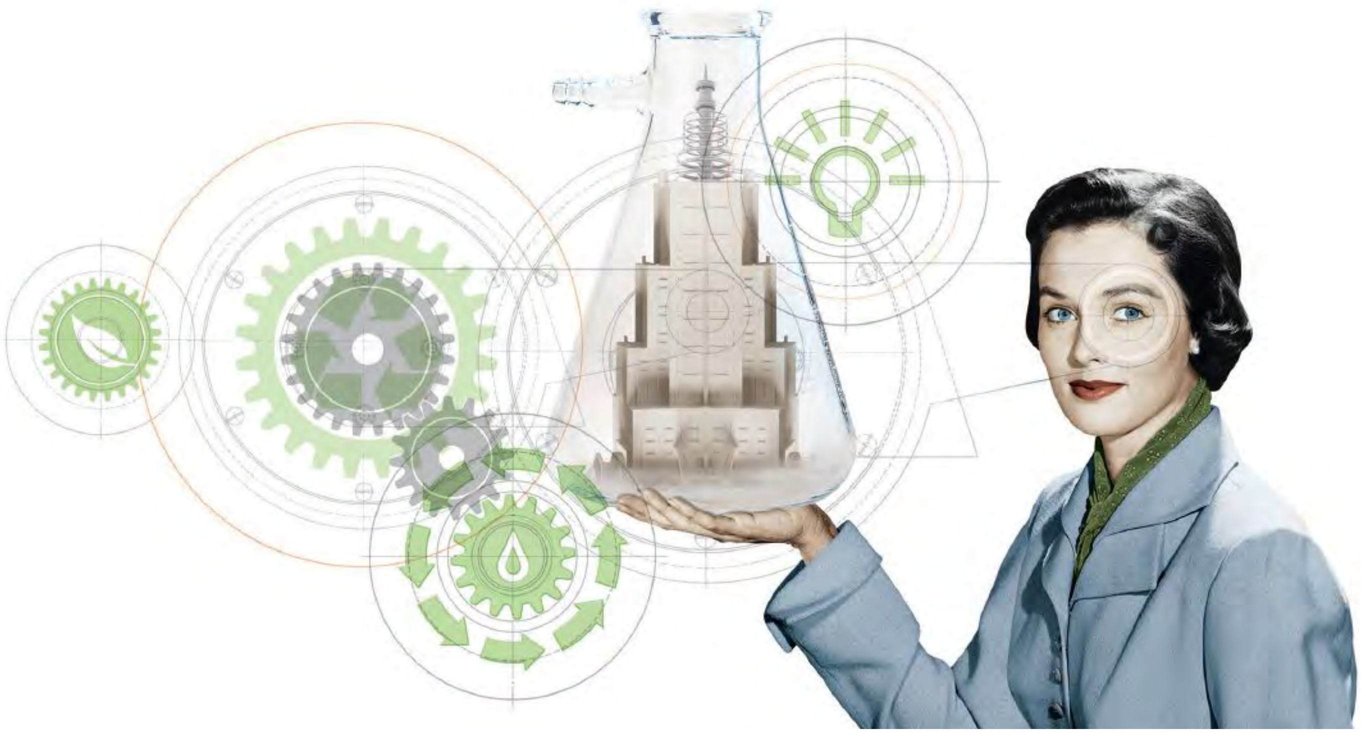


ILLUSTRATION: VIKTOR KOEN

THERE'S NO "SETTING AND FORGETTING" WHEN IT COMES TO research in practice for Z Smith, AIA, a researcher with a physics background and a doctorate in engineering who is a principal and director of sustainability and building performance at New Orleans-based Eskew+Dumez+Ripple (EDR).

"Most design presentations are a string of hypotheses," he says. "Now, with the rise in prominence of environmental architecture, they predict that the building will use less energy or less water. But the funny thing is that as I got into architecture I learned that architects almost never go back to find out if that is true."

For the past five years, evidenced-based design has been a key to the success of EDR. Performing routine checkups (keeping tabs on energy bills) and deeper dives (quantifying the success or failure of collaborative space) both strengthen the case for research while providing results both trivial and profound. For instance, Smith says, collaborative space can be a complete flop just because the office coffee pot was removed for aesthetic reasons. "It looks really great in the photographs," he says, "but it's not really a cozy and comfortable space for two people."

While research can become a budget line item, it certainly beats designing and wasting money based on hunches, he says. "My initial interest in doing research into achieved building performance well past the one-year warranty period was for building our credibility and winning the kind of work we want to win," says Smith. "We like the jobs where the clients actually care how the buildings work."

Research certainly has a long history in architecture, and Smith and his colleagues Andrea Love, AIA, director of Building Science at Boston's Payette, and Colin Booth, associate designer at Sasaki Associates in Boston, will discuss how their firms have embraced research in a session titled "Three Firms' Approach to Integrating Research Into Practice" at the AIA National Convention in Atlanta.

"Rather than trying to solve problems incrementally and bit by bit, each project is building on the knowledge of the previous projects," says Love, who splits her time 50/50 between project design and research. That knowledge, too, differentiates Payette in their market, helping to position them as thought leaders on a number or research topics, like thermal bridging, for which the firm was awarded an AIA Upjohn Research Initiative Grant in 2012.

Love says the onus to solve the pressing issues laid out in the Sustainability Leadership Opportunity Scan, a report published by the AIA in 2014, is on the entire profession, not just the firms actively participating in research. To that end, Payette does not keep its findings secret. All of its research projects are posted to the firm's website to "drive a culture committed to perpetual learning."

While firms like Payette have spun off entire divisions devoted to research, Sasaki Associates is more democratic. Booth says the firm sets aside $100,000 each year for research projects, allocates smaller amounts for on-project research, and provides money for ideas that may turn into formal proposals. Anyone in the firm can propose a project and, once reviewed by the firm's executive committee, a period of input and selection begins.

Spending firm dollars on research is one option, Booth says, but he also sees efforts underway for architects to reap the benefits of tax credits for research and design. Ideally, he'd like to see the profession enjoying the same benefits as other industries.

Regardless of how the work is fostered, Booth says that research is vital for a firm's survival in today's environment. "Innovation is the buzzword, but it does reflect the common understanding that change is the new normal," he says. "Climate change is a much more widespread and accepted phenomenon in the U.S., and therefore we're being asked by our clients, thankfully and finally, as designers to address the issue and plan for it in our designs, not just through mitigation but now also adaptation." —*Dominic Mercier* AIA

A Real Peach

Rounding up some of Atlanta's notable places and their backstories

Hurt Building

Downtown Atlanta, James Edwin Ruthven Carpenter Jr., 1913; 1926 addition

Plenty of cities have triangular blocks and, occasionally, you'll find a building whose architect took full advantage of an acute angle to design something special. It's a matter of "turning a corner," in studio parlance, but it's also a matter of acknowledging the city beyond. One of the most handsome examples of this, which also happens to be a model of the Greek Revival in America, is William Strickland's Merchants' Exchange Building in Philadelphia (1834). There, Strickland made the most of an odd angle by designing a rotunda that borrowed the proportions and scale of a monument on the Athenian Acropolis, and created a piece of urban sculpture.

Three generations later, James Edwin Ruthven Carpenter Jr., referenced Strickland's approach with the rotunda for his Hurt Building, one of Atlanta's own "flat irons" designed for a difficult triangular site downtown. But Carpenter had to turn more than just a corner using Classical proportions. He also had to deliver a 17-story structure behind it. Working with the building's patron and builder John Hurt (an engineer by training), Carpenter turned to Daniel Burnham's Flatiron Building (1902) in New York and Louis Sullivan's Carson, Pirie, Scott and Company Building (1899) in Chicago to not only understand how to design a tall office building ("artistically considered," as Sullivan would say) but how to humanize it at street level.

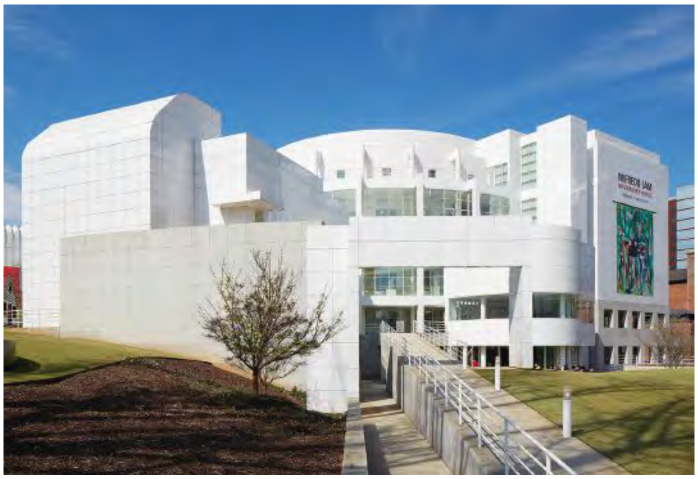
High Museum of Art

Midtown Atlanta, Richard Meier & Partners, 1983; 2005 addition by Renzo Piano Building Workshop

You barely have to scratch the surface of "famous debates in architecture" before your nail hits the Whites versus the Grays—two groups of architects, conveniently packaged by critics in the 1970s into diametrically opposed camps: the Whites, Corbusian in their spare approach to form and regard for context; and the Grays, willing to adapt historical precedent and critical of architecture that makes no attempt to reference the broader culture.

It's much more complicated than that, as ideological debates often are (perhaps taking a Gray view), but it's also just about that simple (perhaps taking a White one). Richard Meier, FAIA, typifies the Whites (perhaps more than anyone) and his High Museum of Art typifies a Late Modernist approach to design. It's a stark white "machine for living" (or, in this case, gallery-going) in which the abstract geometrical plan drives its basic organization and program. The plan also defines its basic experience and procession through atria and galleries. It's also an iconic part of the skyline in Atlanta-everyone knows the High and how to get there-and it attracts more than half million visitors each year.

An addition, which was completed in 2005 and designed by Renzo Piano, Hon. FAIA, doubled the amount of available gallery space; its aluminum panels gel nicely with the 1983 building's enamel façade, and its subtle massing balances some of the sweeping heroic gestures of the southeast corner. More importantly, the Piano addition proves that the debate between Whites and Grays—acontextualists and



contextualists—is still a viable one. These aren't mutually exclusive camps after all—just as Meier's and Piano's contributions to the High aren't mutually exclusive buildings. Rather, they are part of a timeless discussion about architecture's role. And, in the end, Whites need Grays to prove something just as much as Grays need Whites to disprove something.

Playscape

Piedmont Park, Isamu Noguchi, 1976

When Parc de la Villette opened in 1986, it transformed the career of Bernard Tschumi, FAIA, as well as a corner of Paris that lost its abattoirs and much of its identity. Parc de la Villette's follies—museums, sculptures, and stages—elevated the idea of a "playscape" for urbanites, defined by elemental shapes and bold colors. It also represented a reinvestment by the city in civic space expressly for public benefit. When cities do that, it becomes one of those quality-of-life issues that pays dividends ad infinitum.

Rewind a decade, and you will find an important precedent: Isamu Noguchi and Herman Miller's Playscape in Atlanta's Piedmont Park—an echo of the Japanese sculptor's failed 1933 plan to turn one New York City block into Play Mountain (reportedly killed by parks czar Robert Moses). Playscape, completed in 1976, continues to thrive—its elemental shapes knit together in a tight radial plan. Its follies, rendered in blue, green, orange, and red, feel just as inviting to adults as they do to children. Sure, there's a slide and swings, but there are also sculptures that have no purpose other than to be climbed, sat on, and explored.

PHOTOGRAPHY: DANA HOFF

The park's 3.5 million visitors each year—more than six times the population of Atlanta proper—confirm its popularity. Those who find their way to the southwest corner of the park find a moment that's open to interpretation. And, so long as we rate cities according to quality of life, our ability to interpret our cities remains vital (or, *derive* and *détournement*, as a younger version of Tschumi would have claimed). If Atlantans are guilty of anything, it's of having a good time—particularly at Playscape.

Central Library

Atlanta-Fulton Public Library System, Marcel Breuer Associates, 1980

Thirty-five years ago, Marcel Breuer completed his final building—the Central Library for the Atlanta-Fulton Public Library System—at the age of 80. It's often compared to the Hungarian-born architect's Whitney Museum of American Art in New York City, with a steel frame supporting concrete slabs and façades composed of bush-hammered precast concrete panels—reminiscent of an inverted ziggurat. It's also a fine piece of formal Brutalism, a style of architecture coined by British architecture critics decades ago that's attracted some press of late, predictably centering on maintenance issues and divided public opinion on aesthetic propriety.

In the same vein, the Breuer library is a more troubled building than New York's Breuer counterpart, dogged by costly water damage, material failures, and performance issues. A $5 million renovation in 2002 stemmed the leaks, but the building remains imperiled by years of deferred maintenance, which landed it on the World Monuments Watch for endangered buildings in 2010—galvanizing the local preservation community. The library will survive, it seems. It's just a question of cost.

"If you want a home run you pick Hank Aaron," said Atlanta's public library director Carlton Rochell in 1974, to convince his selection board to go with Breuer. Looking back on Breuer's oeuvre, it's clear that, in a 50-year career, he rarely ever swung and missed. There were only Aaronesque hits—thoughtful, sculptural, and stirring works of architecture all over the world. Atlanta's library is certainly no exception. —*William Richards* AIA

AIAKNOWLEDGE

A BREUER VETERAN LOOKS BACK ON THE MODERNIST MASTER'S MATERIAL CHOICES

Robert F. Gatje, FAIA, began his career in 1953 when Marcel Breuer hired him as a draftsman, fresh off a Fulbright Scholarship at the Architectural Association School of Architecture in London. Gatje stayed at the firm for more than two decades, eventually becoming a partner and taking the lead on several major European commissions, most notably the IBM France Research Center at La Gaude and the French ski resort town Flaine. "Breuer was a detail-oriented man," says Gatje. "I admired him because he took the responsibility of designing the best building he could, very seriously, every time."

I LIVE IN NEW YORK CITY AND WE'RE SURROUNDED BY scaffolding everywhere, in which people are repairing brick façades or stone façades with great care because they accept that their buildings need to be maintained. Yet concrete gets a bad name—I don't know why. It must be maintained for the same reasons as brick or stone, and when it's not, everyone points to it as a material failure. People felt that concrete didn't need any maintenance—which is not the fault of concrete, of course. It was a misunderstanding of the material over time.

Concrete, as it cures, develops small cracks, and Breuer accepted the visual imperfections by losing them in his strong patterns of joint and formwork. He was a great craftsman, brought up on wood, and used board-formed concrete for his aims as a sculptor. Others use concrete as if it were plaster, looking for purity and smoothness, but they pay an eventual price in patching cracks and surface spalling.

Breuer learned a lot about concrete working with his great friend Pier Luigi Nervi on the UNESCO Headquarters in Paris. For the IBM France Research Center at La Gaude, a project I worked on and know well, Breuer invented several things. One, he called the "tree-column"—a way of supporting the outside wall at different points—and another, a deep "folded" concrete façade that provided raceways for mechanical services and resulted in a deep shadowed grid of great beauty. At the time, he left its construction up to the contractor from whom he learned much about modular precast concrete. He told me once that IBM France was his favorite project.

Breuer was not known as a Brutalist architect. For one thing, the term was not used at the time—certainly not by us in the office. It was applied later by English and American critics—badly translated from *béton brut*, or "rough-formed concrete," and badly used to describe a whole range of buildings. Paul Goldberger, Hon. AIA, in his long obituary for *The New York Times,* never once called Breuer a Brutalist architect. He did, however, identify him as a "Bauhaus architect," a label that Breuer hated because he felt that it reflected his early schooling, not his mature work.

The Whitney Museum of American Art wanted a building that would put it back on the map as, at the time, it had been lost in the shadow of the Museum of Modern Art for too long. Breuer imagined the inverted ziggurat form perched over Madison Avenue right from the start, even though his engineers said he'd have to use steel rather than his beloved concrete for its structure.

Of course, the building is iconic now, but at the time, I remember going up Madison Avenue with Breuer in a taxi, and we drove right by the Whitney just after it had been completed. The driver took one look at it and said to both of us, "What the hell is that?" Breuer loved that question. He turned to me and said, "That's exactly the kind of reaction I was hoping for."

—As told to William Richards AIA

AIAPERSPECTIVE

TOUCHSTONES

ENGAGEMENT'S FRONT IS WIDE AND VARIED

PHOTO: CARL BOWER

ALTHOUGH OUR PROFESSION IS HIGHLY REGARDED, THE PUBLIC has at best an imperfect idea of the many ways our work touches their lives. A case in point is this year's AIA Honor Awards. Writing for *Interior Design*, Misty Milioto asked what this collective group of award recipients said about the current state of architecture. My response was to point to the extraordinary breadth of achievement, the examples of which (despite their range) share a strong commitment to social consciousness.

An obvious example is this year's Whitney M. Young Jr. Award recipient. The justly acclaimed Rural Studio works closest to the earth where people live, providing beauty, delight, and cultural pride to those often underserved. At the other end of the scale is AIA Kemper Award recipient Edward Mazria, FAIA, whose focus is global. Here is an architect who is mobilizing our profession to save the planet. Spanning decades and continents, the work of AIA Gold Medalist Moshe Safdie, FAIA, celebrates people and place in a manner that respects, and is enriched by, the cultures with which he interacts. And consider the dynamic juxtaposition of AIA Architecture Firm Award recipient Ehrlich Architects with Topaz Medallion recipient Peter Eisenman, FAIA. The former subtly weaves modernist and traditional multicultural design elements to shape projects that have a popular, vernacular feel, while Eisenman reminds us that thorny intellectual questions and creative disruptions are as central to the human spirit as sustenance and shelter.

As this year's honor awards make clear, we have amazing stories to tell. Shining a bright light on the many different ways our work enriches lives and entire communities is the goal of the AIA's three-year "Look Up" public awareness campaign. A member priority, this multimedia initiative gives us a platform to engage the public with stories about the contributions that our profession makes to improve the health, resiliency, sustainability, and, yes, beauty of our communities.

Sometimes the impact of our work is immediately visible, like Houston's Centennial Gardens in Hermann Park. Sometimes, however, it takes years before the full impact of our contribution to the physical and spiritual health of a community can be fully seen.

Whether the impact is immediate or over time, the power of architecture to make a positive difference is a message the public wants to hear and, if I'm right, will be eager to tell. When the public becomes our storytellers, imagine the possibilities. Certainly it will surpass our wildest dreams. AIA

Elizabeth Chu Richter, FAIA
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HIGH PERFORMANCE COATINGS

FOR INDUSTRIAL AND DECORATIVE FLOORS

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LEARNING OBJECTIVES

At the end of this program, participants will be able to:

1. Understand the history and basic science behind modern polyurethane and polyurea floor coatings.
2. Name several sustainability market drivers and aesthetic preferences for floor coatings and how they fit in green building standards.
3. Understand the surface preparation, safe use and handling requirements for a professional application of these coatings.
4. Be familiar with floor coating case study examples from real world projects that re-tasked or adapted existing concrete floor space and the reasons for their selection.

CONTINUING EDUCATION

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By Steven Reinstadtler and Paige Lozier

THE HISTORY OF HIGH PERFORMANCE FLOOR COATINGS

The evolution of high performance coatings started in 1937 when Otto Bayer developed isocyanates and urethanes, effectively discovering polyurethane chemistry. Polyurethane-based coating technologies are still well known in the coatings industry today for their proven performance. Aromatic isocyanates were first used in coatings in the 1940's but this building block was not light stable and would yellow over time. Aliphatic isocyanates were invented and introduced to the coatings market in the 1960's. Aliphatic building blocks are inherently light stable so they retain their original color for pigmented coating systems or remain water clear rather than yellowing in the case of clear coatings. In the 1970's waterborne polyurethane dispersions (PUDs) were introduced, as were two component (2K) solventborne polyurethane coatings and 2K solvent-free aromatic coatings. The 1980's saw the dawn of 2K polyaspartic and first generation 2K waterborne coatings. Most recently, in the 2000's, the industry optimized high performance coating technology with 2K waterborne polyurethane coatings and waterborne UV curable coatings.

Due to their excellent chemical and abrasion properties, polyurethane based floor coatings first found their way into industrial or heavy duty applications such as production facilities, chemical and pharmaceutical plants, and other high abuse floors. They were usually used as a durable topcoat over epoxy primers and/or basecoats.

A recent trend, especially in sustainable building practices, is the use of a building's existing concrete floor as a decorative element of the structure. Architects and designers are increasingly using this ubiquitous building component in more and more aesthetically pleasing ways. Diamond polishing, stamped concrete and decorative stains are being employed as durable yet beautiful floor options in both new construction as well as refurbishment work. However, these concrete surfaces and finishes can still lose their appeal should the wrong liquid accidentally come in contact with the surface since current coatings and sealers may not resist many common staining agents. Application of a high performance coating is very important for the longevity of these floors and has extended the use of these high performance coatings into light duty and decorative flooring applications.

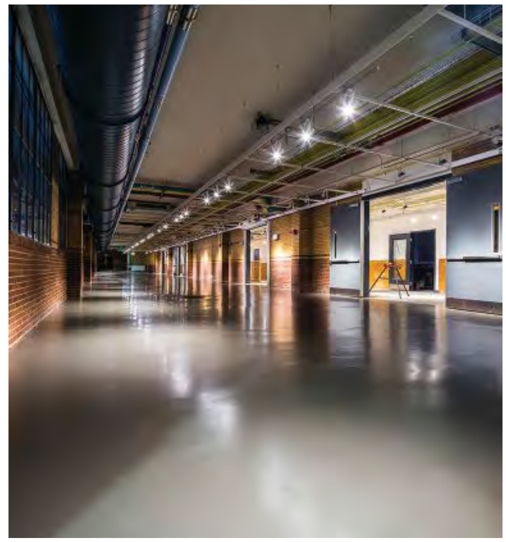
THE SCIENCE OF HIGH PERFORMANCE FLOOR COATINGS

This article will discuss four high performance coating solutions: polyaspartic coatings, one and two component waterborne coatings, and waterborne UV curable coatings, all of which contain no added phthalate, formaldehyde or heavy metals. First let's cover the basic chemistry behind why these types of coatings have such excellent properties, which are linked to two very different but related topics, hydrogen bonding and crosslinking.

Hydrogen bonding is a network that is set up like ropes and magnets. Certain parts of the polyurethane or polyaspartic molecule are attracted to each other much like opposite poles of a magnet. These molecules can group together just like a handful of magnets might. With enough force, these magnets can be pulled apart when there is strain applied to the coating but they also allow for thermoplastic flow to relieve the stress and allow for some elastic movement. The hydrogen bonding provides the combined benefits of extraordinary hardness and flexibility because the magnets can be pulled apart and rejoined.

Crosslinking is an entanglement of the polymer chains, very much like a screen in a window. Imagine that the intersection where the horizontal and vertical pieces of screen cross is where two polymer chains cross. A screen with large holes in it could bend very easily and could allow chemicals to pass through. As those holes get smaller and smaller, which would be attributed to a higher crosslink density, the screen gets stiffer and keeps out unwanted chemicals. Increasing the crosslink density increases the physical strength and chemical resistance of the coating, forming a very tight network of bonds throughout the coating.

Hydrogen bonding is a network that is set up like ropes and magnets.



Recent developments of polyaspartic and waterborne polyurethane coatings and sealers address many of the desired attributes sought by the formulator, contractor and owner such as chemical and stain resistance, low odor, long term performance, ease of use and concrete penetration. Photo Courtesy of Bayer MaterialScience

THE NEED FOR HIGH PERFORMANCE COATINGS IN DECORATIVE APPLICATIONS

For the use of concrete as a decorative element in commercial buildings such as retail space, large grocery chains, hotels, restaurants, office buildings and light industrial applications, there are several types of concrete flooring options that may be used. First, an existing concrete floor may be ground and polished to a high gloss using diamond grinding equipment. Typically, the final polishing grit varies between 800-3000 grit. This method works well when the existing concrete floor is in good shape, has desirable aggregate content, size, and color, and is free of major cracks. After polishing, the floor may also be treated with a lithium silicate based densifier which creates a harder surface that resists micro abrasion and the subsequent concrete dust that can be generated.

Additionally or separately the concrete can be treated with a decorative concrete stain which imparts a desired color and look to the otherwise plain finish. By itself, this floor preparation method initially allows for a durable finish and good aesthetic qualities. However, over time the surface may be exposed to chemicals and foodstuffs which can stain or even damage the concrete, creating an uneven spotty look. Even with the use of lithium silicate, the concrete surface can still be porous enough for certain staining agents to penetrate and leave a discolored area. In grocery stores, some common products can significantly alter the appearance of the decorative or polished concrete if they are accidentally spilled on the floor. For instance, vinegar or related products such as pickles and relish will etch the concrete due to their acid content and cause a discolored area as well as down glossing of the affected area.

In order to address the staining or discoloring issue, applicators and owners have historically used acrylic based sealers to attempt to protect their decorative concrete investment. These types of products are often generically referred to as "stainguard" or "guard" products. Many contained significant quantities of volatile organic compounds (VOCs) and solvents which posed both odor and sustainability issues. More recent acrylic products, while reduced in VOC or solvent, often do not have the durability or chemical resistance needed for long term performance.

Recent developments of polyaspartic and waterborne polyurethane coatings and sealers address many of the desired attributes sought by the formulator, contractor and owner such as chemical and stain resistance, low odor, long term performance, ease of use and concrete penetration.

By drawing on the proven power of polyurethane chemistry in many adjacent industrial markets, these polyurethane technologies have been developed that meet or exceed the desired targets of this growing market segment.

The following four coatings discussed are coatings that would either be used directly on concrete, over a primer, over a primer and basecoat, or on top of a polymer or cementitous self-levelling overlay.

Polyaspartic coatings are typically used where there is fast return to service time desired, as they cure very quickly. Photo Courtesy of Bayer MaterialScience

POLYASPARTIC COATINGS

Let's first cover polyaspartic coatings, a two component polyurea based system that is aliphatic rather than aromatic so it has excellent light stability and weather stability. A polyaspartic resin, or a mixture of polyaspartic resins, reacts with an aliphatic isocyanate to form a polyaspartic coating.

Polyaspartic coatings are typically used where there is fast return to service time desired, as they cure very quickly; with polyaspartic technology contractors no longer have to waste time "watching the paint dry." Additionally, they can be applied at higher wet film thicknesses which could eliminate a coat thus further reducing time and cost. They also have excellent clarity, durability and weatherability, and are lower VOC compared to solventborne systems.

Polyaspartic coatings have been used for more than 15 years in high-performance industrial protective applications such as bridge infrastructure, water and wastewater, and transportation. More recently, these types of coatings have begun to migrate into commercial and architectural applications due to end users' desires to protect their architectural infrastructure while maintaining a high degree of aesthetics and beauty. Decorative flooring is one area into which polyaspartic coatings have migrated with success.

Architects and construction professionals in the industrial, commercial and residential markets seek durable and beautiful coatings to protect concrete floors. Contractors and applicators are looking to utilize high-performance materials with low volatile organic compounds (VOCs) and a fast-curing process time to improve productivity. Contractors applying the coatings are often under pressure to accomplish excellent work cost effectively in a limited timeframe. Whether for residential garage floors, game rooms and basements, or commercial applications such as hotel lobbies, restaurants or retail space, polyaspartic coatings are able to meet contractors' and end users' needs.

The chemistry of polyaspartic coatings has a unique, adjustable reactivity with the capability for fast curing that offers high gloss retention and excellent abrasion resistance. This ultra-low VOC coating technology allows formulators the flexibility to control the rate of reaction and cure, providing the option to formulate a mixture with a pot life ranging from five minutes to more than two hours. This leads to increased productivity as well as reduced labor costs for contractors.

Polyaspartic coatings can be formulated to achieve a 1:1 or 2:1 (by volume) mix ratio which makes the system easier to use for painting contractors and limits issues related to off-ratio mix. These ratios can be achieved by adding the correct isocyanate, reactive diluents, VOC compliant solvents or plasticizers to the formula.

Coatings made with polyaspartic esters can be applied at temperatures below 50o F as well as in high ambient temperature environments, which extends the application season for commercial and residential projects. These coatings can be applied by simple brush, roller and/or squeegee and do not require special application equipment. Many decorative floor coatings are less than 4 mils thick but polyaspartic technology can have a high film-build per coat if desired, which can eliminate a coating layer. Applicators can put on in one coat what would usually take 2 or 3 coats in a typical, lower tolerance coating. Typical polyaspartic coatings can be applied from start (base coat) to finish (top coat) in an eight-hour work day. Polyaspartic coatings are also often used as a topcoat over epoxy basecoats due to their non-yellowing nature.

Lastly, when used as a clear protective finish over a decorative stained concrete floor, polyaspartic coatings have what the decorative market calls color pop. When the coating is put onto a decorative finished concrete floor it makes the color in the floor pop out. Many other coatings, especially water based coatings, do not have this attribute.

One of the few drawbacks of polyaspartics is that although they are well-suited for application in high temperature environments, high humidity can affect the cure time. If there is a lot of humidity in the air or if the concrete has absorbed a lot of moisture, the curing process is sped up and the contractor must work faster to put the coating down. Another drawback is that because it is a two component system it requires mixing, and smaller batches must be mixed because of the fast cure time. In addition, polyaspartics are difficult to down gloss or matte.

The chemistry of polyaspartic coatings has a unique, adjustable reactivity with the capability for fast curing that offers high gloss retention and excellent abrasion resistance.

Due to increased demand for higher durability concrete sealers, waterborne polyurethane technology is now considered a replacement for traditional acrylic stainguard products. Photo Courtesy of Bayer MaterialScience

DEVELOPMENT OF WATERBORNE POLYURETHANE COATINGS

The next coating technologies we will discuss are one component and two component waterborne coatings. For decades, solventborne polyurethane coatings have been considered the mainstay for high performance coatings used in architectural, industrial maintenance, corrosion, and construction applications due to their excellent mechanical and weathering properties. But increased governmental, regulatory, and sustainability pressures have created a need for coatings technology that would reduce or eliminate VOCs, hazardous air pollutants (HAPS), heavy metals and/or other environmentally detrimental compounds.

In the past decade, the first generation of waterborne polyurethane coatings was formulated and introduced to the market. While offering the chance to replace some of the VOCs and solvents with water, many of these coatings still had in excess of 250 g/L of co-solvent. In addition, these coatings often fell significantly short of the solventborne polyurethane standard in chemical, abrasion and UV resistance. As with most emerging technologies, the learning curve was steep and the second generation of waterborne polyurethane coatings was developed with the goal of meeting or exceeding the desired traits of the solventborne polyurethane coatings but with significant reductions in VOC and solvent levels.

These second generation waterborne polyurethane coatings have achieved the property goals and are "truly waterborne"—having 0–20 g/L co-solvent levels. Due to the increased demand for higher durability concrete sealers, this waterborne polyurethane technology has been looked at as a replacement for the traditional acrylic stainguard products currently being used.

1K WATERBORNE POLYURETHANE COATINGS

First let's discuss one component waterborne coatings. A one component, aliphatic-based polyurethane coating gives very good UV and weathering stability. This chemistry is based on a polyurethane dispersion without a second component; it merely air dries to form a polyurethane coating. The polyurethane dispersion is made by reacting polyurethane components in a solvent to make long polymer chains. Water is then added and the solvent stripped off using a vacuum process. This leaves clumps of polyurethane chains floating in or 'dispersed' in water. When the coating is applied to a surface, the water evaporates and the clumps bump together and entangle, forming a polyurethane film. This process is called coalescence.

The benefits of one component polyurethane waterborne coatings are that they have very good color and gloss retention, good durability, and they are easy to use since they are one component. They are lower VOC because they typically have only 50–100 g/L of co-solvent, which translates to lower odor.

Some of the drawbacks of one component waterborne coatings are that due to the water content in the system they have a longer cure time in cold weather or high humidity. For direct-to-concrete application on a poorly prepared surface they may require a layer of clear primer. This seals the concrete and keeps it away from the waterborne coating, which can sometimes milk out if there are contaminants left in the concrete. Finally, one component coatings may stain due to vehicle hot tire exposure.

This article continues on http://go.hw.net/AR515Course1.
Go online to read the rest of the article and complete the corresponding quiz for credit.

QUIZ

1. True or False: Aromatic building blocks are inherently light stable so they retain their original color for pigmented coating systems or remain water clear rather than yellowing in the case of clear coatings.
   a. True
   b. False

2. Which of the following coatings is a two component polyurea based system?
   a. Polyaspartic
   b. Two component polyurethane
   c. One component polyurethane
   d. One component waterborne UV curable

3. True or False: Typical polyaspartic coatings can be applied from start (base coat) to finish (top coat) in an eight-hour work day.
   a. True
   b. False

4. True or False: When a polyaspartic coating is put onto a decorative finished concrete floor it makes the color in the floor pop out.
   a. True
   b. False

5. The second generation waterborne polyurethane coatings are "truly waterborne", having ______ co-solvent levels.
   a. 20–30 g/L
   b. 40–50 g/L
   c. 0–20 g/L

6. Which of the following is a benefit of one component waterborne polyurethane coatings?
   a. Good durability
   b. Very good color and gloss retention
   c. Easy to use
   d. All of the above

7. Which of the following coatings offers increased stain resistance while protecting against chemical agents such as oils, acids, caustics, and solvents?
   a. Polyaspartic
   b. Two component polyurethane
   c. One component polyurethane
   d. One component waterborne UV curable

8. Which coating cures within minutes?
   a. Polyaspartic
   b. Two component polyurethane
   c. One component polyurethane
   d. One component waterborne UV curable

9. True or False: Approximately 80% of coating failures are related to poor surface preparation.
   a. True
   b. False

10. In the wedding cabin case study, which type of coating was used?
   a. Polyaspartic
   b. Two component polyurethane
   c. One component polyurethane
   d. One component waterborne UV curable

SPONSOR INFORMATION

Bayer MaterialScience

As an innovation leader in the development of high performance coating raw material technologies, Bayer MaterialScience enables architects, designers, and building owners by providing real world solutions for built environment challenges. Bayer MaterialScience develops coating solutions for flooring, interior and exterior walls and trim, and fluid applied roofing with high performance and sustainability in mind.

ACHIEVING EFFECTIVE ACOUSTICS

Increasing speech privacy and reducing the number of noise disruptions experienced by employees is key to both comfort and concentration. Credit: iStockphoto/Abel Mitja Varela.

Presented by: LogiSon Acoustic Network

LEARNING OBJECTIVES

By the end of this educational unit you will be able to:

- Introduce the goals of acoustic design, methods of noise control
- Identify how various interior design elements can help achieve good acoustic performance in an office setting
- Explain several of the principles behind the use of these techniques and materials
- Demonstrate that a combination of acoustic treatments is key to achieving the desired results.

CONTINUING EDUCATION

CREDIT: 1 LU

COURSE NUMBER: ARmay2015.2

Use the learning objectives above to focus your study as you read this article.

Visit http://go.hw.net/AR515Course2 to read more and complete the quiz for credit.

By Niklas Moeller

INTRODUCTION

Studies show that acoustics are an essential consideration in meeting what is arguably the primary goal of the office: to provide a setting conducive to optimal work performance. Consider, for example:

- A decade-long survey of 65,000 people run by Center for the Built Environment (CBE), University of California, Berkeley, found that lack of speech privacy is the number one complaint in offices.
- A concurrent study run by Finland's Institute of Occupational Health shows that unwilling listeners demonstrate a 5 to 10% decline in performance when performing tasks such as reading, writing and other forms of creative work.
- In their report *What We've Learned about Focus in the Workplace* (2012), global design and architecture firm Gensler states that most employees still spend more than half their time on individual work that requires concentration.
- 70% of participants in a study commissioned by the American Society of Interior Designers (ASID) said they would be more productive if their office was quieter.

Such statistics suggest that the benefits of an effective acoustic environment in terms of workplace satisfaction and profitability would be substantial.

But what is an effective acoustic environment? Because many have an incomplete understanding of this concept, the acoustic performance of a facility is often left to chance—and is usually disappointing. This need not be the case. In all but the most difficult situations, effective acoustics can easily be achieved—first, by understanding the basic requirements for good acoustic performance and, second, by incorporating the methods and materials necessary to meet those requirements into the office design.

The first part of this course introduces the goals of acoustic design, methods of noise control and how various interior design elements can help achieve good acoustic performance in an office setting. The second part explains, in acoustical terms, several of the principles behind the use of these techniques and materials. Through examples of how sound masking works in conjunction with absorptive elements, it also demonstrates that a combination of acoustic treatments is key to achieving the desired results.

GOALS OF ACOUSTIC DESIGN

The workplace should provide occupants with speech privacy, comfort and freedom from distracting noises, and enable them to work without disrupting others. The creation of such a space should be cost effective, while maintaining the flexibility required to accommodate change.

NOISE CONTROL METHODS

The formula many professionals use to achieve these results is the 'ABC Rule,' meaning Absorb, Block and Cover. In recognition of the fact that a combination of these three elements is required to create proper acoustical conditions, this guideline is also known as the 'Rule of Threes.'

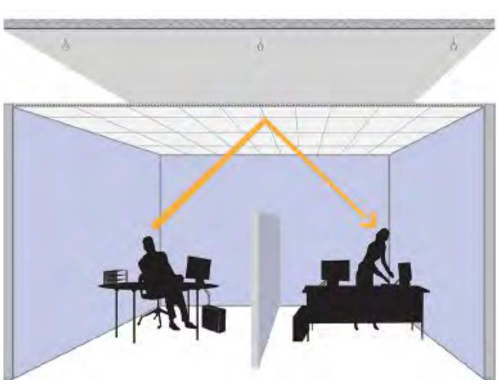


Diagram 1: Absorptive materials reduce the volume of noises, the length of time they last, and the distance over which they travel. Credit: KR Moeller Associates Ltd.

ABSORB NOISE

Absorptive materials reduce the energy of noises bouncing off their surfaces back into the workplace. In so doing, they shorten the time noises last and the distance over which they travel, lowering overall volumes and echoing in the space. Given that absorption only works on noises that reflect off a surface, this strategy typically has greater influence on sounds created at a distance from the listener.

Because the ceiling is usually the largest unbroken surface in a facility, a good absorptive tile is important. Offices should invest in the best tile they can afford and ensure consistent coverage throughout the facility. Any partial treatment of a space decreases acoustic control.

Ceiling absorption is often rated using Noise Reduction Coefficient (NRC), which essentially ranges from 0 (0% absorption) to 1.00 (100% absorption). In open plan areas, the higher the NRC, the better. In decreasing order of acoustic performance, ceilings typically rank as follows: fiberglass tile, mineral tile, perforated metal tile, no dropped ceiling, drywall and solid metal tile. The last four types usually exhibit a significant decline in acoustic performance; however, there are mineral and perforated metal products that demonstrate better than average NRC ratings. The thickness of a mineral or fiberglass tile affects its acoustic performance. Generally, the thinner the tile, the more transparent and less absorptive it will be. Foil backing on a fiberglass tile helps contain sounds within closed offices. Placing fiberglass insulation above the ceiling tiles has only marginal acoustic benefits and hinders access to the ceiling.

Articulation Class (AC) and Ceiling Attenuation Class (CAC) are two additional performance ratings to consider when selecting a ceiling tile. AC is the measure of the tile's ability to absorb noise reflected off the ceiling into neighboring cubicles in open plan areas in the frequencies that are important for speech privacy. CAC indicates the tile's value as a barrier to airborne sound transmission between adjacent closed offices. Most manufacturers suggest a rating of 35+ indicates a high-performing tile. If the tile's ability to block transmission between offices is key and it has a high CAC, it may have a lower NRC.

Lighting components can also affect acoustics. If a traditional flat acrylic lens is used, up to 20% of the absorptive ceiling tile is replaced with sheets of hard plastic, increasing sound reflection from the ceiling back into the workplace. This effect will be even more pronounced if any lenses are located directly between two workstations. In this case, the occupant's speech reflects directly into the adjoining workspace. The best approach is to use a suspended, indirect light fixture; most are narrow, curved, and perforated, so they maintain the ceiling's absorptive surface. If an in-ceiling fixture is a must, one should opt for a deep parabolic lens, which disperses the sound reflected back into the space.

Open ceilings are a popular design choice today. While they can be aesthetically appealing, they eliminate a major source of absorption, raising noise levels and increasing reverberation (i.e. echo). If an exposed structure is desired, an appropriate percentage of the deck should be treated with an absorptive material. Another option is to use a perforated and corrugated metal deck with an absorptive material placed behind the perforations before the concrete is poured.

Though they are used less frequently than acoustical ceilings, absorptive wall materials can also play a significant role in office acoustics. Absorptive panels are effective when applied to large vertical surfaces and to key reflective locations such as atrium walls or walls that reflect noise from the foyer up into the office space. They can also be used in areas where the ceiling treatment is not absorptive.

Workstation panels should also be absorptive, particularly if there is no acoustical ceiling tile. Ideally, workstation partitions integrate absorptive panels over their entire surface. However, when cost is a concern, a good fallback is to require absorptive panels on the inside of the partition above the work surface, helping reduce the reflection of the occupant's voice back into the neighboring workspace.

To reduce sound paths, minimize openings between and around the workstation panels, as well as underneath them if carpeting has not been used. Also minimize the number and size of reflective surfaces such as glass, metal and drywall components in the workstation because they increase the reflection of noise and conversation, causing them to be heard over greater distances.

Absorption and the reduction of footfall noise are the main acoustic considerations when selecting flooring. Hard flooring is highly reflective and results in a more reverberant environment. Carpeting greatly reduces footfall noise, but typically provides only minimal absorption of frequencies in the range of human speech. Flooring will have a greater absorptive effect when under-padding is used. For example, commercial carpeting on concrete typically has an NRC of about 0.25, while carpeting with under-padding may have an NRC of 0.55. The final rating will depend on the actual products chosen. At minimum, soft flooring should be specified for high-traffic areas.

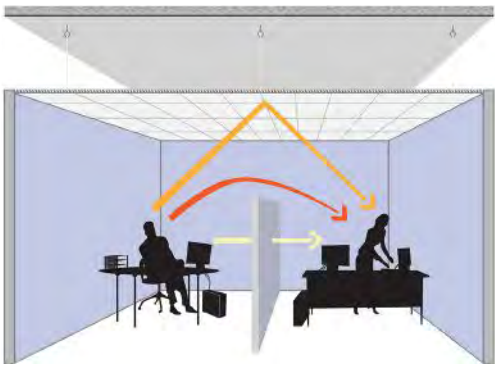


Diagram 2: Blocking noise is achieved through the use of physical barriers and a well-planned layout. Credit: KR Moeller Associates Ltd.

BLOCK NOISE

Another method of controlling noise is to block sound transmission.

The most basic barrier is a wall, though efforts to increase flexibility and decrease construction costs have reduced their use in most offices. If there is no ceiling, walls should be built to the deck. If there is a suspended ceiling, walls can be built to the ceiling. In this case, normal or confidential privacy levels are achieved through the combined performance of all other aspects of the room's design (e.g. ceiling tile, doors, interior windows, and sound masking).

The wall's sound transmission class (STC) rating indicates how well it attenuates airborne noise. The higher the rating, the better the wall generally is at preventing airborne transmission. However, these ratings are lab-tested and frequently overstate real-world performance by a minimum of 5 to 10 points. Site-tested field STC or noise isolation class (NIC) ratings are better gauges, but unfortunately only testable after the fact.

Wall performance is dramatically affected by penetrations and gaps. Outlets and switches should not be located back-to-back on opposite sides of the wall, and wall perimeters should be well-sealed with an acoustical sealant or gasket. Cable raceways along the base of the wall should include a demising partition that provides some level of acoustical isolation. Many of these requirements also apply to demountable wall systems.

When door and interior window STC ratings fail to meet the wall standard, they also reduce the room's overall performance. Gasketing material or sweeps can be added to the doors depending on the speech privacy level needed when they are closed. Of course, when the door is open, the wall's acoustical benefit virtually disappears. For example, an STC 40-rated wall with an open door that represents 10% of the wall's area reduces its effective STC to 10. The same is true for STC 45 and 50 walls. If the door represents 20% of the wall area—which is the case for a standard 3 feet (0.9 meter) door in a 10 x 10 foot (3 x 3 meter) wall—then the effective STC is only 7.

HVAC systems must also meet several criteria. Supply ducts should not connect adjoining closed rooms before connection to the main supply duct, and air return grilles should not be placed straddling walls between closed spaces. If using raised flooring, one should set the requirements for acoustical performance to prevent cross-talk between rooms.

Plenum barriers are sometimes used to block sound transmission over walls that extend only to the suspended ceiling. However, they can be expensive and somewhat difficult to properly install. Breaks—either from installation or subsequent damage—significantly reduce the effectiveness of drywall or rigid fiberglass barriers. Furthermore, the use of plenum barriers can require the installation of expensive acoustic air return ducts in order to limit the transmission of sound through the ductwork while maintaining airflow.

Blocking is also an important strategy in open-plan spaces. With the size of workstations dropping dramatically in recent years, the ramifications for workers are significant. There are many more people within the same area producing more noise overall, and because there is less distance between people, noises reach more listeners at higher volumes. Workstation partitions above seated head height (60 to 65 inches; 1525 to 1650 millimeters) serve to attenuate the sounds passing to an occupant's nearest neighbours. The panels should also have a high STC rating and be well-sealed along any joints, with no significant openings between or below them. Partitions higher than 70 inches (1778 millimeters) are rarely seen anymore and offer decreasing acoustic benefits relative to their cost, though using slightly taller partitions in high traffic areas can be beneficial.

While there is general agreement among the acoustical community that partitions much lower than 60 inches (1525 millimeters) provide little acoustical value, today they are often lowered or eliminated in an effort to increase window access and daylighting. In these situations, one should use workstation partitions that rise to 48 inches (1220 millimeters), but are topped with 12 inches (305 millimeters) of glass. Although this strategy is not as acoustically effective, it provides some physical containment.

If workstation partitions are too low or dispensed with altogether, it can have doubly negative consequences for privacy and distraction because how much a person understands of what another is saying depends on whether they can see them speak—an effect known as visual cues. Not only will the lack of physical separation allow speech to travel more easily and be more clearly understood, but the ability to see and be seen will also further reduce privacy.

The office layout can also be used to block sound. Locate noisy office machines and areas with high activity and noise levels, such as call centers, in remote or isolated areas. Minimize direct paths of sound transmission from one person to another by seating employees facing away from each other on either side of partitions.

While using barriers can reduce flexibility, they are essential, especially in areas where people are working in close proximity to each other. No other acoustic treatment has any effect over very short distances. In other words, dispensing with barriers reduces acoustic performance in a way that cannot be offset by other design decisions.

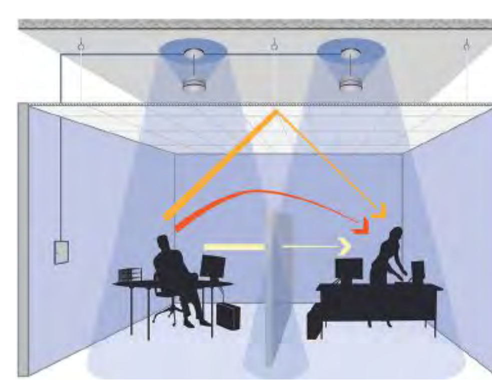


Diagram 3: A sound masking system consists of a series of loudspeakers that distribute an engineered sound similar to softly blowing air, covering conversations and noise. Credit: KR Moeller Associates Ltd.

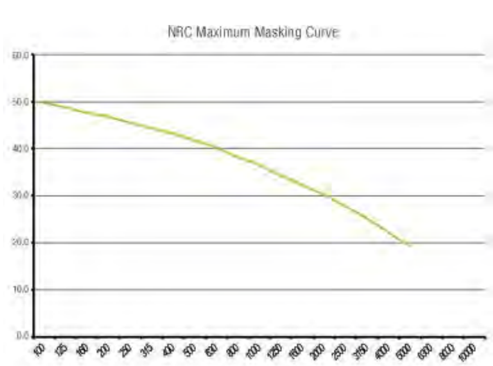
COVER NOISE

Most people are familiar with at least some aspects of the first two strategies, but 'cover'—which is accomplished using a sound masking system—is the least known or understood noise control method. Therefore, it is useful to provide a brief description of this technology.

Basically, a sound masking system consists of a series of loudspeakers, installed in a grid-like pattern in or above the ceiling, and a method of controlling both their zoning and output. The sound the loudspeakers distribute is most often compared to that of softly blowing air. The premise behind this solution is simple: any noises that are below the new ambient level are covered up, while the impact of those above it is lessened because the degree of change between the baseline and any volume peaks is smaller. Similarly, conversations are either entirely masked or their intelligibility is reduced, improving privacy and further decreasing the number of disruptions to concentration.

Many people refer to such systems as 'white noise' systems; however, this is a misnomer. The term 'white noise' describes a very specific type of sound used in early masking systems developed in the 1970s. These systems were unsuccessful due to their inflexibility and the irritating hissing quality of the sound they produced, but the name became widely adopted. Newer sound masking technologies typically do not use a white noise signal.

In open-plan spaces, the generally accepted masking volume is between 45 and 48 dBA. In closed spaces, masking volumes are typically several decibels lower because higher ambient volumes are less expected and, therefore, less accepted in smaller spaces. Here, the masking volume should be between 40 and 45 dBA, unless the required speech privacy levels cannot be met due to the manner in which the closed rooms were constructed. Spot treatment of local areas is discouraged because it draws attention to the masking sound and risks lowering occupant satisfaction. The sound masking system should also provide control so volume variation is no more than ± 0.5 dBA (1 dBA total) as occupants cross the open plan or move between similar closed rooms.



A sound masking system should provide the correct masking spectrum. The National Research Council of Canada (NRC) curve strongly conforms to those specified by acousticians for decades. Credit: NRC

QUIZ

1. The 'ABC Rule' overlooks the following noise control strategy:
   A) Covering speech and noise with sound masking
   B) Reducing or eliminating unnecessary sources of noise
   C) Installing absorptive flooring, wall and ceiling treatments
   D) Using physical barriers, such as walls

2. It is possible to achieve effective acoustics using only one or two noise control methods.
   TRUE FALSE

3. Adding absorption to a facility will:
   A) Shorten the time noises last B) Reduce the distance over which noises travel
   C) Lower overall volumes and echoing in the space D) All of the above

4. Lighting components can affect a facility's acoustics.
   TRUE FALSE

5. Blocking is a noise control strategy that can only be used in closed rooms.
   TRUE FALSE

6. A wall's sound transmission class (STC) rating indicates:
   A) Whether or not it should be built to the deck B) The level of speech privacy it provides
   C) How well it attenuates airborne noise D) None of the above

7. Workstations lower than this height provide little acoustical value:
   A) 75 inches B) 60 inches
   C) 48 inches D) 42 inches

8. Absorption and blocking reduce the volume peaks in a space, but they also tend to lower a facility's background sound level.
   TRUE FALSE

9. When installed in a facility, sound masking will:
   A) Lower dynamic range B) Maximize acoustic consistency
   C) Add 5 to 12 dBA of ambient volume to private offices D) All of the above

10. If incorporated during the design phase, sound masking can reduce the specifications for other acoustic treatments.
    TRUE FALSE

Visit http://go.hw.net/AR515Course2 to read more and complete the quiz for credit.

SPONSOR INFORMATION

Introduced in 2003 by industry leader KR Moeller, the LogiSon Acoustic Network is the world's first networked sound masking, paging and music system. TARGET software accurately tunes the masking sound to the specified spectrum, maximizing speech privacy and noise control. Worldwide distributors provide turnkey services and expert support. Visit www.logison.com.

CONSTRUCTIBLE DREAMS

MAKING THE WORLD'S HIGH-PROFILE, HIGH-PERFORMANCE FACADES

Presented by:

Ornamental Metal Institute of New York

LEARNING OBJECTIVES

After reading this article, you will be able to:

1. Understand the factors affecting façade aesthetics today, including environmental performance, architectural languages, transparency, and context.
2. Understand the types of research being conducted in relation to façade design and materials today.
3. Learn about recent or ongoing innovative façade projects and how they are being realized.
4. Learn about the digital modeling tools and systems that connect design with real-world building strategies.
5. Evaluate the contributions of new curtain walls to green and sustainable design standards.

CONTINUING EDUCATION

CREDIT: 1 LU/HSW

COURSE NUMBER: ARmay2015.3

Use the learning objectives above to focus your study as you read this article.

Visit http://go.hw.net/AR515Course3 to read more and complete the quiz for credit.

Rising to 2,074 feet, Gensler's Shanghai Tower will be the second-tallest building in the world when completed. A double-skin façade that encloses a series of 12- and 15-story atria will help passively cool the building even in stifling weather. © Gensler

Written by: Jennifer Krichels

Today's high-performance facades are simulated and perfected long before they are ever built. Sometimes, even, thanks to social media and global connectivity, a building's swooping form or glistening glass walls become the darling of the public eye years before it is ready for occupants, raising the bar even further on the aesthetics and function of new landmarks. Designer, fabricator, and installer must work in tandem to achieve the desired results, using collaborative design approaches that would have been unimaginable even a few years ago.

While tools and modeling software have never been more able to inspire new design and construction goals for facades, the materials, glazing fabrication techniques, and manufacturing systems used to achieve the end result are constantly in flux as architects push the envelope. In this article, we will look at the research and development being done in emerging areas of façade materials, design, and performance, and examine real-world projects that combine research innovation, collaborative design processes, and construction feasibility to improve not only façade performance, but also human comfort.

The building's 120-degree rotation, developed during wind-tunnel testing, reduced building wind loads by 24 percent. The shape saves money, too, requiring 14 percent less glass than a square building with the same total floor area. © Gensler

The Roadmap on the Future Research Needs of Tall Buildings published by CTBUH. Courtesy CTBUH

SUPERTALL SKINS: DESIGNING FUTURE CITIES

In introducing *The Roadmap on the Future Research Needs of Tall Buildings*, an in-depth study published by the Council on Tall Buildings and Urban Habitat (CTBUH), Timothy Johnson, chairman of CTBUH and a design partner at global architecture firm NBBJ, makes this observation: "Research funding, in most regions of the world, has declined year-on-year for most of the last several decades—putting in jeopardy the very act of research to better our existence. Against the backdrop of the planet's urban population increasing by a million or more people every week, research into making cities more efficient and sustainable is vitally needed, now more than ever. Urban density is a key factor in this and, while tall buildings are not the only solution for achieving greater density, they are being embraced as a key element of that solution in many cities around the world."[i]

The *Roadmap* is a joint venture between CTBUH, the International Council for Research and Innovation in Building and Construction (CIB), and the United Nations Educational, Scientific and Cultural Organization (UNESCO). Split into eleven broad subject areas, ranging from *Urban Design, City Planning and Social Issues, to Energy: Performance, Metrics and Generation*, the *Research Roadmap* suggests a new hierarchy of research priorities (and points out existing research gaps) for the architecture and building industries to consider in the coming years.

Within each subject area, research trees present subcategories that have been evaluated and organized through a series of questionnaires distributed to those involved in the ownership, development, design, planning, construction, consultancy, operation, maintenance and research of tall buildings. Each topic is "scored based on its importance and relative immaturity," explain the editors. In total, 358 individual tall-building research topics and their relative priorities are presented.

Within the category of *Cladding and Skin*, a number of trends emerge. Among the 32 individual topics identified, only five categories receive an "importance score" lower than 3.9 (just below "very important"), a result that seems to indicate both urgency and very high

CASE STUDY #1

Shanghai Tower | Shanghai, China | Gensler

One such tower is on the rise in China's largest city. Measuring 2,074 feet and 124 stories, Shanghai Tower is slated to be the second-tallest skyscraper in the world when it is completed later in 2015. Designed by global architecture and planning firm Gensler with a team including structural engineer Thornton Tomasetti, the tower is becoming both a new benchmark for megatall buildings, especially those that employ a double-skin façade to meet goals of performance and appearance.

Designed as a soft vertical spiral, the tower will be a self-sustaining vertical city with vertically interconnected neighborhoods within a total of 120 floors, with four additional levels for mechanical equipment and a Tuned Mass Damper. The mixed-use program containing office, boutique office, luxury hotel, retail, and entertainment and cultural venues is divided into nine zones, each with an atrium space meant to be a gathering place for occupants within that zone, as well as a public amenity that allows circulation between two adjacent high rises. The building's overall shape was determined through a series of calculations to determine its optimal rate of twist, as well as extensive wind-tunnel testing analysis.

In a study delivered at the 2010 International Conference on Building Envelope Systems and Technologies in Vancouver, Canada, Aleksandar Sasha Zeljic, leader of the Shanghai Tower façade design team for Gensler, presented an in-depth look at development of the tower's more than 2.26 million square feet of glazing area. The team designed the curtain wall as "a symbiosis of two glazed walls,"—the exterior curtain wall (Curtain Wall A) and the interior curtain wall (Curtain Wall B) with a tapering atrium between the two walls[iv].

Zeljic explains the complex process the design team used to develop the curtain wall's geometry: "Gensler's façade team used a variety of available software that involved scripting parametric flexibility in analysis. Early digital tools were Revit and Generative Components; however later studies on exterior wall were conducted exclusively through Rhino with Grasshopper parametric mechanism as well as 3D Max and AutoCAD. This allowed for a constant precise geometrical understanding of the various exterior wall schemes being proposed and their relationship to building form.[v]"

In the project's competition phase, Gensler had decided not to pursue façade designs with a surface diagrid or triangulated panels due to the client's wish that the tower's double skin would obstruct views from within the building as little as possible. Other parameters included glass size—lites would not be larger than 7 feet, 6 inches to accommodate glass floating, coating and thermal glass–processing capabilities in China.

The final design of Curtain Wall A comprises nearly 1.4 million square feet of glass, and about 28,315 curtain panel units in total. With 144 panels per floor, the façade has eight different panel types, with a larger number of same panel types (95 percenet) except on the "V-strike" area, a sharp indentation that rises the height of the tower. For a more detailed description of Shanghai Tower's Curtain Wall A and B structures, read Zeljic's research via the link noted in the endnotes of this article.

Functionally, one of Shanghai Tower's primary goals is to create a double-skin structure that can capitalize on the natural convection of air. Though a passive system, like that detailed later in this article within the case study for Gensler's design of the Tower at PNC Plaza, the tower expects to significantly reduce the total heating and cooling demands a tower of this size could expect without convection cooling. With other LEED strategies employed in the building, the system creates 21 percent energy efficiency, compared to ASHRAE 90.1–2004.

The curtain wall consists of more than 20,000 interior and exterior panels with more than 7,000 unique shapes. © Gensler

The building skin is suspended from above on huge cantilevered trusses that are stabilized by hoop rings and struts. © Gensler

CASE STUDY #2

The Belfer Building's undulating south facade controls solar thermal gain passively with a double curtain wall whose perforations let warm convection currents escape the cavity between its inner and outer surfaces. © Tex Jernigan

Weill Cornell Medical College Belfer Research Building[vi] | Ennead Architects | New York, New York

At Weill Cornell Medical College's recently completed Belfer Research Building, a gemlike, energy-efficient double curtain wall presents a striking face to the neighborhood and is one of the powerful factors, according to campus architect William H. Cunningham, behind the college's successful recent recruitment of several prestigious scientists.

To design the façade, Ennead Architects consulted with Atelier Ten to organize the research building's design around the programmatic need for daylight: Researcher offices face south to access sun and views (Computational Fluid Dynamics studies were conducted to shape the south façade shading openings to minimize heat accumulation), while laboratories face north to take advantage of diffuse light, ideal for the open work environment.

Cunningham and Ennead's team—design partner Todd Schliemann and project architect Craig McIlhenny—are all graduates of Cornell's architecture school. The team of Cornell, Ennead, curtain-wall consultants Heintges, fabricators Permasteelisa, and Tishman Construction met a tight budgetary challenge by devoting ample time to planning, design, and pre-construction testing of technical solutions, so that the actual construction proceeded relatively swiftly. "We are a very conservative client, all of this innovation and testing aside," says Cunningham. "We're going to own our own buildings, and we intend to keep them for 100 years, so we are very careful to do something that I think is going to have longevity."

While the facades components are standard, the way they are assembled is unique, particularly in the signature south façade. "There's a certain efficiency that went into selecting the die shapes, so that when the unitized pieces were set together in the field, even if the angle was 10 degrees off from another angle, those shapes were able to accommodate that through the gasketing and still keep it air- and watertight," notes McIlhenny. "So while it looks like there may be a lot of complicated dies involved in this, there actually was a lot of repetition and parts that were reused for different geometries."

Unitized components in both the inner and outer curtain walls allowed elegant solutions to a set of interdependent problems without breaking the bank. The undulating façade with punched openings and ventilation slits offers unusual visual complexity, reading variously from street level as a theatrical curtain, a chessboard, rows of balconies (referencing those of the residential Upper East Side), or an irregular geometrical pattern of rectangles and trapezoids.

Beyond its striking aesthetics, the double curtain wall functions as an energy-sparing *brise-soleil*. It is one of several areas where creative metalworking is essential to the Belfer's high performance, both in environmental terms—the project achieved LEED Gold—and in creating welcoming, flexible working spaces for researchers in multiple fields. "There's every type of curtain wall or enclosure known to mankind on this building," comments Richard Mazzella, senior vice president at Tishman: "there's ribbon windows, there are decorative metal panels, there's the sunshade curtain wall with the catwalks in it, a regular storefront, the skylight in the back ... a lot of different types of façade systems that played into the structure."

The United States does not have Germany's code requirement that every worker be located near natural light, but if it did, says McIlhenny, the Belfer would easily pass. With floor-plate dimensions of 85 by 260 feet, it is a long, slim building whose ample interior glazing ensures that daylight from its southern façade penetrates deeply into not only the offices and lounges along that south wall but the laboratory areas reaching the north. Even with low-emissivity glass, controlling solar gain here is a challenge; the solution is the passive double-skin curtain wall, which serves multiple purposes along with defining the building's visual profile.

The outer skin, Cunningham reports, is composed of aluminum and laminated glass panels with a ceramic frit pattern of two different densities, heavier on spandrel glass and lighter on vision glass, and two different colors, white for high reflectance on the exterior and black inside. The weathertight inner curtain wall, tied back to the structural concrete slabs, supports brackets at the lower edge of each panel; these support catwalks (some open and grated, some solid), which in turn support the outer wall. Computational fluid dynamics (CFD) studies, McIlhenny notes, found that the cavity between the outer and inner layers (varying from a foot to 30 inches deep with the panels' undulations) acts a chimney, carrying heat upward by convection. To reduce heat buildup, the designers introduced ventilated openings, both large rectangles and horizontal slots at levels where the catwalks are solid.

The openings, the architects realized, might invite pigeons, with the obvious consequences for the clean surfaces. To exclude birds completely rather than deter them with unsightly conventional bird wire, says McIlhenny, "we came up with this idea of tube-steel frames with these tension rods, absolutely straight, [with] over 1,000 deflection criteria, so we had to keep it very, very taut ... almost like bicycle spokes." The aggregate tension requires a stiff frame of tubular steel around the perimeter. Set screws in the side panels allow the rods to be tightened in unison if they ever slacken over time, he adds; no problems with uneven tension have arisen to date, so the frequency of such maintenance is impossible to project, but the capability is there. Daylight dimming systems on the perimeter optimize lighting control depending on how much sun enters the working spaces.

The north, east, and west façades use a different strategy for thermal-envelope performance: a primarily brick cavity wall with a horizontal strip window system and pre-weathered zinc panels. Economics and ease of construction, Mazzella reports, led to the choice of a hand-laid brick cavity wall, replacing an initial plan for a precast concrete façade with a brick veneer on these three sides. A related consideration was neighborhood and community-board concern over tower cranes, which were particularly acute during the planning stages (coinciding with two highly publicized crane collapses elsewhere in Manhattan); two cranes would have been necessary to place precast. Instead, backup to the brick was cast in concrete. "By doing the upturned and downturned beams that support the brick," Mazzella adds, "we eliminated a hung lintel system [and] all the block that would be needed for the backup ... we saved two trailing activities behind the structure and before the façade would go on. So that was a big time saving and money saving for the client, and it also played into a safer project, with less operations around the perimeter." Crews were able to start window work on these three sides earlier, which was also advantageous for the south façade schedule.

Within the building, floors been assigned not according to conventional academic departments, but by disease entities and major body systems: one floor is dedicated to brain and mind diseases, for example, mixing psychologists, neurologists, neuroscientists, surgeons, and medical personnel all working together, breaking down the siloing that so often hinders interdisciplinary communication. The ample lounge areas, visible from the labs through interior glazing, increase the awareness of colleagues' work and the opportunities for casual conversations that lead to intellectual cross-pollination throughout this research campus of the future.

The south curtain wall's open ventilation segments exclude birds with tension rods spaced approximately ¾ inch apart. Grated and open catwalks support the outer skin and allow access for maintenance. © Ennead Architects immaturity across the field of tall-building façade research. Categories tagged as especially important include, "Research on the use of innovative/advanced materials and cladding systems in tall building façades," "Research on the design, construction and performance of dynamic/active façade systems in tall buildings," and "Research on façade-integrated energy generation and collection systems in tall buildings"—ranked 1st, 4th and 5th, respectively.[ii]

In the categories listed above, current understanding of glazed curtain walls and the standardized use of materials like glass, aluminum, and silicon, may not apply in supertall building applications. (The CTBUH defines a tall building based on at least one of three categories:[iii] height relative to context; proportion; and tall building technologies, such as elevators or structural wind bracing as a result of height. It defines "supertall" as a building over 300 meters (984 feet) in height, and a "megatall" as a building over 600 meters (1,968 feet) in height. As of August 2014 there are 82 supertall and 2 megatall buildings completed and occupied globally, with more under construction. This presents an opportunity, and a necessity, for development of alternative materials and systems. In its report, CTBUH identifies photochromatic glazing, aerogel, highly insulating panels, dynamic façade systems, and façade-integrated photovoltaics, as just a few technologies being tested and improved due to increasing demands from the architecture and design communities.

THE SCIENCE OF FACADES: USING ENVIRONMENTAL RESEARCH IN DESIGN

While up to 95 percent relative humidity and other environmental, wind, and seismic conditions in climates like Shanghai requires architects practicing there to push facades to their limits, the strategies employed on the world's supertall structures are at play in a variety of forward-thinking projects around the world. International design consultant Atelier Ten has been integral in consulting some of the most energy efficient and sustainably exemplary projects today on a range of environmental strategies. Their work can be especially important in buildings with stringent environmental requirements, such medical laboratories. In addition to adhering to strict visual and thermal requirements, it is also important to keep researchers healthy and productive.

Visit http://go.hw.net/AR515Course3 to read more and complete the quiz for credit.

QUIZ

1. In the past several decades, research funding into the sustainability for growing cities around the world has
   a. increased   b. decreased
   c. tripled   d. remained the same

2. According to the Council on Tall Buildings and Urban Habitat (CTBUH), the following technology is being tested for improved implementation in tall-building applications:
   a. photochromatic glazing   b. dynamic façade systems
   c. façade-integrated photovoltaics   d. all of the above

3. Computer simulations and energy studies should be used to show the impact of various curtain wall designs on energy performance and daylighting
   a. only if requested by the owner   b. earlier rather than later in the design phase
   c. during the implementation phase   d. by the curtain wall fabricator

4. In the United States, building codes require that workers be located near a source of natural light:
   a. True   b. False

5. Bending glass in two axes is
   a. not possible with current glass fabrication methods
   b. a cost-effective way to create curved glass
   c. challenging due to residual stresses that build up during the fabrication process, leading to breakage
   d. none of the above

6. The behavior of laminated glass depends on
   a. the mechanical properties of its interlayer   b. the glass fabricator
   c. the weather conditions to which it is subject   d. all of the above

7. Due to the complex geometry of double-curved glass, it is not possible to engineer curved-glass facades without customized numerical algorithms:
   a. True   b. False

8. When outlining the goals of the Tower at PNC Plaza's façade, architects at Gensler considered the following:
   a. urban impact   b. workplace performance
   c. energy response   d. all of the above

9. Which of the following are acceptable strategies to determine feasibility for a double-skin design that relies on natural ventilation to cool interior spaces of a high-rise?
   a. evaluating buildings with similar designs in similar climates around the world
   b. monitor the climate of the building site
   c. conduct computer-based performance analysis
   d. all of the above

10. Which of the following are acceptable strategies to reduce energy consumption in a high-rise office tower?
   a. natural ventilation through a double-skin curtain wall
   b. a solar chimney
   c. orientation of interior spaces to reduce temperature fluctuation
   d. all of the above

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LEARNING OBJECTIVES

At the end of this program, participants will be able to:

1. Identify potential sources of moisture intrusion and how moisture is transported through the building envelope.
2. Examine the importance of rainscreens and weather barriers in moisture mitigation.
3. Describe draining and drying mechanisms of wall assemblies and different types of rainscreen technologies.
4. Discuss rainscreen technology test methods that measure their performance.

CONTINUING EDUCATION

CREDIT: 1 HSW/LU

COURSE NUMBER: ARmay2015.4

Use the learning objectives to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit http://go.hw.net/AR515Course4 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.

By Paige Lozier

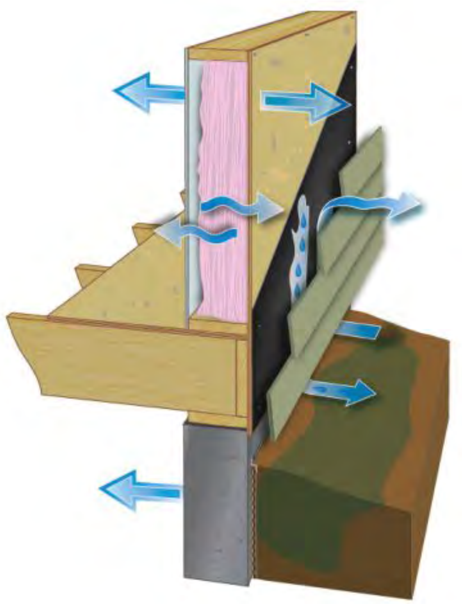
THE PATH OF LEAST RESISTANCE

There is no such thing as a water-tight structure. Because water takes the path of least resistance, it will find even the smallest opening in the building envelope, allowing moisture to enter the wall system, no matter how many layers of protection are provided. Therefore, in addition to keeping water out with various weather resistive barriers (WRB), systems must be put in place to allow water to exit the envelope once it inevitably does get in.

Moisture intrusion in a wall assembly poses numerous threats to the health of occupants, as well as to the structural safety of the building itself. Moisture can arise from various sources and will travel through a building envelope by different means. In order to protect building components and maximize occupant safety, rainscreens should be employed to keep water out, as well as to provide a drying mechanism for the building.

Historically, before building materials technology became so advanced as to essentially hermetically seal a building, a building breathed on its own. There was no insulation, so when moisture entered, natural ventilation allowed the structure to dry out, as the building was not airtight. In addition, construction materials typical of the time such as stone and brick were not as susceptible to moisture, and even frame buildings that are more moisture sensitive had significant drying capacity. Minimal vapor resistance, moisture storage capacity, and insulation equated to better air exchange through the cavity, ensuring drying of excessive moisture.

As energy efficiency improved, moisture retention increased. Now buildings are so energy efficient and constructed so "tightly" that when moisture enters it can become trapped and is unable to dry. This is when building moisture becomes a major issue; if walls stay wet for too long, moisture problems will arise.



Moisture can arise from various sources including precipitation, ground water, construction materials, elevated relative humidity and interior sources of moisture. Photo courtesy of Cosella-Dorken

WATER WATER EVERYWHERE

Ideally, bulk water, such as wind-driven rain, would never intrude behind a water resistive barrier. But in the real world, it enters through penetrations such as screw and nail holes, flashing details, and other imperfections, like window sealants and gaskets that are not properly designed to flex with the window.

Precipitation is an obvious source of moisture intrusion, but other less obvious sources are the inherent moisture present in construction materials, elevated relative humidity, ground water, as well as interior moisture sources. Construction moisture is elevated when excess water evaporates from building materials such as curing concrete and drying lumber, or during the construction process when materials are exposed to the elements.

Elevated relative humidity is the amount of water in the air compared to the maximum amount of water it can hold at a given temperature. Cold air cannot hold as much water as warm air. When air comes into contact with a surface, which reduces its temperatures so that the relative humidity reaches 100% (the maximum amount of water air can hold) dew point temperature has been reached. Building surfaces at or below dew point temperature will condense water onto the surface of building materials. Keeping relative humidity low keeps the dew point temperature low and reduces the potential for condensation.

Finally, there are numerous interior moisture sources that can contribute to moisture problems in the building enclosure, including transpiration from human bodies and pets, evaporation from plants, cooking, heating, laundering, cleaning, broken water pipes, backed up drainage and seasonal absorption.

Internal moisture degradation is a leading cause of premature failure of building envelopes. Photo courtesy of Cosella-Dorken

THE EFFECTS OF MOISTURE INTRUSION

Moisture in envelope assemblies can cause numerous problems affecting the indoor air quality of a building and the longevity of building components. Internal moisture degradation is a leading cause of premature failure of building envelopes.

Persistent moisture can lead to rot, corrosion, expanding soil which can crack or undermine the foundation, corrosion of metal components, ice dams, and other forms of deterioration. Moisture also supports insect infestation, ranging from mites to cockroaches and ants.

If elevated moisture levels persist on or inside a wall or roof assembly, they can lead to the growth of microorganisms such as mold and bacteria. The metabolism of mold and bacteria can create microbiological volatile organic compounds (MVOCs) that adversely affect air quality inside a building. Mold can only grow in the presence of high levels of moisture and is very serious to building occupants.

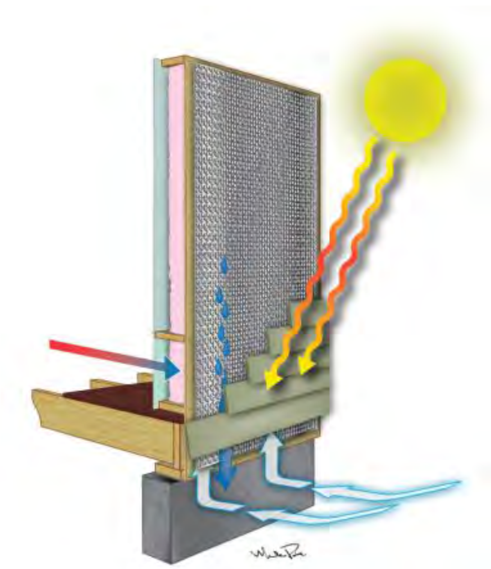
Molds are a type of fungi that survive in areas where there is an organic food source and high moisture levels. Many building materials including wood, paper, carpet, foods and insulation are common fungi food sources. When mold spores are allowed to spread to damp areas indoors, they begin growing and digesting whatever they land on, gradually destroying it.

A combination of moisture and temperature causes mold spores to germinate. Of the approximately 250,000 types of molds spores, about 200 can be found within buildings and it is possible for these mold spores to be transported several hundred miles through the air. According to ASHRAE, when combined with a surface temperature between 50 and 104 degrees Fahrenheit, mold spores will germinate in as quickly as 24 hours with a surface relative humidity at 100%. At a relative humidity of 98%, it will take 7 days, and at 80% it will take approximately 30 days.

Mold produces allergens that can trigger allergic reactions or asthma attacks in those people allergic to mold spores. Most mold exposure symptoms result from inhaling or touching mold, with the most common symptoms being asthma, nasal or sinus congestion, sensitivity to light, skin irritation, shortness of breath, headache, fatigue and burning eyes. Serious cases of mold exposure can lead to lung disease and a compromised immune system.

According to the 2012 NIOSH alert, *Preventing Occupational Respiratory Disease from Exposures Caused by Dampness in Office Buildings, Schools, and Other Nonindustrial Buildings*, "the best current evidence suggests observations of dampness, water damage, mold, or mold odors are the best indicators of dampness-related health hazards, rather than microbiologic measurements." Owners, employers and occupants should take measures to minimize the likelihood of persistent building dampness and subsequent respiratory problems in exposed occupants. These measures include regular inspection of the building for evidence of dampness, as well as regularly scheduled inspections of HVAC systems. Occupants should be informed that respiratory effects from exposure in damp buildings can occur and owners should implement a system for response to building dampness and musty or moldy odors, leaks, and flooding incidents, as well as building-related respiratory symptoms or disease.

According to ASHRAE, when combined with a surface temperature between 50 and 104 degrees Fahrenheit, mold spores will germinate in as quickly as 24 hours with a surface relative humidity at 100%.



To minimize water or vapor penetration because of air pressure differentials, try to achieve some degree of pressure equalization across the cladding, its joints and junctions. Photo courtesy of Cosella-Dorken

MANAGING WATER-DRIVING FORCES

Precipitation can enter walls through kinetic energy, surface tension, gravity, capillary action, and wind-driven rain.

Kinetic energy (pressure differentials) propels raindrops into unprotected openings in the substructure. If there are air pressure differentials, meaning air pressures are lower inside the structure than outside the structure, water can be driven from the exterior to the interior of the building through microscopic holes in the building materials. To manage the kinetic energy of raindrops, protect openings from direct rain entry with sealants and gaskets or by overlapping materials.

Vapor is another form of moisture that must be considered. Vapor moves because of air flow, which can be caused by cracks, gaps and penetrations present in every building. Air leakage can occur from floor drains, joints and cracks, sill plates, windows, electrical receptacles, ceiling light fixtures, chimney penetrations, and plumbing stacks, amongst others.

Vapor always moves from higher to lower pressure. For example, in the winter it is cold and dry outside and warm and humid inside, so vapor moves to the outside. In the summer the opposite is true, so vapor moves to the inside. Vapor also moves because of heat flow (warm to cold).

Vapor diffusion is another moisture transport mechanism and functions independently from air flow. It's potential to cause moisture problems in wall assemblies is much smaller than that of airflow, but is still significant. If moisture content in air is different inside and outside of a wall, vapor diffusion will occur until the vapor pressure differential is eliminated (equal vapor pressure on either side of the wall). Resistance to vapor diffusion depends on the water vapor permeance of materials (perm rating).

To minimize water or vapor penetration because of air pressure differentials, try to achieve some degree of pressure equalization across the cladding, its joints and junctions. Air pressure across the cladding is a function of the effectiveness of the weather barrier system, the size of the venting in the cladding, the volume of air chamber between the weather barrier, and the stiffness of the chamber.

Surface tension is another water driving force that causes water to cling to and travel along the underside of horizontal building components such as joints and window heads. This water can be drawn into the building by gravity or unequal air pressure. To minimize surface tension, add drip edges under any projecting horizontal surface such as window-sills, balcony floors or soffits.

Gravity moves rainwater down the face of the cladding and into sloped openings that the water encounters on its way down. The force of water entering by gravity is greatest on improperly sloped horizontal surfaces and vertical surfaces with penetrations. These areas must remove water from envelope surfaces through adequate sloping, correct drainage and proper flashing.

Capillary action is a suction force that draws water into permeable materials and small openings. This is the natural upward wicking force that occurs primarily at the base of exterior walls; the smaller the fissure, the greater the suction and rise of water. Building components that cannot withstand a large amount of water exposure, such as plywood or gypsum board, can create environments conducive to microbial growth and/or component failure. To manage water penetration through capillary action, drainage and vent holes should be minimum 7/16" wide to avoid bridging by water and thicker materials should be specified that will delay or minimize water absorption.

A successful wall design provides multiple pathways for drainage and doesn't allow the water to build up in the wall system. Photo courtesy of Nichiha

METHODS OF WATER REMOVAL IN A TYPICAL WALL SYSTEM

The primary functions of a building enclosure are to separate the inside and outside of a building, protect the inside from external elements, and conserve energy. An enclosure's performance is determined by heat flow, air flow, and moisture flow, which are all interlinked.

Moisture management is possible through the use of a combination of methods including weather resistive barriers (both air and water), vapor permeation, cavity drainage, as well as a rainscreen, which resists wetting and allows drying when moisture does permeate.

The four components of a successful building envelope design are deflection, drainage, drying and durability. Deflection limits the structure's initial exposure to rain with the use of overhangs and flashing. Drainage redirects any moisture that penetrates the wall to the exterior. Then, any moisture that penetrates the wall should be able to dry within a reasonable amount of time before causing damage to the structure. Finally, only durable, weather-tolerant materials should be used.

In conjunction with these four design considerations, a modern wall system should typically be designed with six layers. These layers are exterior cladding, stud framing, weather resistive barriers and flashings to manage water and drainage, insulation to provide energy efficiency, anchors and fasteners to hold the system together, and finally sheathing as the interior layer.

A successful wall design provides multiple pathways for drainage and doesn't allow the water to build up in the wall system. The wall should be "back ventilated", meaning air is allowed to circulate, which enables the wall to dry out as conditions moderate and change.

A reliable, high performance wall system will have redundant water resistant layers built in to give water multiple opportunities to exit the wall. For example, water that makes its way into the wall system and across the air space will first run down the face of the water resistant sheathing. Water that penetrates the sheathing joints reaches the air and water resistive barrier, which is the primary line of defense. Water must be able to drain down that layer and freely exit the cavity.

As water drains down the face of the sheathing or weather resistive barrier, it must be able to drain through protected weep openings that are kept open by mortar drop protection, and down to the through-wall flashing at the base of the wall, which is installed to catch and direct water out of the wall. With these multiple pathways open, not only does water get out, but air also gets in so that the wall is back-ventilated and able to dry.

This article continues on http://go.hw.net/AR515Course4. Go online to read the rest of the article and complete the corresponding quiz for credit.

QUIZ

1. Which of the following is a source of moisture intrusion?
   a. Elevated relative humidity
   b. Precipitation
   c. Construction materials
   d. All of the above

2. True or False: Many building materials including wood, paper, carpet, foods and insulation are common fungi food sources.
   a. True
   b. False

3. Which of the following is a water driving force that causes water to cling to and travel along the underside of horizontal building components?
   a. Gravity
   b. Kinetic energy
   c. Capillary action
   c. Surface tension

4. True or False: The four components of a successful building envelope design are deflection, drainage, drying and durability.
   a. True
   b. False

5. How many layers does a typical modern wall system have?
   a. 1
   b. 3
   c. 6
   d. 9

6. True or False: The terms water resistive barriers and weather resistive barriers are interchangeable.
   a. True
   b. False

7. What are the two key performance features a rainscreen adds to a wall system?
   a. Drainage
   b. Cooling
   c. Ventilation
   d. Heating

8. There are _____ required components of a rainscreen wall assembly, which offer multiple moisture-shedding pathways.
   a. 1
   b. 2
   c. 3
   d. 4

9. Which type of rainscreen prevents all rainwater penetration, while deliberately forcing air to penetrate the wall cavity in order to equalize pressure on the exterior and interior of the outer wall?
   a. D/BV
   b. PER

10. True or False: In AAMA Test Method AAMA 509-9 the only pass/fail criteria is that the weather barrier does not permit water penetration into the structure.
   a. True
   b. False

NICHIHA ADDS DISTINCTIVE EDGE TO ATLANTA LUXURY APARTMENT BUILDING

PROJECT DETAILS

Architect: Lord Aeck Sargent

Installer: Living Stone Construction

Location: Atlanta, GA

Product: VintageWood, Illumination

When the time came to develop the 355-unit, five-story Berkshire Terminus upscale apartment building in the Buckhead section of Atlanta, the design team had one goal: complement the neighboring institutional and corporate office spaces while still offering something distinctive.

"We wanted to be a good neighbor," says Ben Hudgins, project manager and architect of Lord Aeck Sargent in Atlanta. "We wanted to conform to the design standard set by the existing campus while creating something unique."

This also required they follow zoning and code requirements already set for the area, such as the amount of glass the building had at the street level. They met the intense street-level fenestration requirement by incorporating a two-story leasing/lobby space and two-story townhome-style walk-up units.

Choice of exterior materials was one way the team successfully differentiated this building from those nearby. The team specified Nichiha VintageWood fiber cement panels for the corners and the most prominent façade of the building to create texture and warmth next to the glass.

"The building is primarily gray and white, so the eye is immediately drawn to the cedar wood color and texture of the VintageWood product. This gives the building an artistic flair that adds life to an almost homogenous contemporary design," says installer Bryce Dryden, vice president and director of operations for Living Stone Construction in Kennesaw, Ga.

The use of aluminum composite material panels makes direct reference to the existing buildings which are made entirely of glass and metal. Nichiha's Illumination product was also used on this project as a budget friendly option.

As is the case with most urban infill projects, one of the biggest challenges was keeping roads and walkways open and accessible. In addition, the team needed to be sensitive to the neighboring businesses that still had to operate while the building was under construction.

Along with its aesthetics and streetscape, the property further embraces its location with amenities such as a roof terrace that provides an outdoor space complete with TV, fireplace lounge seating, and Buckhead skyline views.

Dryden's team also benefitted from the ease of installing Nichiha products on a previous project. Given the additional experience our team gained, this installation was both smooth and efficient, Dryden adds.

The team was happy with the project and how the materials were used.

"The Nichiha panels and VintageWood matched the sophisticated look the owner wanted to achieve for this affluent, uptown district," Dryden says. *"The building is a high-profile one, and other building owners and architects from around Atlanta regularly inquire about the design, and more specifically the Nichiha VintageWood panels on it."*

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Cathedral of Christ the Light; Oakland, California; Design architect: Skidmore, Owings & Merrill. Photo by Timothy Hursley

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LEARNING OBJECTIVES

After reading this article you will be able to:

1. Compare the material, project and environmental costs of wood to other building materials.
2. Explain innovative wood technologies and how they are contributing to a wide range of sustainable designs.
3. Discuss the environmental impact of wood throughout its life cycle, including its renewability, certification options, impacts on energy efficiency, low carbon footprint, and end-of-life recycling and reuse.
4. Examine research and examples demonstrating the positive impact of exposed wood on a building's occupants.

CONTINUING EDUCATION

AIA CREDIT: 1 LU/HSW
GBCI CREDIT: 1 CE Hour

AIA COURSE NUMBER: ARmay2015.4
GBCI COURSE NUMBER: 920003245

Use the learning objectives above to focus your study as you read this article.

Visit http://go.hw.net/AR515Course4 to read more and complete the quiz for credit.

Designers today are finding new possibilities in one of the oldest building materials on earth. Wood has always been valued for its beauty, abundance and practicality, but many of wood's inherent characteristics are rising to very current challenges. Wood's traditional values and newest technologies meet in the projects presented in this course, illustrating the advantages of wood in four areas: cost-effectiveness in a wide range of projects; adaptability for use in challenging, visionary new designs; lower environmental costs throughout its life cycle, from its source in renewable, carefully managed forests, through an energy-efficient service life, and often on to a new, recycled and reimagined use; and a unique human-nature connection that has always been intuitive, but is now being documented in research.

COST CONSCIOUS

As a material grown throughout North America, wood can be locally sourced and is usually less expensive than alternative building materials. Wood building systems also typically cost less to install when construction is viewed as a whole, for a number of reasons. Wood is readily available and tends to be delivered quickly, and most communities have a large pool of qualified tradespeople with wood framing experience, which minimizes construction delays and keeps labor costs competitive. Wood's adaptability and ease of use also translate into faster construction schedules, while a smaller foundation may be needed because of its light weight.

For the Carroll Smith Elementary School in Osceola, Arkansas, wood's light weight indirectly led to savings. The project was originally designed in concrete block. This would have required expensive piers to address soft soil conditions. The project team also looked at using steel construction elements, which were found to concentrate the load in unacceptably small areas. Ultimately, the project team selected wood thus reducing both the need for piers and the cost of the structural system. According to Ferran Espin of PKM Architects, lead designer for the project, using wood for the walls, floor and roof deck saved approximately $10 per square foot compared to a steel structure with light metal gauge framing. John Warriner of John Warriner and Associates, also part of the architectural team, said wood was the natural choice for this project given its economic value and design flexibility. Designing the building using wood allowed the team to meet all of the project requirements in the most financially responsible way.

In addition to material costs, an aggressive construction schedule was one of the main drivers for the choice of wood in Emory Point, a mixed-use project near Emory University in Atlanta, Georgia. Designed by Cooper Carry and The Preston Partnership, the 442-unit project includes one five-story wood-frame building over slab-on-grade and three four-story wood-frame buildings over one-story concrete podiums. According to Brad Ellinwood, PE, of Ellinwood + Machado Consulting Structural Engineers, a number of systems were considered but wood was by far the most economical. For the structural frame portion only, the wood design cost approximately $14/square foot compared to $22/square foot for a 7-inch post-tensioned concrete slab and frame. Despite the need for significant site preparation, wood's ease of use allowed the entire project to be completed in just over a year.

Often, even when wood is chosen to meet other goals, cost is still the deciding factor. For the Marselle Condominium project in Seattle, Washington, wood construction helped the building meet requirements of the local Master Builders Association Built Green program. But while the environmental recognition was an added benefit, the developer considered the decision to use wood framing purely financial. "If the project had been built using all concrete, for instance, it would have cost about 30 percent more," according to Kory Knudson, vice president of Norcon, NW, Inc. "If we had built the entire project out of steel, it would have taken much longer and we would have had to make many energy modifications."

INNOVATIVE USES FOR A TRADITIONAL BUILDING MATERIAL

Building codes recognize wood's structural performance capabilities in a broad range of applications—from the light-duty repetitive framing common in small structures to the larger and heavier framing systems used to build arenas, schools and other large buildings. However, around the world, architects and structural engineers are extending the boundaries of wood design, while innovative technologies and building systems continue to expand opportunities for wood use in construction. It's a symbiotic relationship that has also influenced the evolution of building codes and standards.

Environmental recognition with local green building programs was a plus for the Marselle Condominiums in Seattle, Washington, designed by PB Architects, but cost was the driving factor in the decision to use wood construction. Photo by Matt Todd, courtesy of WoodWorks

For example, the Cathedral of Christ the Light in Oakland, California is an extraordinary timber cathedral designed to last 300 years using a unique structural system. Designed by Skidmore, Owings & Merrill LLP (SOM), the soaring 36,000-square-foot, 1,500-seat structure replaces another cathedral destroyed during a 1989 earthquake. Architecturally stunning, the new building features a space-frame structure comprised of a glued-laminated timber (glulam) and steel-rod skeleton veiled with a glass skin. Given the close proximity of fault lines and non-conformance of the design to a standard *California Building Code* lateral system, the City of Oakland hired a peer review committee to review SOM's design for toughness and ductility. Through the use of advanced seismic engineering, including base isolation, the structure has been designed to withstand a 1,000-year earthquake. Engineers were able to achieve the appropriate structural strength and toughness by carefully defining ductility requirements for the structure, using three dimensional computer models that simulate the entire structure's nonlinear behavior, testing of critical components relied on for seismic base isolation and superstructure ductility, and verifying their installation.

An example with farther-reaching implications is the Long Hall in Whitefish, Montana, the first commercial building in the U.S. to be built from cross laminated timber (CLT). Although CLT has since been written into the *2015 International Building Code*[1] (IBC), it was new to code officials when this Type VB structure was built under the 2009 IBC. Darryl Byle, PE, of CLT Solutions worked with the local building department more than six months in advance to address concerns and keep the project on schedule. Among the challenges, the team needed approval of the CLT system as a stand-alone, one-hour rated assembly in order to feature exposed CLT on the interior. Byle used data on fire design from sources such as the *National Design Specification® (NDS®) for Wood Construction* and experimental CLT fire test data from manufacturers and independent sources to demonstrate that CLT panels could be expected to perform well in a fire event.

In addition to CLT, parallel strand lumber (PSL), glulam and prefabricated paneling systems are among the products contributing to a wider range of wood buildings. They have made wood a viable choice for applications such as arenas, gymnasiums and lobbies, which require tall walls and large open spaces with minimal, intermediate supports.

Speed record: Taking speed of construction to an entirely new level, the two-story Long Hall in Whitefish, Montana, designed by Datum Design Drafting and engineered by CLT Solutions, took just five days to erect and gave the owner a sustainable, energy-efficient building. It was the first commercial building in the U.S. made from CLT. Photo by gravityshots.com

For example, glulam can be manufactured to achieve spans as long as 100 feet and walls up to 20 feet. (See the case study on the Bullitt Center in Seattle, Washington.)

The Bullitt Center. Photo by John Stamets (See case study.)

WOOD AND THE ENVIRONMENT

Wood grows naturally and is renewable. Life cycle assessment (LCA) studies also show that wood yields clear environmental advantages over other common building materials in terms of embodied energy, air and water pollution, and greenhouse gas emissions.

In the past, the green building movement has taken a prescriptive approach to choosing building materials. This approach assumes that certain prescribed practices—such as using local materials or specifying products with recycled content—are better for the environment regardless of the product's manufacturing process or disposal. Today, however, it is being replaced by the scientific evaluation of actual impacts through LCA.

LCA is an internationally recognized method for measuring the environmental impacts of materials, assemblies or whole buildings over their entire lives—from extraction or harvest of raw materials through manufacturing, transportation, installation, use, maintenance and disposal or recycling. When integrated into green building codes, standards and rating systems, LCA encourages design professionals to compare different building designs based on their environmental impacts and make informed choices about the materials they use.

A comprehensive review of scientific literature[2] looked at research done in Europe, North America and Australia pertaining to life cycle assessment of wood products. It applied LCA criteria in accordance with ISO 14040-42 and concluded, among other things, that:

- Fossil fuel consumption, the potential contributions to the greenhouse effect and the quantities of solid waste tend to be minor for wood products compared to competing products.
- Wood products that have been installed and are used in an appropriate way tend to have a favorable environmental profile compared to functionally equivalent products made from other materials.

It's worth taking a closer look at some of the important aspects that contribute to this favorable environmental profile.

Sustainable Source

Sustainable forest management involves meeting society's need for forest products and other benefits, while respecting the values people attach to forests and preserving forest health and diversity for the future. In North America, responsible forest management ensures that forests are legally harvested and managed to meet society's long-term demand for forest products and other sustainability goals. In the U.S. and Canada, this has resulted in more than 50 consecutive years of net forest growth that exceeds annual forest harvests.[3] The rate of deforestation in the U.S. and Canada is virtually zero.[4]

Wood is also the only building material that has third-party certification programs in place to demonstrate that products being sold have come from a sustainably managed resource.

THE TREND TOWARD TALLER WOOD BUILDINGS

Multi-family housing was one of the first market segments to rebound from the recession, because it's more affordable than single-family housing while offering advantages such as less upkeep and closer proximity to amenities. Wood construction is attractive for multi-family projects because it offers high density at a relatively low cost, as well as adaptability on site, faster construction, and reduced carbon footprint. The IBC allows wood-frame construction for five stories and more (e.g., with the use of mezzanines and terraces) in building occupancies that range from business and mercantile to multi-family, military, senior, student and affordable housing. However, there are indications that this may increase as new products continue to enhance wood's ability to add value in multi-story applications. For example, cross laminated timber (CLT) is widely used in Europe and is gaining ground in North America. In Australia, a ten-story CLT building was completed in 2013, and there are eight-story examples in the UK and Austria.

LCA IN CODES, STANDARDS AND RATING SYSTEMS

LCA is more common in Europe than North America, but its use is increasing in both markets because of its holistic approach and power as an evaluative tool. For example:

The UK-based Building Research Establishment's Environmental Assessment Method (BREEAM) is the world's most widely used green building rating system and the basis for many others, including the Leadership in Energy and Environmental Design (LEED) system and Green Globes. The BREEAM modules for offices, multi-family buildings and ecoHomes include calculations based on LCA.

In the U.S., LCA is encouraged in the Green Globes rating system, and included in the American National Standard based on Green Globes, *ANSI/GBI 01-2010: Green Building Assessment Protocol for Commercial Buildings*. With the release of LEED v.4, a pilot credit related to LCA was replaced with optional credits related to LCA, LCA-based environmental product declarations (EPDs), material ingredient verification and raw material extraction.

LCA is incorporated in the draft *California Green Building Standards Code*, American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) *Standard 189.1*, *National Green Building Standard* (ICC 700), and *International Green Construction Code* (IGCC).

Sustainable forest certification allows forest companies to demonstrate the effectiveness of their practices by having them independently assessed against a stringent standard that considers environmental, economic and social values. As of August 2013, approximately 500 million acres of forest in the U.S. and Canada were certified under one of the four internationally recognized programs used in North America: the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), Canadian Standards Association's Sustainable Forest Management Standard (CSA), and American Tree Farm System (ATFS). This represents more than half of the world's certified forests.

Carbon Footprint

As trees grow, they absorb carbon dioxide from the atmosphere. They release the oxygen and incorporate the carbon into their wood, roots, leaves or needles, and surrounding soil. One of three things then happens:

- As trees mature and then die, they start to decay and slowly release the stored carbon back into the atmosphere.
- The forest succumbs to wildfire, insects or disease and releases the stored carbon quickly.
- The trees are harvested and manufactured into forest products, which continue to store much of the carbon. In the case of wood buildings, the carbon is kept out of the atmosphere for the lifetime of the structure—or longer if the wood is reclaimed and manufactured into other products. Wood stores more carbon than is emitted during its harvest, production, transport and installation.

Visit http://go.hw.net/AR515Course4 to read more and complete the quiz for credit.

QUIZ

1. All of the following factors contribute to low material and project cost in wood construction except which one?
   a. A smaller foundation may be needed because of wood's light weight.
   b. Wood can be locally sourced and delivered quickly.
   c. Wood suppliers tend to be small family operations with low overhead.
   d. Construction tends to be faster than with steel and concrete structures.

2. Forest management programs in North America have resulted in: (Select all that apply).
   a. a rate of deforestation that is virtually zero.
   b. more than 50 consecutive years of net forest growth that exceeds annual forest harvests.
   c. limiting tree growth to only a few states and provinces.
   d. Both a and b are correct, but not c.
   e. Both b and c are correct, but not a.

3. True or False: Wood stores more carbon than is emitted during its harvest, production, transport and installation.

4. Which common building materials are certified by third-party organizations to demonstrate that products being sold have come from a sustainably managed resource?
   a. Domestic steel, but not foreign.
   b. Stone and granite.
   c. Only wood.
   d. Wood, concrete and brick.

5. Wood has become a viable choice for applications such as arenas, gymnasiums, lobbies and other buildings which require tall walls and large open spaces with minimal intermediate supports, primarily due to:
   a. improvements in tree culture resulting in stronger lumber.
   b. the ongoing development of wood products and technologies such as cross laminated timber (CLT), parallel strand lumber (PSL) and glued laminated timber (glulam).
   c. computer aided design to reduce loads on structural elements.
   d. materials like window glass and floor covering that are now lighter in weight.

6. The two-story Long Hall in Whitefish, Montana, the first commercial building in the U.S. made from CLT, was designed to be sustainable and energy-efficient, and took how long to erect?
   a. Two years
   b. One year
   c. Six months
   d. Five days

7. Which of the following statements is not true about the Wood Carbon Calculator for Buildings?
   a. It estimates the amount of carbon stored in a wood building.
   b. It estimates the greenhouse gases avoided by not using steel or concrete.
   c. It estimates the carbon emissions that result from energy use in the building's first year of operation.
   d. It can be used to compare the carbon impact of alternate building designs.

8. The embodied energy in buildings and issues of disposal mean that a material's ability to be recycled or reused at the end of the structure's service life has what effect on its life cycle environmental impact?
   a. It's not critical because buildings in the U.S. have a typical service life of over 100 years.
   b. It is important because buildings in the U.S., regardless of material, often have a service life of less than 50 years.
   c. Not much impact because the embodied energy of all major building materials is the same.
   d. Not much impact because no major building materials can be recycled or reused effectively.

9. Which of the following statements best describes the results of the study highlighted in the course measuring the reaction of university students to four different office environments?
   a. Materials used in the office interiors had very little impact on occupant response.
   b. The impact of the materials used in the office interiors varied greatly depending on the individual.
   c. Stress as measured by sympathetic nervous system activation was lower in the wood rooms in all periods of the study.
   d. The color of the material determined occupant response more than the material.

10. From a thermal perspective, which of the following make wood inherently more efficient than other materials?–
   a. The insulating qualities of the wood structural elements, including studs, columns, beams and floors
   b. The fact that wood stud walls are easy to insulate
   c. The fact that options also for insulating wood-frame buildings that aren't available for other construction types
   d. All of the above

SPONSOR INFORMATION

The reThink Wood initiative is a coalition of interests representing North America's wood products industry and related stakeholders. The coalition shares a passion for wood products and the forests they come from. Innovative new technologies and building systems have enabled longer wood spans, taller walls and higher buildings, and continue to expand the possibilities for wood use in construction. www.rethinkwood.com

Presented by:

EFFECTIVE CONCRETE WATERPROOFING TECHNOLOGIES

LEARNING OBJECTIVES

At the end of this program, participants will be able to:

1. Explain the relationship between porosity and permeability and describe the mechanics by which liquid water and water vapor are transported through concrete structures and how this contributes to concrete deterioration
2. Differentiate between dampproofing, waterproofing and vaporproofing.
3. Differentiate between positive and negative side waterproofing and list the common characteristics of these waterproofing methods.
4. Identify the various types of waterproofing systems and differentiate between them.

CONTINUING EDUCATION

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Use the learning objectives to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit http://go.hw.net/AR515Course6 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.

By Marissa Hovraluck, LEED Green Associate

OVERVIEW OF CONCRETE

First and foremost before even talking about waterproofing, it is important to understand what concrete is. It is the most widely used man-made product in the world and is a construction material that basically consists of, in its most common form, cement, aggregates (large and small), and water. The origin of concrete can be traced back to the Babylonians, who used a clay-mix similar to concrete. The modern day version of concrete was not invented until 1756, when British engineer John Smeaton pioneered the use of cement in concrete. The composition of traditional concrete is relatively simple; however, today's concrete is often a complicated mix, consisting of a number of complex chemical reactions, ensuring durability and longevity.

Concrete has many advantages, including low cost, high stiffness, high compressive strength, ease of fabrication, and it is non-flammable. However, there are some disadvantages, or limitations associated with concrete as well, such as low tensile strength, it is brittle, and, to some extent, durability can be an issue if not protected from the elements.

CHEMISTRY OF CONCRETE

Concrete hardens by a process called hydration whereby cement and water form a paste that coats the aggregate, and this paste hardens and gains strength. During this reaction, there are a number of compounds formed, such as calcium silicate hydrate (CSH) and calcium hydroxide (CH). CSH is the most important of these as it contributes to setting, hardening, strength development, and volume stability. CH contributes by providing an alkaline environment which is beneficial to the reinforcing steel as it helps to reduce the potential for corrosion. In addition, other compounds such as calcium aluminate hydrate and calcium ferrite are also formed by hydration.

When it comes to determining the strength of concrete, the key factor is the water to cement ratio or mass ratio of water to cement. A lower water to cement ratio will yield a concrete which is stronger, while a higher water to cement ratio yields a concrete with less strength. Water also affects the workability and consistency of the concrete mix.

LIMITATIONS OF CONCRETE

Although concrete is very durable, it will eventually deteriorate from natural weathering and the degree of this deterioration is dependent on a number of factors. The first of these is the exposure of the concrete to moisture, temperature, and chemicals. It is imperative that the concrete is designed to accommodate these exposures.

One of the most critical forms of concrete deterioration is the corrosion of reinforcing steel. This is caused by the breakdown of the passive layer provided by the concrete around the steel. While this concrete layer is intact, it inhibits corrosion but this protection is lost when the film is destroyed by infiltration into the concrete by chemicals, excessive amounts of chloride, or other ions that reach the steel. Another form of deterioration is carbonation. This is a process that occurs due to the reaction between carbon dioxide and a hydroxide forming a carbonate in the cement paste called calcium carbonate. In the presence of water, carbonic acid can form, which lowers the pH and breaks down the passivating layer. In the presence of water and oxygen, the steel will corrode. Yet another deterioration process occurs in the presence of chlorides. These ions can penetrate through the pores or defects of the passivating film, again lowering the pH of surrounding concrete, and in the presence of moisture, form iron chloride. This then destroys the passivating film and initiates corrosion. A final deterioration process can occur in the presence of sulfates in the soil. This occurs as a result of sulfates in the soil or ground water reacting with the calcium aluminate hydrates that form during hydration. The deterioration is a result of an expansive reaction.

The mix design of concrete is critical for long term durability. Using too much water in the concrete mix can lead to excessive bleeding resulting in various deficiencies such as a weakened concrete surface, finishing problems such as trapping of water in the top surface, and pitting problems. Selecting the wrong types of materials (aggregates) can result in pop-outs that can occur due to the expansion of porous aggregates. There is also the potential of alkali aggregate reactions, such as ASR (alkali silica reactivity) and ACR (alkali carbonate reactivity), which are the result of alkalis in the Portland cement and certain siliceous aggregates causing abnormal expansion and cracking.

When it comes to inadequate design, there are also a number of factors that result in deterioration. These include:

- Inadequate accommodation for movement during thermal changes
- Inadequate accommodation for shrinkage
- Inadequate design for differential settlement
- Inadequate design for structural capacity

Even when all of the above factors are considered, actual placement of the concrete along with poor construction practices can result in deterioration. This can range from minor defects such as honeycombing, bug-holes, surface dusting, and pitting, to major defects including finishing, inadequate concrete cover, and various types of cracking that include shrinkage cracking, settlement cracking, thermal stress cracking, tension cracking, and cold joints. Other deterioration factors can result from inadequate protection of the concrete such as spalling, delaminations and salt-scaling.

All of the major deterioration factors listed can be traced back to the presence of water in the structure. To protect the structure, it is necessary to provide a waterproofing system that reduces the potential for this concrete deterioration. No matter how good the concrete is, it can still be described as permeable and porous. The extent of water penetration into a structure is determined by these two characteristics, permeability, and porosity.

WATER PENETRATION

Permeability can be defined as the measure of the ease with which fluids will flow through a material. Cracks in concrete interconnect flow paths and increase concrete permeability. The progression of these cracks allow for more water or aggressive chemical ions to penetrate into the concrete, facilitating deterioration. The lesser the permeability, the more durable the concrete.

There are various factors that can affect the permeability of concrete. These include trapped air pockets from inadequate compaction, empty spaces produced due to the lack of mixing water by evaporation, the age of the concrete (older concrete is more permeable), and the grade of cement particles. A finer grade of cement allows for a better hydration reaction creating smaller voids and ultimately more dense concrete.

Deterioration of concrete due to its permeability includes the factors mentioned earlier. A more permeable concrete increases the structure's vulnerability to the attack of water, chemicals, and sulfates. Also, due to this, there is the increased potential of the corrosion of the steel reinforcement as well as an increased potential of freeze/thaw damage in those climates that are susceptible to freezing temperatures.

Related to permeability is porosity which also determines the extent of water penetration.. Porosity can be defined as the ratio of the volume of openings or voids to the total volume of the material. In other words, the spaces in the concrete. The most important factor in determining the porosity of the concrete is the water to cement ratio. A greater water to cement ratio will produce a concrete with a greater porosity.

MOISTURE IN A STRUCTURE

Now that the deterioration factors of the concrete have been examined, it is important to understand the two types of moisture that enter the structure, and the process. These are liquid water and water vapor.

It is important to understand the difference between water and water vapor because controlling these requires different techniques.

HOW DOES MOISTURE ENTER?

The presence of water in its liquid form around a structure can be from numerous sources, and in order to select a system that can control water penetration, it is important to consider all of these sources. These include: the water table—the depth of this needs to be determined and understood; and, site drainage—is there naturally occurring site drainage, or do alternate drainage methods need to be addressed. Something to consider is that fine-grained soils can draw water from considerable distances. Both of these can be determined by a soil report.

Another factor to consider is the irrigation system. When designing a structure that incorporates this, it is important that the waterproofing and drainage system can accommodate the extra water that will be present as a result.

And then there are cracks in concrete. As we have mentioned, they are a prominent part of concrete, it will crack. The location of these cracks can somewhat be controlled by the design of the concrete, however, there is also the possibility for cracking to occur that has not been accounted for. Water can enter through these cracks, and so it is important for the system to be designed to accommodate this cracking.

And no matter how good everything is, waterproofing details are a major factor that controls everything; if the detailing is lacking, water will find its way in.

Hydrostatic Pressure
When considering a waterproofing system to control liquid penetration, it is important to look at two factors that allow for the movement of water. These are hydrostatic pressure, and capillarity.

Hydrostatic pressure is the pressure coming from the weight of the liquid and its value is directly proportional to the height of the liquid and the density of the liquid. In other words, the deeper you go, the more pressure will be present. A denser liquid will also produce a greater hydrostatic pressure.

In scientific terms, hydrostatic pressure increases in proportion to the depth measured from the surface because of the increasing weight of fluid exerting downward force from above.

Capillarity
Capillarity is the force that results from greater adhesion of a liquid (water) to a solid surface than internal cohesion of the liquid itself and is therefore able to literally rise along vertical surfaces. That means that liquid rises against gravity. The amount of capillary rise is determined by the spaces between the particles, or if you are looking at tubes, a tube with a smaller diameter will produce a greater rise. When selecting granular materials for drainage, larger spaces between the aggregate will reduce the potential for capillary rise, but will also allow water to drain freely through those spaces.

Water Vapor
Moisture can also enter a structure in its gaseous form—water vapor. Being a gas, water vapor will move from an area of high pressure to low pressure as a result of a difference in vapor pressure, which is dependent on temperature and relative humidity. Looking at conditions below grade, the diffusion of water vapor is typically from the ground into the structure through the concrete slab. Ambient conditions in the ground are approximately 55 degrees Fahrenheit and 100% RH, conditions within a structure will result in a lower vapor pressure, and since concrete is not a good vapor barrier, this water vapor readily passes through the concrete.

When selecting the correct system, it is essential to differentiate between dampproofing, waterproofing, and vaporproofing. These terms are sometimes misunderstood and this can lead to the selection of improper materials when trying to control moisture intrusion. Waterproofing is defined as the resistance of the passage of water under hydrostatic head pressure.

Dampproofing
Dampproofing is defined as the resistance of water in the absence of hydrostatic head pressure. Dampproofing materials typically will not bridge cracks in concrete that may occur during the life of a building. It is important to understand this, as without proper drainage there can be the presence of hydrostatic pressure and as discussed earlier, the concrete will crack.

Vaporproofing
A vaporproofing material is one that is totally immune to the passage of a gas under pressure. As mentioned earlier, vapor diffusion occurs due to differences in vapor pressure, and below grade, this method of moisture movement needs to be considered. It is important to understand this vapor movement when it comes to the selection of waterproofing materials or various floor coatings and their vapor permeance. If materials are used that are not breathable, such as a number of urethanes and epoxies, and they are subject to vapor diffusion, premature failures of these coatings can occur as a result.

CHARACTERISTICS OF A WATERPROOFING SYSTEM

As previously mentioned, there is not one material that is suitable for every situation, so the selection of a suitable waterproofing system should be dependent on the requirements of the project.

Some common characteristics that should be considered are: that the system be effective against moisture intrusion, both liquid water and water vapor.; it needs to be continuous as water will find a way in if there are inconsistencies in the system; and, it needs to be durable both during and after construction, and definitely needs to be robust and durable for the life of the structure. Having a premature failure of a waterproofing system can be catastrophic and costly.

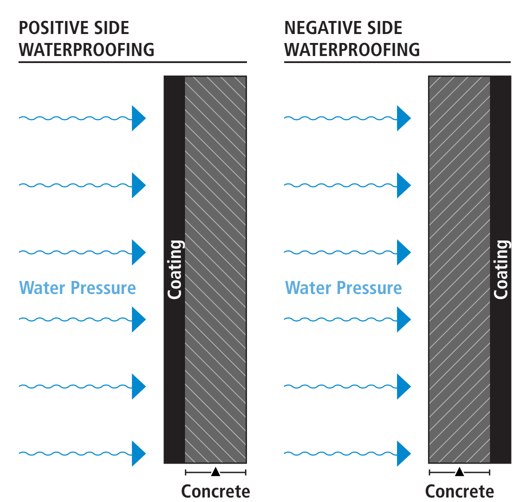
When considering the selection of a waterproofing system, resistance to hydrostatic pressure, capillary action, and vapor pressure should be considered. It is necessary to understand how to protect against these.

When looking at hydrostatic pressure, it is important to design for proper site drainage, whether it be in the form of a granular type material, or a pre-manufactured drainage layer. There are various options available but the goal is the same, reduce the hydrostatic pressure on the system. In addition, a waterproofing material is to be used. This can be one of a number of materials, as will be discussed shortly.

Capillary action requires the same sort of protection, using a material that provides a capillary break, as larger spaces mean less capillary rise. Again, this is also used with a waterproofing material to provide the best level of protection.

In certain situations, dependent on the project requirements, a vapor barrier (or retarder) will be required to address the vapor pressure issue. This is independent of liquid water and needs to be considered in certain situations. Some waterproofing materials will perform this function, others will not. So the selection of the material is very important for long term performance.

If there was one waterproofing system that would work in every situation, that would make things easier, unfortunately this is not the case. The system needs to be selected based on the requirements of the project. When selecting this system, it is important to understand if the material is considered to be a positive side or negative side waterproofing system. What does that mean?



Positive Side Waterproofing
Positive side waterproofing is a system that is applied to the exterior (or wet) side of the concrete. This is currently the most predominant type of waterproofing and includes all types of commercially available systems; blindside,

self-adhesive, fluid-applied, and cementitious. This type of waterproofing protects the interior of the facility from moisture infiltration and also protects the structural components (concrete and steel). The primary advantage of positive side waterproofing is that it prevents water from entering the substrate. This can also help provide freeze/thaw protection in those climates where this occurs, as well as provide protection of the substrate from any potential corrosive components that may be in the groundwater. One major disadvantage of this type of waterproofing is that after installation the system is virtually inaccessible for repairs. The result of this is that any issues with the waterproofing system will be very costly to address.

As mentioned, most of the waterproofing systems can be applied on the positive side and include sheet membranes, fluid-applied membranes, cementitious waterproofing, and flexible cementitious coatings. Most of these systems also require the use of a protection board to protect it from the backfill placed after membrane application. It is important to check with the manufacturer to determine this. Alternatively, composite drainage boards can act as a protection layer of the membrane, but will also provide great drainage around the structure, sometimes negating the use of drainage fill material.

Negative Side Waterproofing

Negative side waterproofing is applied to the interior face, or dry side, of the concrete. Such systems include cementitious coatings and crystalline materials. The key criteria for these materials are that they are able to withstand hydrostatic pressure that will be acting on the "bond" of the material. The breathability of these materials is important to prevent water vapor issues and debonding of the waterproofing system from the substrate. This can occur with non-breathable type systems such as epoxies or urethanes. The primary advantage of negative side waterproofing is that the area is fully accessible after installation so defects or required touch-ups can be repaired with no surface removal or intrusion to the substrate. Negative side waterproofing allows the water into the substrate, which may be an advantage (curing), but also a disadvantage as there are potential issues such as corrosion and deterioration from freeze-thaw.

Negative side waterproofing systems can typically be broken down into crystalline waterproofing and flexible cementitious coatings.

QUIZ

1. When it comes to inadequate design, which of the following is a factor that results in concrete deterioration?
   a. Inadequate accommodation for shrinkage
   b. Inadequate design for differential settlement
   c. Inadequate design for structural capacity
   d. All of the above

2. True or False: Permeability can be defined as the measure of the ease with which fluids will flow through a material.
   a. True
   b. False

3. Which of the following is the main type of materials used for membrane protection?
   a. Asphaltic boards
   b. Plastic of foam boards
   c. Prefabricated drainage layers
   d. All of the above

4. True or False: Flexible cementitious coatings cannot be applied in the same applications as crystalline materials because they possess opposite characteristics.
   a. True
   b. False

5. The application of crystalline materials can be done by:
   a. Product is mixed up and surface applied to the concrete
   b. Added directly to the concrete at the ready mix plant
   c. Sprinkled onto a fresh concrete slab
   d. All of the above

6. Which of the following is the most widely used man-made product in the world?
   a. Fiberglass
   b. Concrete
   c. Foam
   d. Paper

7. Which of the following is not a type of moisture that can enter a structure?
   a. Liquid water
   b. Ice
   c. Water vapor
   d. None of the above

8. True or False: When considering a waterproofing system to control liquid penetration, it is important to look at two factors that allow for the movement of water, hydrostatic pressure, and capillarity.
   a. True
   b. False

9.Which of the following materials is one that is totally immune to the passage of a gas under pressure?
   a. Dampproofing
   b. Vaporproofing
   c. Waterproofing
   d. None of the above

10. When considering the selection of a waterproofing system, which of the following should be considered?
   a. Resistance to hydrostatic pressure
   b. Capillary action
   c. Vapor pressure
   d. All of the above

This article continues on http://go.hw.net/AR515Course6.
Go online to read the rest of the article and complete the corresponding quiz for credit.

SUSTAINABLE CHOICES IN LUXURY FENESTRATIONS

Presented by:

Windows create a unique opportunity for the architect to create a luxury living space that is both comfortable and energy efficient.

LEARNING OBJECTIVES

After reading this article you will be able to:

1. Discuss the main attributes and relevance of windows in sustainable (green) building design
2. List the critical aesthetic and functional roles of fenestration in the design of luxury residential projects
3. Evaluate windows according to the key performance criteria such as base material, cladding, and hardware
4. Select a superior window for luxury home projects that will be long lasting, durable, and aesthetically pleasing

CONTINUING EDUCATION

CREDIT: 1 HSW/LU

COURSE NUMBER: ARjune2014.2

Use the learning objectives above to focus your study as you read this article.

Visit http://go.hw.net/AR614Course2 to read more and complete the quiz for credit.

By Andrew Hunt

Luxury homes offer the architect, builder and buyer a unique opportunity to create dwellings that are distinctive, comfortable and aesthetically pleasing. Increasingly, sustainable design is becoming more important to luxury home owners. Opulence does not need to be wasteful of natural resources. Even large floor plans can prove to be conservation-minded if the architect, builder and homeowner decide to pursue a "green" route.

Designing a luxury home that is environmentally responsible must take into account many aspects of the building process including design, construction practices, air sealing and insulation, and material selection. Windows sit at the crossroads of sustainable material selection and luxury design. The right window can reduce energy use, contribute to green building goals and also provide the touch of quality and beauty a luxury home requires.

WINDOWS AND GREEN BUILDING

Concerns about climate change, rising energy costs, and a general trend towards environmental responsibility have created a homebuilding market where sustainable goals are increasingly important to both buyer and builder.

A report from the U.S. Department of Energy (DOE) shows that residential buildings consume 22 percent of all the energy used in the United States annually. In addition to this, according to the USGBC (United States Green Building Council) buildings in the United States account for 39 percent of total carbon dioxide emissions. Beyond energy conservation, sustainable design can also increase comfort, save material costs, create a more healthful living space and produce a more durable building. The positive qualities of sustainable or green building make it especially attractive in the luxury home market where homes are often built in unique and environmentally attractive or sensitive areas.

Sustainability and green building design are not new concepts in the practice of architecture. The principles have existed for decades. There have always been designs that take advantage of natural systems, from tepees to the Capitol Building, but the materials and forms were not technically advanced. Today, construction materials and building science technologies have evolved enough that they can support sustainable building goals, and windows are no exception.

GREEN BUILDING AND BEYOND

Green building programs can support and architect's goal of creating a sustainable design while also satisfying the aesthetic needs of the project.

Green building is a very popular trend today but goes beyond simply improving insulation and recycling construction waste. Today green building also takes into account many other more subtle metrics. Here are a few of the important ones to consider:

Embodied Energy (EE): the quantity of energy required to manufacture and supply (to the point of use), a product, material, or service.

Life Cycle Assessment (LCA): the total environmental impact of a material or product through every step of its life—from the raw material extraction, to transport, manufacturing, assembly, installation, use in a building, and finally through its disassembly, deconstruction and/or decomposition. This term is also known as a cradle-to-grave analysis.

Windows have evolved from single-pane light sources to the high tech fenestrations now recognized as an integral part of the green built environment. Modern windows have the ability to lower energy bills by reducing, or allowing, solar gain, depending on the climate zone. Understanding the main attributes of windows and how these characteristics apply to green or sustainable building goals is an important first step in matching the right window with a luxury home.

As popular as green building is, it remains subjective. Identifying processes and products that are green is an extremely difficult task. It is not always scientific and there may not be a definite yes or no answer. The answer is often relative. However, there are a number of programs and organizations available to assist with assessments. When it comes to windows, being able to identify a high-quality product that will satisfy sustainability, comfort, and luxury aesthetic goals is critical. The following are some of the more common programs and organizations that help define green or sustainable building products and practices.

Energy Star

Energy Star is a joint program of the U.S. Environmental Protection Agency (EPA) DOE designed to help save money and protect the environment through energy efficient products and practices.

Energy Star qualified windows have met a series of energy efficiency guidelines set by the EPA and the DOE. It does not measure/evaluate materials or their sources.

National Fenestration Rating Council (NFRC)

As a non-profit organization, the NFRC administers a uniform, independent rating and labelling system for the energy performance of windows, doors, skylights, and attachment products. Their goal is to provide fair, accurate, and reliable energy performance ratings so that architects, builders, code officials, contractors and homeowners can compare different products and make informed product choices.

Ratings provided by the NFRC also help building officials, state government employees, and others involved in code development and enforcement to determine if products meet local codes. The NFRC is also one of the industry standard rating organizations that help manufacturers have a fair and level playing field to compare products and an accurate method of showing the energy benefits of new designs or technology.

American Architectural Manufacturers Association (AAMA)

The AAMA is a material-neutral organization, comprised of members from window, door, and skylight manufacturers, component and supply manufacturers, and service and consulting companies. Established in 1936, AAMA represents all sizes of companies, from all across the USA and internationally. Addressing issues of critical importance to its members, it provides a forum for sharing experiences and knowledge, while participating in efforts to shape the future for its members.

AAMA is a primary source for performance standards, product certification and educational programs for the window, door and skylight industry. AAMA proactively and effectively influences codes, construction and specification issues.

Window and Door Manufacturers Association (WDMA)

WDMA is a trade association for the window, door and skylight industry with members in Canada and the USA. The organization offers a Hallmark Certification program to ensure that fenestration products are manufactured in accordance to their standards. In addition, they develop industry standards and test methods, certify products to industry standards.

As a trade organization WDMA represents the industry before building code and regulatory bodies, conducts research and collects data on the fenestration industry, provides educational programs and training for members, and serves as an information clearinghouse for specifies, architects, builders, contractors and consumers.

The Sustainable Forestry Initiative

Founded by the American Forest & Paper Association in 1994, the Sustainable Forestry Initiative (SFI) was originally designed as a code of conduct for the forest products industry in the United States, the SFI program has become one of the world's largest sustainable forestry and certification programs.

In 2007, a new, fully independent organization, the Sustainable Forestry Initiative, Inc. was created to direct all elements of the SFI program. They developed a comprehensive third-party certification procedure for participants to document and communicate their compliance with the SFI Standard.

To be certified, an applicant must undergo a review of its operations by an audit firm accredited by an independent body, such as the American National Standards Institute (ANSI) or the Standards Council of Canada. Auditors must meet educational and professional criteria established by SFI, Inc.

Forest Stewardship Council (FSC)

The FSC is an international not-for-profit membership-based organization that accredits certification organizations (such as Rainforest Alliance–SmartWood) in order to guarantee the authenticity of their claims. Their goal is to promote environmentally responsible, socially beneficial, and economically viable management of the world's forests by establishing a worldwide standard of recognized and respected Principles of Forest Stewardship.

Founded in the early 1990s, FSC was created to change the dialogue about the practice of sustainable forestry worldwide. The FSC standards represent the world's strongest system for guiding forest management toward sustainable outcomes.

In addition to these specific product certification programs, there are several green building programs that can validate the overall design and construction of the building. These programs can be especially helpful when selecting windows as they can suggest attributes or certifications a window must have to be considered part of an overall sustainable design package.

The following are a few of the more recognized green building programs available today for sustainable design for residential homes.

NAHB's Model Green Home Building Guidelines

The National Association of Home Builders designed the program as a tool kit for individual builders looking to engage in green building practices. It also aims to assist homebuilder associations looking to launch their own local green building programs.

The Model Green Home Building Guidelines are for the mainstream homebuilder and is designed to systematize green design and the construction process. The program highlights the methods a mainstream homebuilder can effectively include to introduce environmental solutions into new homes.

Leadership in Energy and Environmental Design (LEED)

LEED Green Building Rating System is the nationally accepted benchmark for the design, construction, and operation of high-performance green buildings. LEED provides building owners and operators with the tools they need to have an immediate and measurable impact on their buildings' performance. It promotes a whole-building approach to sustainability by recognizing performance in five key areas of human and environmental health: sustainable site development, water savings, energy efficiency, materials selection and indoor environmental quality.

In the United States, LEED is administered by the U.S. Green Building Council; in Canada, it is operated by the Canada Green Building Council.

While these certifications and programs can help point the architect toward a window that can satisfy sustainable design goals, it is important to understand the basic criteria that these programs use to evaluate windows. There are two general areas to be familiar with when evaluating the sustainable aspects of a window, energy efficiency and what the materials used to produce the window.

While some green building programs focus strictly on commercial buildings, more opportunities are being created for residential sustainable project.

HOW WINDOWS CAN BE ENERGY EFFICIENT

Windows impact the energy efficiency of the house by reducing the heat transfer from the outside environment to the inside of the home. To determine how well a window operates at reducing heat transfer, there are three factors that can be evaluated: direct heat transfer, solar gain, and air tightness.

To evaluate the direct heat transfer of a window is to determine how well a window blocks heat from directly conducting through the unit. To measure this, windows are given a U-factor. U-factor is the rate at which a window, door, or skylight conducts non-solar heat flow. It is usually expressed in units of BTU/hr-ft^2-oF. For windows, skylights, and glass doors, a U-factor may refer to just the glass or glazing alone. NFRC U-factor ratings, however, represent the entire window performance, including frame and spacer material. The lower the U-factor, the more energy-efficient the window, door, or skylight.

The second evaluation of energy efficiency for windows is how well the product performs at blocking solar radiation, or sunshine, from passing through the glazing. This rating is called the solar heat gain coefficient (SHGC). The SHGCis the amount of solar radiation admitted through a window, door, or skylight—either transmitted directly and/or absorbed, and subsequently released as heat inside a home. The lower a product's SHGC, the less solar heat it transmits and the greater its shading ability. A product with a high SHGC rating is more effective at collecting solar heat during the winter. A product with a low SHGC rating is more effective at reducing cooling loads during the summer by blocking heat gain from the sun.

The third rating to consider when evaluating a window for energy efficiency is the air leakage rating. This is the rate of air movement around a window, door, or skylight in the presence of a specific pressure difference across it. It is expressed in units of cubic feet per minute per square foot of frame area (cfm/ft^2). A product with a low air leakage rating is tighter than one with a high air leakage rating.

These three primary energy efficiency ratings can be found on the NFRC label attached to the window, although the reference to the air leakage is optional in many regions. For windows, Energy Star bases its qualification only on U-factor and solar heat gain coefficient ratings.

Historically, single pane windows did very little to reduce the amount of energy that passed between the outside environment and the inside of the home. Glass by itself is highly conductive, so to improve energy efficiency a second and then third pane of glass was added to the window frame. The spaces between the panes greatly reduce heat transfer and are filled with argon or a similar inert gas with a low heat transfer property. The gas works to both reduce heat transfer and also eliminate fogging from humidity between the panes.

The other aspect of energy efficiency in windows is the coating put on the glass panes. Low-emissivity (low-e) coatings on glazing or glass control heat transfer through windows with insulated glazing. A low-e coating is a microscopically thin, virtually invisible metal or metallic oxide layer deposited directly onto the surface of one or more of the panes of glass. The low-e coating lowers the U-factor of the window. Different types of low-e coatings have been designed to allow for high solar gain, moderate solar gain, or low solar gain.

Windows manufactured with low-e coatings typically cost about 10% to 15% more than regular windows, but they may reduce energy loss by as much as 30% to 50%. This significant reduction in energy loss can be especially advantageous for luxury homes, which are generally larger and have more windows than traditional homes.

A final consideration when evaluating low-e windows for luxury homes is the UV, or ultraviolet, protection the window coatings offer. Blocking UV light is important because it can protect furniture, art, carpet and décor from the fading effects of UV exposure. Low-e windows can block over 70 percent of the UV light coming into the house through the window.

Visit http://go.hw.net/AR614Course2 to read more and complete the quiz for credit.

QUIZ

1. Which of the following is not a benefit of sustainable design in luxury home building?
   a. Improved energy efficiency
   b. A more healthful living environment
   c. Improved home security
   d. Increased durability

2. What does the U-factor rating of a window measure?
   a. The number of panes in the window (singe, double, or triple)
   b. How well the unit blocks the flow of thermal energy or non-solar heat flow
   c. How well the window reflects visible light
   d. The amount of noise the window allows to pass through

3. What does SHGC stand for?
   a. Society of Heating, Glass, and Countertops
   b. Sustainable and Healthy Guidelines Council
   c. Sustainable Home Governance Committee
   d. Solar Heat Gain Coefficient

4. Why is blocking UV (ultraviolet) light an important aspect of luxury home design?
   a. UV rays increase heat within the building, driving up energy bills
   b. Excessive UV rays can lead to house fires
   c. UV rays can fade furniture, carpets, and art
   d. You should not try to block UV light

5. Which of the following should be considered as part of the life cycle analysis of a window?
   a. Initial cost of the product
   b. How easy the product can be recycled at the end of its functional lifespan
   c. Weight and shipping costs
   d. The value, in dollars, of the potential energy savings

6. What are some of the primary benefits of daylighting as an architectural design element?
   a. Improved mood for the occupants
   b. Increased resell value
   c. Reduce energy use through temperature regulation and artificial light use
   d. Improved line of sight for occupants

7. What is the base material of a window?
   a. The glass or glazing type
   b. The type of primer paint used
   c. The exterior of the bottom sill
   d. The material the frame is made from

8. What are some of the attributes of a high quality window base material?
   a. Moisture resistant and dense grain
   b. Sustainable forest certified
   c. Natural smell and pleasing grain tone or color
   d. Low VOC

9. From a quality standpoint, which of the following describe the benefits of extruded aluminum when compared to roll-formed aluminum?
   a. Extruded aluminum can withstand greater impact without sustaining damage
   b. Extruded aluminum can be shaped for more intricate profile details
   c. Provides a more uniform base for high quality paint finish
   d. All of the above

10. True or false. Copper and bronze, as a window cladding material are superior products because they will retain factory finish for the entire life of the window
    a. True
    b. False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“To frame the current exhibit within the context of MoMA’s own institutional history seems to repeat the very error that this exhibit seeks belatedly to correct.”

MoMA’s Latin American Mea Culpa by Alexandra Lange

The Museum of Modern Art's new exhibition, "Latin America in Construction: Architecture 1955–1980" (until July 19), is an assembly of work that may never be repeated. With more than 500 original drawings, models, photographs, and films from the last half-century, by architects working in 10 countries and one commonwealth, the show reveals a depth to the region's architecture well beyond Oscar Niemeyer, Roberto Burle Marx, Luis Barragán, and the insurgent Lina Bo Bardi. While all of the above appear multiple times across the exhibition's five galleries, they are flanked by equally talented colleagues, collaborators, and mavericks.

It is a remarkable collection of everything you could possibly call Modernism—diagrid skyscrapers, abstract landscapes, megastructures, cities of slabs. The tricky part is figuring out how to navigate the treasures. You could get stuck in the front room where, on a set of seven screens reminiscent of some 1960s World's Fair pavilion, filmmaker Joey Forsyte has assembled vintage footage into jaunty eight-minute documentaries on the region's cities. We see palm trees and old cars, zeppelins and beaches, skyscrapers and hand-of-God architects placing little blocks in a sea of the same.

Or you might get caught in the second room, where Mario Pani and Enrique del Moral's campus plan for Universidad Nacional Autonoma de Mexico (1947–54) faces off against Carlos Raúl Villanueva's Ciudad Universitaria, Caracas (1945–70). "Both were at once motors for their respective cities' expansions and model cities in their own right," says the wall text. "Both were built in a few short years to showcase modern architecture as a carrier of national identity and as a synthesis of the arts, integrating sculpture, murals, mosaics, and related arts."

Then there's a display titled Brasília, which includes Lúcio Costa's soaring 1957 competition sketch for the capital. The curators have carefully eschewed the photography-first approach to architecture so common today online, privileging original architectural drawings, models, and collages, as well as vintage photographs that, while not oversized, are mostly spectacular. One in particular, taken by Brazilian photographer Marcel Andre Felix Gautherot of the ministries under construction in Brasilia in 1958, makes it look as if the buildings are shimmering themselves into being, like desert mirages, while workers in the foreground immediately belie that reading. (MoMA also sponsored an Instameet, which prompted Instagram users to upload more than 17,700 present-day images of the featured projects; search the hashtag #arquimoma.)

Lúcio Costa and Oscar Niemeyer's Plaza of the Three Powers in Brasília

LEONARDO FINOTTI

As for the main event, it unfolds in the museum's large sixth-floor temporary exhibition gallery, which has been left as one big room, subdivided by display walls stripped to their metal studs above head height. I thought this was a nod to the indoor–outdoor flow of space in Latin American architecture, but was told by a publicist it was actually in response to the "in construction" of the exhibition's title. The top of the southern gallery wall is marked with a timeline of important political dates, too high for easy reference; below that is a chronological survey of significant experiments in housing. Elsewhere in the room are other typological arrangements, not all well marked, including cultural and sports facilities, recreational projects, and offices.

Buenos Aires, the first city in the southern hemisphere to build a skyscraper, Palacio Barolo (1919–23) by Mario Palanti, also held a competition in 1961–62 to design the first modernist skyscraper, Edificio Peugeot. Competition entries, mounted in a grid, show that not much has changed since then: There's a Miesian slab, a Fosterish diagrid, an Anne Tyng–like spaceframe. Only the shadowy photos suggest the age of the entries; at least in international skyscraperland, Modernism marches on.

Because of the archival emphasis, and the sheer number of works in the show, most displays are far from immersive. A rare exception is the one for Clorindo Testa and SEPRA Arquitectos' headquarters for the Banco de Londres y America del Sur, Buenos Aires (1959–66), which includes sketches and a giant cutaway model—one of several new models made and installed at eye height so that you can mentally enter the building. A 1965 photo by Manuel Gomez Piñiero reveals an interior scale similar to that of the

(later) Ford Foundation by Roche Dinkeloo, which also features an internal space with a set of stacked, shelf-like façades.

An Institutional Mea Culpa

The exhibit was organized by Barry Bergdoll, former chief curator of the Department of Architecture & Design; curatorial assistant Patricio del Real; Jorge Francisco Liernur from the Universidad Torcuato di Tella, Buenos Aires; and Carlos Eduardo Comas of the Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. In an interview with *Metropolis,* Bergdoll discussed the show as a personal and institutional mea culpa. The last time MoMA surveyed Latin American modern design was 1955, with the photographically driven "Latin American Architecture Since 1945."

The 1955 exhibit, as well as the 1943 MoMA show "Brazil Builds," were both significant. But to frame the current exhibit within the context of MoMA's own institutional history seems to repeat the very

Bergdoll spoke, at the press preview, of recognizing Latin American architecture "as the great conversationalist that it was." But as I went through the exhibit, I felt that it failed to inspire those conversations.

error that this exhibit seeks belatedly to correct. The museum's research and scholarship matter, of course, but the work featured here is already influential and significant on its own. It doesn't need MoMA's imprint to somehow validate it.

Bergdoll spoke, at the press preview, of recognizing Latin American architecture "as the great conversationalist that it was." But as I went through the exhibit, I felt that it failed to inspire those conversations, whether about the "synthesis of the arts" mentioned in the campus projects, or dialogues between individual architects, or how the political systems in that timeline on the wall shaped the architecture. The show could do more to integrate these monuments into an international narrative, regionally and globally, and tease out the connections between people, buildings, and the arts.

Those connections don't have to be formulated (as they have often been in the past) as the north influencing the south: You can make a network chart without directional arrows. At times it felt like the wall labels were trying so hard not to suggest influence as to leave visitors without any interpretive framework at all. When I see Jesús Tenreiro Degwitz's 1967–68 headquarters for the Corporacion Venezolana Electrificación del Caroní, with its stacked structure and gridded outrigger sunshades of brick and steel, I can't help thinking of Eero Saarinen's 1964 Deere & Co. headquarters in Moline, Ill., with the same (minus the brick). Did both architects visit Katsura?

Alvar Aalto is mentioned on the label for the beautifully planned Residential El Polo complex in Bogotá (1959–62) by Rogelio Salmona and Guillermo Bermúdez. But he's not mentioned in the text accompanying the two spectacular churches by Uruguyan engineer and architect Eladio Dieste, which, in their handling of brick, light, and curves, suggest a kinship with the Finnish architect (though Dieste's engineering was likely more advanced).

What "Moderno" Gets Right

For a sense of what's missing, head up Park Avenue 15 blocks to the Americas Society. There, guest curators Maria Cecilia Loschiavo dos Santos, Ana Elena Mallet, and Jorge F. Rivas Pérez have organized the small but exquisite "Moderno: Design for Living in Brazil, Mexico, and Venezuela, 1940–1978" (until May 16) around the question of the domestic landscape. A few designers overlap between the two shows. There's the Bahia chair and a wall-size image of the Glass House by Bo Bardi, another chair by the great Mexican architect Pedro Ramírez Vázquez, and the Mexican entry from MoMA's epochal 1940 Organic Design in Home Furnishings competition: the webbed Scorpion chaise by Michael Van Beuren, Klaus Grabe, and Morley Webb.

The chaise and the drawings from the society's archives underscore the point that modernist ideas happened in many places at once: Bruno Mathsson in Sweden and Danish Jens Risom in New York also explored combinations of webbing and wood for seating during this era. Moreover, the wall text discusses designers like Van Beuren and Cynthia Sargent (one of a handful of women in "Moderno") who came from North America to Latin America and stayed. (Van Beuren also trained at the Bauhaus.) Sargent's wall-size Scarlatti rug, in pink and orange and yellow, provided the hit of graphic color that I associate with Latin American architecture, and which, on the whole, seems lacking in the MoMA exhibit.

In another welcome turn, "Moderno" calls out more of the contemporary crosscurrents between nations. In its attempt to avoid comparisons, the MoMA curators screened out most North American and European architects who built in Latin America during this era, and relegated work by Latin American architects outside of their country of origin to a


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separate export section. This creates a motley array of projects in the MoMA exhibition's final hallway, including pavilions for expos in Milan, Montreal, and Osaka, designs for major buildings in Spain, and a rough sketch for the central plaza at Louis Kahn's Salk Institute in La Jolla, Calif., by Barragán, a consultant on the project. A spectacular model for the 1968 Mexican pavilion in Milan by architect Eduardo Terrazas distills the design for the Olympic games (here credited to Terrazas, Ramírez Vázquez, Brit Beatrice Trueblood, and American Lance Wyman) into an approximately 4-foot by 2-foot lidded box, like the most fabulous dollhouse in the world. But why no other images from the actual games, and why not put this artifact over near the stadiums section?

There's also the question of the numerous modern architects, Bo Bardi and Villanueva among them, who were born abroad but moved to Latin America. Without resuming the tired narrative of Le Corbusier bringing Modernism to this part of the world, it still seems possible to talk about who came from where and studied or worked with whom.

It's difficult to address these matters in an exhibition, but I still think the curators of "Latin America in Construction" could have offered more guidance about the superlative artifacts assembled. I came away from the galleries overwhelmed by what I didn't know, but very excited to plan my next trip south.

The Mexican Pavilion of the Triennale di Milano, 1968

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“A major part of the experiment will unfold this summer, because the building will not be air-conditioned. This is a daring experiment in Philadelphia.”

KieranTimberlake’s New Sandbox by Witold Rybczynski, HON. FAIA

It's always revealing when architects design their own offices. Norman Foster, Hon. FAIA's vast glass-walled London studio overlooking the Thames signals teamwork and stylish competency. Renzo Piano, Hon. FAIA's terraced hillside greenhouse complex in Genoa is both technically advanced and leafily romantic. Frank Gehry, FAIA's industrial shed in Santa Monica is messily disorganized—in an arty way.

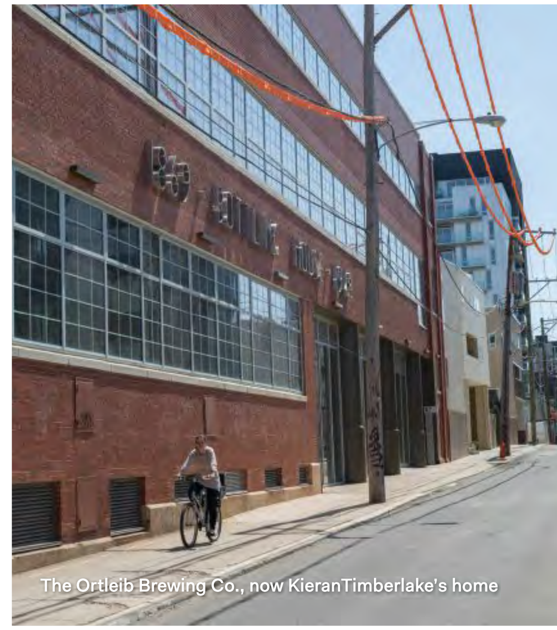
Stephen Kieran, FAIA, and James Timberlake, FAIA's new office is situated in Northern Liberties, a gritty Philadelphia neighborhood that, in an earlier age, was home to factories, mills, tanneries, foundries, and breweries—an unexpected setting for an architecture firm. But in this case a fitting one, because their office is not a showpiece but a hands-on workplace—purposeful, flexible, open-ended. Kieran calls it "our huge sandbox."

A visitor approaching the entry lobby is not greeted by the usual display of architectural models and artful photographs of completed buildings, but by the view, through a glazed wall, of a large workshop. The assorted machine tools, workbenches, stacks of building materials, a concrete mixer, and a hand pallet truck send a clear message: This is a place where things are *made*.

KieranTimberlake's new home is a two-story red-brick structure built in 1948 as a bottling house for the Henry F. Ortlieb Brewing Co., one of Philadelphia's many German-style breweries. (The original sign on the exterior of the building includes "1869," the brewery's founding date.) Decommissioned in 1981 when Ortlieb was taken over by a competitor, the cavernous building stood empty, finding intermittent use as a jazz club, a brewpub, a boxing venue, and a baseball batting cage. In 2012, KieranTimberlake bought the building and spent two years renovating it. The firm, which currently employs 85 people, moved in at the beginning of this year.

Ortlieb's architect was Richard Carl Koelle, a graduate of the University of Pennsylvania whose mentor, Paul Cret, had started incorporating modernist elements in his work by the late 1930s. The bottling house's modular ribbon windows, standardized bays, exposed steel structure, and unadorned brick are typical of Philadelphia's International Style, of which the most illustrious example is Howe and Lescaze's PSFS Building.

KieranTimberlake's respectful renovation—the restored building is now listed on the National Register of Historic Places—preserves the original architecture. Workers replaced the old aluminum factory sash windows with high-performance facsimiles, repaired the glazed brick walls of the interior, restored



The Ortleib Brewing Co., now KieranTimberlake's home

the roof monitor, and put on a new roof. Bits of the old bottling house poke through here and there: an old refrigerator room door, a piece of overhead gantry, a pipe railing in the fire stair.

Today, the first floor contains a lunch room, a research lab, a data room, a technical library, and material samples storage, as well as the workshop, which has direct access to the street since it was originally a truck dock. A tall open room outside the workshop is what Kieran, who gives me a tour, calls a "maker space." "Most projects use site-based mock-ups, but by then the construction has started and it's really too late to make substantive design alterations," he says. "We build mock-ups in our office during the design process." For example, the architects built a life-size section of the curtainwall for the Rice University physics lab, Brockman Hall, one of the winners of this year's AIA Institute Honor Awards for Architecture (see page 196). For a low-rise housing system being developed for a client in Ahmedabad, India, they modeled structural components and fabricated prototype panels of lightweight concrete. "We had a workshop in our old office," says Kieran, "but we have more space here, which will allow us to build larger mock-ups and leave them up longer."

The main studio is on the second floor, where the bottling line was originally located. Steel trusses span 76 feet and create a spectacular column-free space 190 feet long, brightly lit by ribbon windows and an overhead roof monitor. The room is filled with architectural workstations: the usual office clutter of keyboards, big flat monitors, laptops, ergonomic task chairs, file cabinets, and the occasional roll of yellow trace. Circular conference tables are interspersed among the desks.

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Photo by David Laudadio

No partitions or cubicles interrupt the sea of work tables, and the initial impression is of a Bloombergian bullpen, the sort of open office embraced by Silicon Valley firms such as Facebook, Google, and Yahoo. This impression is misleading. For one thing, the layout is not static. “Everything is movable,” says Kieran. Work desks, drawer cabinets, chairs, and conference tables are all on large wheels that can be locked in place with a foot pedal. “People regularly move around as new projects come along and new teams are formed,” he says, pointing to a group of architects sitting around a table. The no-nonsense furniture, designed by the architects using a workbench system with black epoxy tops, was moved from the firm’s old office. “The movable furnishings have evolved over more than a decade and are now a deep part our culture,” says Kieran. His own desk, like that of the other partners, is out in the open; there are no private offices.

Teamwork is fundamental to any architectural practice, but moving furniture rather than moving

The second-floor studio has movable furniture that can be rearranged as new project teams are created

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people from desk to desk is unusual. Instead of shifting between anonymous workstations, people take their personalized work environments—chair, work table, computer desk, and rolling file—with them. Power, telephone, and data are provided by a grid of outlets in the raised access floor. The only planning constraint is provided by heavy drawing files that define circulation spaces on the edges of the work area; otherwise the "plan" is the result of changing circumstances. The scattered layout reminds me of an improvised campground.

The open-office concept is often criticized—and often disliked by users—because of the lack of privacy.


The studio, which often resembles an improvised campground

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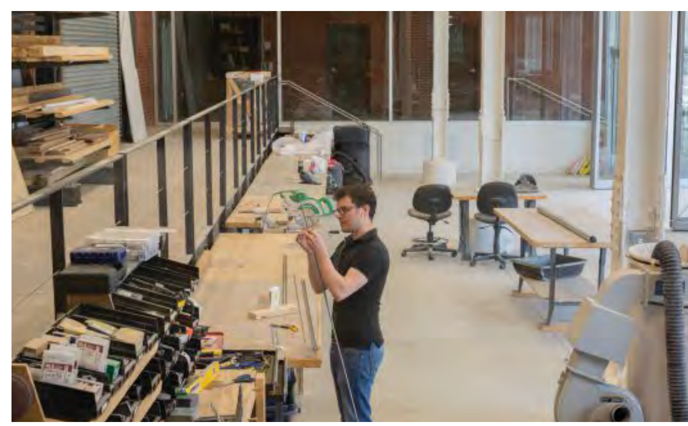
The KieranTimberlake office provides a common remedy: adjacent to the open space are a variety of meeting rooms. Five open spaces, for team reviews and presentations to clients, are enclosed by 10-foot-tall pin-up walls that resemble huge easels—tilted to make them easier to write on. Needless to say, they are on wheels. In addition, there are five smaller enclosed rooms that provide seclusion—and quiet—for meetings, writing, conference calls, and private tête-à-têtes. The walls are painted with dry-erase paint and function as floor-to-ceiling whiteboards. "Our previous office had three open and three enclosed meeting spaces," says Kieran. "Everyone felt that we needed more conference space." The firm is using a similar arrangement of open plan and private meeting rooms in the much anticipated American embassy in London, now under construction.

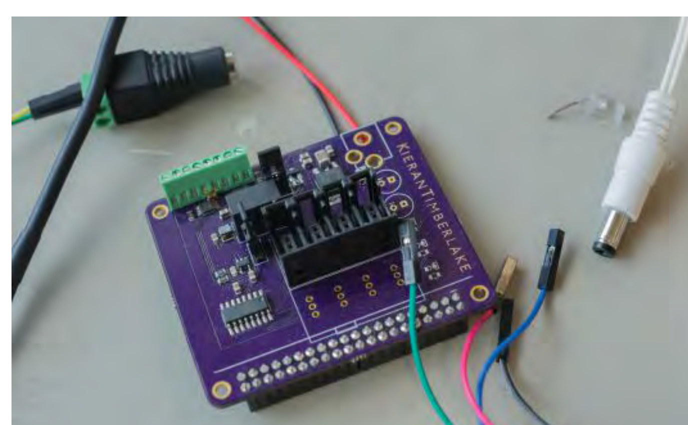
The Cognitive Benefits of Taller Ceilings

"We tend to assume that employee engagement is about the work, that so long as we give talented people challenging tasks and the tools to excel, they will be happy," observes the psychologist Ron Friedman in his recent book, *The Best Place to*

Work: The Art and Science of Creating an Extraordinary Workplace (Perigree Books, 2014). "But that formula is incomplete. Our mind responds to the signals in our environment. And the less comfortable we are while doing our work, the fewer cognitive resources we have available." In his discussion of open plans and private cubicles, Friedman points out that research has shown that no single setting is conducive to every task. The solution is to offer choices. "When companies offer employees a choice of location, they don't just create an environment that better positions workers to succeed, they empower their team members, demonstrating trust in their decision-making abilities," Friedman writes.

At a time when many companies are adding amenities such as basketball courts and putting greens to enhance their employees' experience of the





Top: The workshop, which was originally a truck dock

Above: An interface board, which connects the office's wireless sensors measuring temperature and humidity levels to the network

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workplace, Friedman argues that feeling good at work may be the result of something much more primal. For example, he cites a study that tested participants in two different settings: a room with an 8-foot ceiling and another with a 10-foot ceiling. The surprising finding: "Participants in rooms with taller ceilings were significantly better at finding connections between seemingly unrelated objects than those whose ceilings were slightly lower."

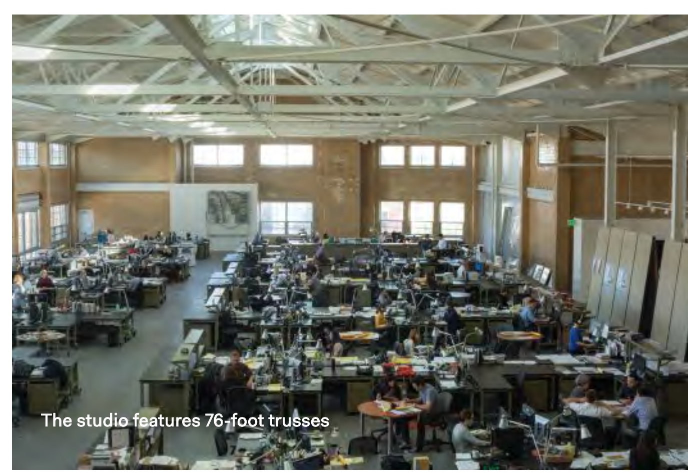
Friedman suggests that many of our environmental preferences—sunlight, view—are rooted in evolutionary psychology. "Research even suggests that the amount of direct sunlight entering an office can reliably predict the level of employee satisfaction in a workplace," he writes, citing a 2013 study which found that employees whose offices had windows slept more soundly at night than their counterparts who worked in windowless offices. It is also likely that sunlight and view are cognitively rejuvenating. "The result is an elevation in mood as well as replenished mental energy that improves our memory and enhances our creativity," Friedman concludes.

Philly Summers Without AC

Kieran agrees. "We all feel better—and work better—in natural light and with fresh air," he says. The Ortlieb bottling house was built when daylight and natural ventilation were the norm. The rooftop monitor, for example, had operable windows for fresh air, and the two banks of ribbon windows brought in daylight. KieranTimberlake has embraced—and enhanced—these "green" features of an earlier era. The west-facing ribbon windows are now fitted with blinds that adjust automatically as sensors read light levels. (During the bright winter day when I visited, the blinds lowered themselves partway as the sun moved around the building.) The operable monitor windows are controlled by the building's environmental management system. Lighting requirements have changed since architects labored at drafting tables, and the chief requirement for computer monitors is lack of glare, not illumination. The studio has a minimum amount of artificial ambient lighting—a single row of LED uplights on the central truss—otherwise workstations have individual task lights. Since there are no partitions, there is a spill-over effect. The 30-foot-tall space is exceptionally quiet, and its sheer volume appears to absorb sound, so that the background noise of multiple conversations rarely rises above a murmur. "It produces a church-like atmosphere," says Kieran. "You tend not to raise your voice. Sometimes I wish someone would occasionally shout out."

The raised access floor of the studio houses a displacement air heating system. This low-induction technology distributes warmed air through a floor plenum. Since warm air has a lower density than cool air, this creates natural upward convective flows. When I put my hand above a floor register, I can feel the very slight pressure of lukewarm air. Kieran explains that the new office is an experiment with the firm as the subject. "For example, we've tried keeping the temperature on the low side," he says, "and though it's been only four days since we moved in, it's amazing how quickly people have adapted, wearing sweaters and heavier clothes." (When I speak to him a month later, he says that they have made adjustments to the heating—it was a little too cool, even with sweaters.)

Roderick Bates is a member of the research group within the office that is responsible for monitoring the environmental performance of the building and providing information to—and getting feedback from—the staff. More than 400 sensors, many embedded in the building's walls and floors during the renovation, monitor ambient air temperature, surface temperature, and the temperature of the building fabric, as well as relative humidity. The wireless sensor network, which KieranTimberlake is in the process of commercializing, is designed and fabricated in-house. The collected data will be used to develop a management plan to "tune" the building on a daily basis.


The studio features 76-foot trusses

Already, according to Bates, they have found that air quality is exceptionally high. He also explains that while the old building is relatively leaky, the thermal mass of the concrete floors and masonry walls is so large that their surfaces' radiant temperature makes it possible to reduce the ambient air temperature without jeopardizing comfort. "We are currently experimenting to see the effect of cycling down the heating system at night," says Bates. He tells me that

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the long-term goal is to influence human behavior by passing on cost-savings directly to the staff.

A major part of the experiment will unfold this summer, because the building (except for the data room) will not be air-conditioned. This is a daring experiment in Philadelphia, where summers are hot and humid. The combination of active and passive cooling will depend on a variety of devices: opening windows in the monitor, using exhaust fans, supplying night-cooled air via the floor plenum, and dehumidifying air at the height of summer. “We’re all a little nervous,” says Bates. I tell him that I plan to return in August to experience it for myself. “Expect to see a lot of shorts,” he says.

A Shift in Workplace Control

James Timberlake has described the firm’s new home as “the model of a 21st-century office space.” This is not hyperbole. However much LEED ratings are touted, the most effective way to reduce carbon emissions is not by building new buildings—no matter how energy-efficient—but by repurposing old ones instead. And real energy conservation, as opposed to greenwashing, requires more than fancy gadgets. It requires actual data on how buildings function environmentally and, equally important, real-life data on how their occupants behave: opening and closing windows, turning lights on and off, or even wearing shorts.

Daylighting and natural ventilation are not only energy issues. As Ron Friedman reminds us, productivity—and creativity—in the workplace are greatly enhanced when we experience a general sense of physical well-being. Sunlight, fresh air, views, and even tall ceilings trigger deep-seated human responses that contribute to this feeling. And desks on wheels are not just a design trick. The ability to control and adapt our surroundings, and to choose the surroundings—big or small, open or enclosed—that suit the work we are doing, represent a shift of emphasis away from centralized to individual control. That shift may well herald the future of the 21st-century office. The best place to work? A place with choices.

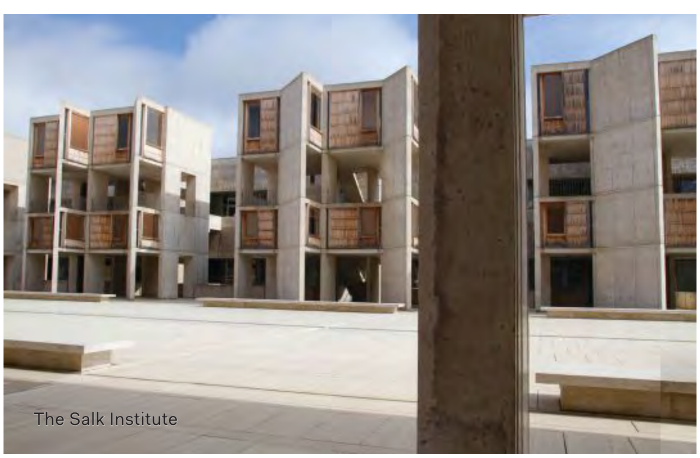
"We've got real problems with concrete. We've got real problems with modern metals. We've got problems with plastics, with curtainwalls and glass."

How the Getty is Saving Modernist Architecture by Mimi Zeiger

It's hard to believe that the Salk Institute is nearly a half-century old. Louis Kahn's masterpiece, perched on Pacific bluffs in La Jolla, Calif., has always had a conflicted relationship with time. Critic Esther McCoy, in a 1967 issue of *Architectural Forum*, wrote that "Kahn has said that he builds for today, not the future, but Dr. [Jonas] Salk maintains that in the laboratory building the future was built into today."

The Salk Institute might be enduring in its design. But even icons age. Today, the landmark needs significant work on its concrete and glass façade, as well a plan for maintaining the limestone courtyard. Kahn couldn't have predicted that fungus spores would drift on marine air from nearby eucalyptus trees and take root on the building, discoloring and eroding the teak window screens.

Which is why the Salk teamed up with the Getty Conservation Institute (GCI) to develop a long-term preservation strategy for the site. Based on a condition survey, historical research at the Kahn archives in Philadelphia, DNA testing, and surface treatment analysis on the building's façade, CGI came up with a conservation methodology. The Salk Institute Conservation Project, as it's called, is a model field study within the Getty's Conserving Modern Architecture Initiative (CMAI).


The Salk Institute

CMAI's goal is both ambitious and far-reaching: to ensure the survival of our modernist heritage, both here and abroad. In addition to model field projects, the initiative hosts professional training programs for conservators and architects, conducts scientific research on materials-based conservation, stages public lectures and workshops, and will eventually publish a series of books and periodicals.

The need has never been greater. According to CMAI project director Susan Macdonald, the typical life cycle of a traditional building—those made out of brick, stone, and timber—is 60 years before the first minor repair (restoring interior finishes, for instance), and 120 years for the first major repair (such as fixing damage to structural members). Modernist structures, by contrast, have an accelerated cycle—twice as fast, according to Macdonald. Which means that as many postwar buildings have started needing major work, they haven't had conservation plans in place. "By the time we got to the 2000s, these buildings from the '50s and '60s were up for their first major repair," Macdonald says. "Right now a lot of these buildings are at the moment in their life cycle where they need attention and repair. And we're having trouble knowing how to conserve them."

As a key first step, this spring the Getty announced the launch of HistoricPlacesLA.org, an online inventory and map of notable sites that was developed over a decade in partnership with the city of Los Angeles. It includes pre-1900 architecture in addition to modernist landmarks, historic districts and sites of cultural or social importance, and even features infrastructure: bridges, parks, and streetscapes.

GCI is not an advocacy group. Macdonald considers the survey of 880,000 parcels of land for the website project a critical first step in identifying the city's heritage. But as for lobbying and public awareness, CGI will leave that to organizations such as Docomomo International, the nonprofit watchdog for the worldwide preservation of modern architecture, or the Los Angeles Conservancy, one of the oldest nonprofits protecting 20th-century architecture.

Still, by advancing the knowledge of how to preserve modernist buildings, CMAI may be able to sway debates about at-risk sites. As we've recently seen with Brutalist architecture—consider Paul Rudolph's threatened concrete-and-glass Orange County Government Center in Goshen, N.Y., or John Johansen's demolished 1967 Morris A. Mechanic Theatre in Baltimore—a building's neglected condition is often used as justification for razing and redevelopment. When the fate of the Mechanic was still uncertain, Kirby Fowler, president of the Downtown Partnership in Baltimore, underscored the preservation challenges and offered them as reasons for demolition. The theater, he wrote in a statement to ARCHITECT magazine in 2012, is "an obsolete and failing structure that has been a blight on the community."

Form Follows Function as a Curse

Modernist buildings do pose some particularly daunting challenges. That era witnessed an expanded range of building typologies—schools, universities,

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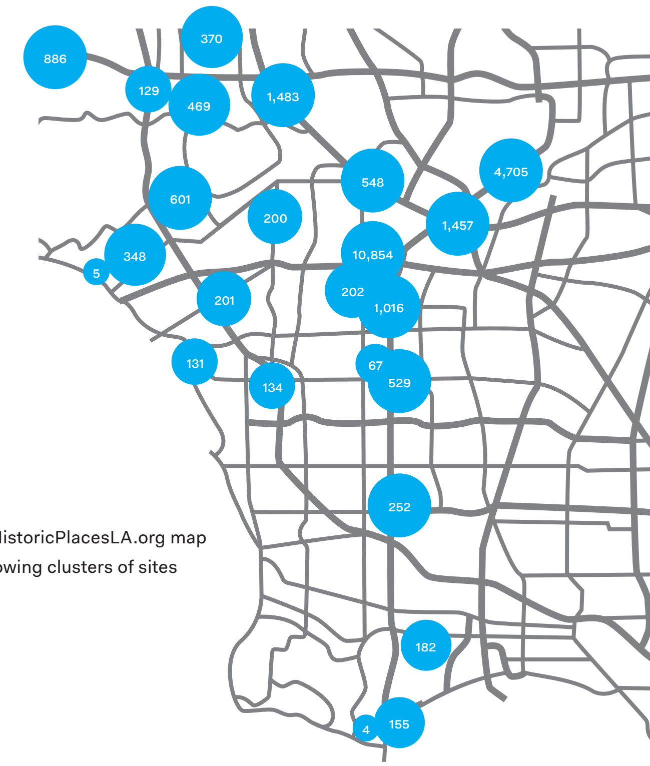
hospitals, industrial buildings, health centers—which were designed for very specific uses. But as those initial purposes become defunct, buildings owners are left with the task of adapting a particular design to a new program. Which is when that old adage—form follows function—becomes more of a curse than a blessing.

Central among CMAI's goals is to develop a holistic approach to maintaining the architectural integrity of buildings in the face of deteriorating materials. In 2013, the Getty hosted "A Colloquium to Advance the Practice of Conserving Modern Architecture," bringing together 60 experts, including Docomomo International president Ana Tostões, and Sheridan Burke, president of the International Council on Monuments and Sites (ICOMOS), which drafted some of the first widely adopted conservation guidelines, the 1964 Venice Charter. Physical conservation, a major theme at the colloquium, inspired a realization of how significant the challenges are with materials. "At the end, we came out and said we've got real problems with concrete. We've got real problems with modern metals. We've got problems with plastics, with curtainwalls and glass," recalls Macdonald.



A HistoricPlacesLA.org map showing clusters of sites

Concrete, Macdonald's area of interest, is the first material that GCI is studying comprehensively. Not only is it the ubiquitous building material of the modernist era; it is also one of the most difficult to conserve. Problems include spalling due to freeze–thaw cycles, cracking, and exposed rebar.

"Concrete was completely widespread and used en masse pretty much everywhere, particularly in the postwar era," Macdonald says. "It's got a lot of challenges, because even though it's a multimillion-dollar repair industry, none of it is particularly targeted well towards conservation. When you think about the exposed concrete buildings like Salk or any of the Brutalist ones, once you start to repair the concrete, the only techniques that are available and work properly now wreck the look of the building."

CMAI researchers are developing a variety of solutions,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from basic guidelines for how to properly patch a concrete façade, to experimental solutions, such as testing how hydrophobic coatings might help protect exposed concrete.

One of the essential tenets of Modernism—experimenting with new materials—has created another unexpected challenge, as many newfangled polymers and plastics haven't aged well. Technologically avant building systems have failed


Eames House

to guard against deteriorating sealants, crumbling foam, or discoloring fiberglass. Moreover, mass-produced and machined components present philosophical questions about authenticity, temporality, and reconstruction. In a position paper presented at the Getty's 2013 colloquium, GCI project manager Kyle Normandin put it this way: "Are standardized, machined building components understood to have the same significance as traditional carved-stone elements on a building façade, which are the work of a craftsperson?"

For Frank Escher and Ravi GuneWardena of the Los Angeles–based practice Escher GuneWardena Architecture, the answer is clearly yes. The

project architects for the initial phase of the work on the Eames House Conservation Project, their wide-ranging practice encompasses everything from contemporary art to working on classic houses by L.A. masters like John Lautner and Quincy A. Jones. (The Eames House was the first of CMAI's field projects; the Salk Institute is its second.)

The firm's investigations in art informed its work on the 1949 landmark, which Charles and Ray Eames designed for themselves in Pacific Palisades, Calif. Escher GuneWardena approached the conservation of the residence like the restoration of a painting: meticulous in the effort not to erase history. "All of the traces that we discovered in the Eames House during early investigations—the cracks in painted surfaces, mechanical abrasions on the wood, or discolorations or stains in the wood—these to us were something that we felt was absolutely necessary to preserve," says Escher. "They are part of the building's history and create a very particular atmosphere. We have always felt—and this began before the Eames

Top: A former GCI project specialist taking ultraviolet light readings in the Eames House

Bottom: GCI laboratory manager David Carson conducting a heating duct investigation in the house

TOP: SCOTT S. WARREN; BOTTOM: SUSAN MACDONALD


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House—that if you can tell that a building has been restored, you have gone too far."

At the Salk Institute, the teak window walls are themselves a kind of modern craft. Conceptually, they're critical to Kahn's idea of providing individual studies—almost monastic cells—to the institute's science fellows. The wood studies were meant as a domestic contrast to the lab. As Esther McCoy writes in her 1967 *Architectural Forum* article: "[Kahn called] one the architecture of the oak table and the rug, and the other the architecture of the pipes."

These studies offer a warm juxtaposition to the cast-concrete walls and the travertine plaza. Weathering of the wall assemblies due to a fungal biofilm from the nearby eucalyptus trees, and decades of trying various surface treatments to remove it, prompted the first phase of CMAI's field study. The team conducted archival research to understand Kahn's intent behind his design of a place that brings together science and the humanities, to figure out what changes had been made to the design during the construction phase, and to document the early history of maintenance and repair.

Preliminary assessments included taking samples of the window walls, which confirmed them as Burmese teak. Additionally, GCI's organic materials laboratory sent the fungus out for DNA analysis. Workers also conducted a number of investigations into the window wall assembly itself, opening up the framing and discovering that the local millworker had used standard studs and plywood inside in addition to the teak. Then they set about creating a series of on-site mock-ups to test various repair strategies. An ongoing project, the mock-ups are left exposed to the coastal climate and are used to model weatherproofing, surface treatments, and replacement techniques.

It's not your average retrofit. But this methodical approach, rooted in scientific and historical research, will help ensure that the Salk Institute thrives for the next half-century. And, if CMAI is successful, the research will help revive buildings whose future is far less certain.

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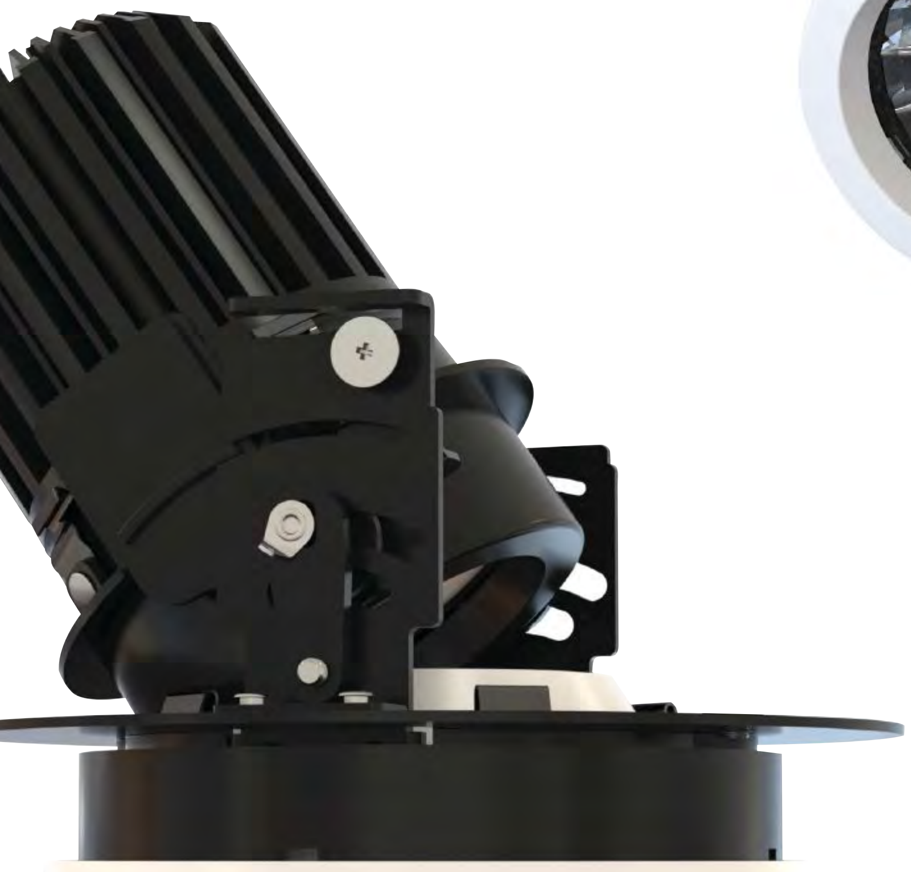

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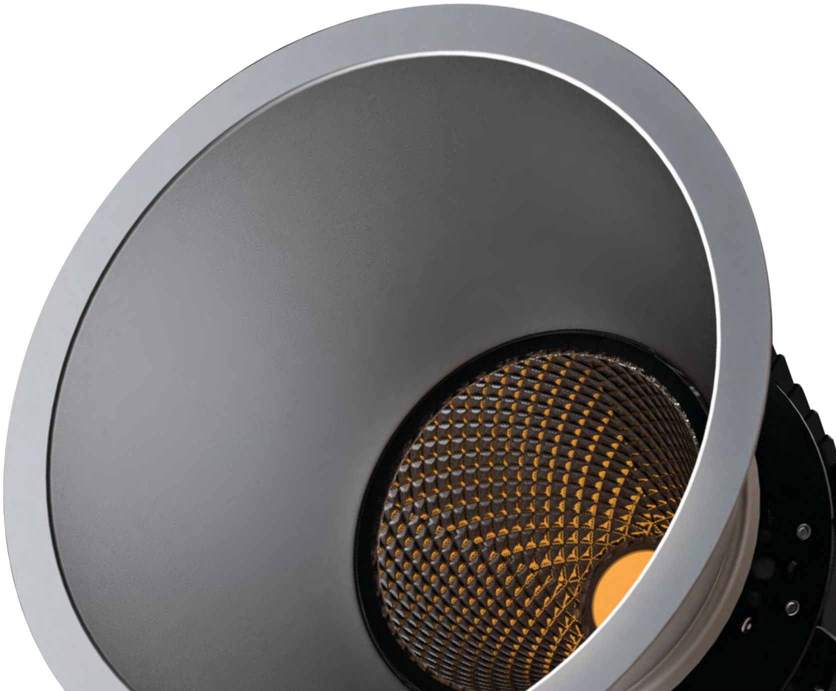

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Ehrlich Architects: Steven Ehrlich, Takashi Yanai, Mathew Chaney, Patricia Rhee

Peter Eisenman

Edward Mazria

Rural Studio: Andrew Freear

Thomas Lollini

Thomas Luebke

MAZRIA: MICHAEL CLARK; FREEAR: ROB CULPEPPER; LUEBKE: ELI MEIR KAPLAN

Mary Hale Stephen Francis Gray Elizabeth Whittaker Justin Crane

AIA Honor Awards

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Edward Mazria, AIA

The Kemper is conferred by the AIA board of directors on an architect member for contributions to the profession through service to the Institute. During a 40-year career as an author and educator, Mazria has spearheaded innovative research on how the built environment is affected by climate change. He is the founder of Architecture 2030, a nonprofit that develops planning, policy, and design solutions aimed at creating low-carbon environments. The organization's 2030 Challenge envisions making new buildings carbon neutral by 2030.

Whitney M. Young Jr. Award

Rural Studio

This award is conferred by the AIA board on an architect or architectural organization that contributes significantly to contemporary social issues. Auburn University's Rural Studio, located in Hale County, Ala., was founded in 1993 by late architecture professors Samuel Mockbee and D.K. Ruth. The mission: to give students hands-on design/build experience while improving the infrastructure and well-being of the underserved local community. Now led by director Andrew Freear, the studio has built more than 150 projects, including various iterations of a $20,000 house; recent work includes a new town hall for Newbern, Ala.; the renovation of a storefront into a public library, also in Newbern; and a home for a new Boys & Girls Club in Greensboro, Ala.

Thomas Jefferson Awards for Public Architecture

Thomas E. Lollini, FAIA

Lollini has made significant contributions to the campus designs of both the University of California, Berkeley, and the University of California, Merced. Hired in 2006 at Merced, he developed the Triple Zero Commitment plan, which pledges that by 2020, the university will achieve net-zero status for energy, waste, and emissions. To date, Merced is the only campus in the world where all the buildings are LEED-certified.

Thomas Luebke, FAIA

For the past decade, Luebke has served as the secretary of the U.S. Commission of Fine Arts in Washington, D.C. An advocate for historic preservation, he was instrumental in helping to find a new use for the historic St. Elizabeth's Hospital campus in D.C., which will be the future home of the Department of Homeland Security. Before joining the commission, Luebke worked as a preservation historian for the Alfred Mullett–designed Old Executive Office Building in D.C., and he also served as the city architect for Alexandria, Va.

The Latrobe Prize

Arid Lands Institute

With California in the midst of a devastating drought, the Arid Lands Institute at Woodbury University, in Burbank, Calif., has developed a new digital water mapping and modeling tool. Called Hazel, it was developed by the institute's Peter Arnold and Hadley Arnold; Rowan Roderick-Jones of Arup's Water Systems Group; Deborah Weintraub, AIA, the chief deputy city engineer for Los Angeles' Bureau of Engineering in the Department of Public Works; and Perkins+Will's Leigh Christy, AIA, and John Haymaker, AIA. The project aims to create solutions for harvesting more water locally, by reclaiming stormwater, recycling wastewater, and by designing other conservation techniques. The AIA College of Fellows awards the Latrobe, a biennial $100,000 research grant. ARCHITECT profiled the Arid Lands Institute in December 2013.

Associates Award

Stephen Francis Gray, ASSOC. AIA

Gray is a Boston-based senior associate at Sasaki Associates and an associate director on the Boston Society of Architects Board of Directors. Currently a lecturer in urban design at the Massachusetts Institute of Technology, Gray previously taught urbanism at Northeastern University and served as a visiting design critic at several Boston-area architecture and planning schools.

Mary E. Hale, ASSOC. AIA

Hale, a Boston-based designer at Shepley Bulfinch, is also a faculty member at the Boston Architectural College. She is a former chair of the Boston Society of Architects' Common Boston committee, which organizes New England's largest free architecture and design festival. Last year, Hale worked with local architects to organize a public panel discussion about Boston's waterfront.

Young Architects Award

José Alvarez, AIA

Alvarez was born in Caracas, Venezuela, and earned his M.Arch. at Tulane University. A principal at Eskew+Dumez+Ripple, where he has worked for 17 years, Alvarez serves as program director of the New Orleans chapter of the AIA Young Architects Forum and is the president of the award-winning Louisiana chapter of the National Organization of Minority Architects.

Zachary R. Benedict, AIA

Benedict manages community-based design and research for Ft. Wayne, Ind.–based MKM Architecture + Design. He has served on the local AIA chapter's board of directors, where he helped establish a partnership with Ball State University's College of Architecture and Planning in Muncie, Ind. That partnership has produced more than 120 student projects focused on downtown Ft. Wayne.

Hafsa Burt, AIA
In addition to running her San Francisco–based firm HB+A Architects, Burt is an involved community leader focused on collaborative change. She is a member of the AIA California Council's Committee on the Environment and regularly lectures on topics such as improving indoor air quality. She has been practicing for 16 years.

Justin Crane, AIA
An associate at Cambridge Seven Architects in Cambridge, Mass., Crane currently serves as president of Learning by Design in Massachusetts, a program which focuses on K–12 education in architecture. He has also served as former chair of the Boston Society of Architects' Ethics Committee and founded the organization's Common Boston Committee, which organizes New England's largest free architecture and design festival.

Sarah W. Dirsa, AIA
Dirsa, an architect at HOK's St. Louis office, is the firm's first social responsibility chair. She is also the co-founder of the firm's community service initiative, HOK Impact, and is a member of the team working on the forthcoming net-zero William Jefferson Clinton Children's Center in Port-au-Prince, Haiti. Dirsa is the president and a founding member of community design nonprofit SEED St. Louis. She earned an M.Arch. and a master's in urban design from Washington University in St. Louis.

Andrew Dunlap, AIA
Dunlap is an architect at SmithGroupJJR in Detroit specializing in building enclosures and thermal analysis. He mentors students through AIA Michigan and is a member of AIA Detroit's Building Enclosure Council. Dunlap earned his M.Arch. from the University of Detroit Mercy in 2002.

James Henry, AIA
After working as the senior healthcare designer at HDR, Henry became the youngest architect in the firm's history to be named a design principal. Based in HDR's Dallas office, Henry serves as the director of communications in his second term as a member of the Dallas AIA chapter's board.

Chris Hong, AIA
Hong joined Honolulu-based Group 70 International as a project architect in September 2011 after working as an architect at NBBJ. He volunteers with Habitat for Humanity and is on the board of directors at AIA Honolulu, where he co-chairs the Young Architects Forum.

James A. Meyer, AIA
Meyer has made a name with his advocacy for public design. In addition to founding the nonprofit Studio Main, in Little Rock, Ark., Meyer has also been a key player in the redevelopment of downtown Little Rock. He is involved with AIA committees and initiatives at local and national levels.

Ann Sobiech Munson, AIA
Sobiech Munson is a certified construction specifier at Substance Architecture in Des Moines, Iowa, and is a founding member of the nonprofit Iowa Women in Architecture, which aims to empower women's involvement in architecture and design. In November 2013, she was elected to the city council in Slater, Iowa. She has an M.Arch. from Iowa State.

Adrianne Steichen, AIA
An associate principal at Pyatok Architecture + Urban Design in Oakland, Calif., Steichen's work focuses on both affordable and student housing. She is a member of the organizing committee for the AIA San Francisco's Missing 32% Symposium. In 2003, she was named the AIA California Council's Associate member of the year. She has an M.Arch. from Tulane University.

Rebecca Talbert, AIA
Talbert joined AEC firm Dewberry as an architect last year. Previously, she was a project architect at RLF. In 2014, she received the AIA Florida President's Award. Talbert is a member of the city of Winter Park, Fla.'s historic preservation board. She earned her M.Arch. from the University of Florida in 2004.

Derek C. Webb, AIA
Webb is a principal at mArchitects in Houston, where he focuses on civic and institutional projects. Webb is currently a secretary on AIA Houston's board, which he chaired in 2008. He received his M.Arch. and an MBA from Texas Tech University.

Elizabeth Whittaker, AIA
Whittaker is the founding principal of Merge Architects, in Boston, and an assistant professor at Harvard's Graduate School of Design, where she earned her M.Arch. in 1999. She is also a member of the Boston Society of Architects' board of directors, and in 2008 co-founded Young Architects Boston to facilitate collaboration among emerging practitioners.

Institute Honors for Collaborative Achievement

The Lyceum Fellowship
Founded in 1985 by Jon McKee, AIA, the Lyceum Fellowship provides travel grants for architecture students. The subject of this year's fellowship is "Rejuvenation," which tasks students with adapting the Empire State Building to create an innovative hub for senior living.

Transsolar KlimaEngineering
Stuttgart, Germany–based climate engineer Transsolar KlimaEngineering describes its mission as ensuring "the highest possible comfort in the built environment, with the lowest possible impact on the environment." The firm's projects include the SANAA-designed Glass Center for the Toledo Museum of Art in Ohio and several buildings at Loyola University Chicago with Chicago-based Solomon Cordwell Buenz. Transsolar also offers climate engineering fellowships through its Transsolar Academy.

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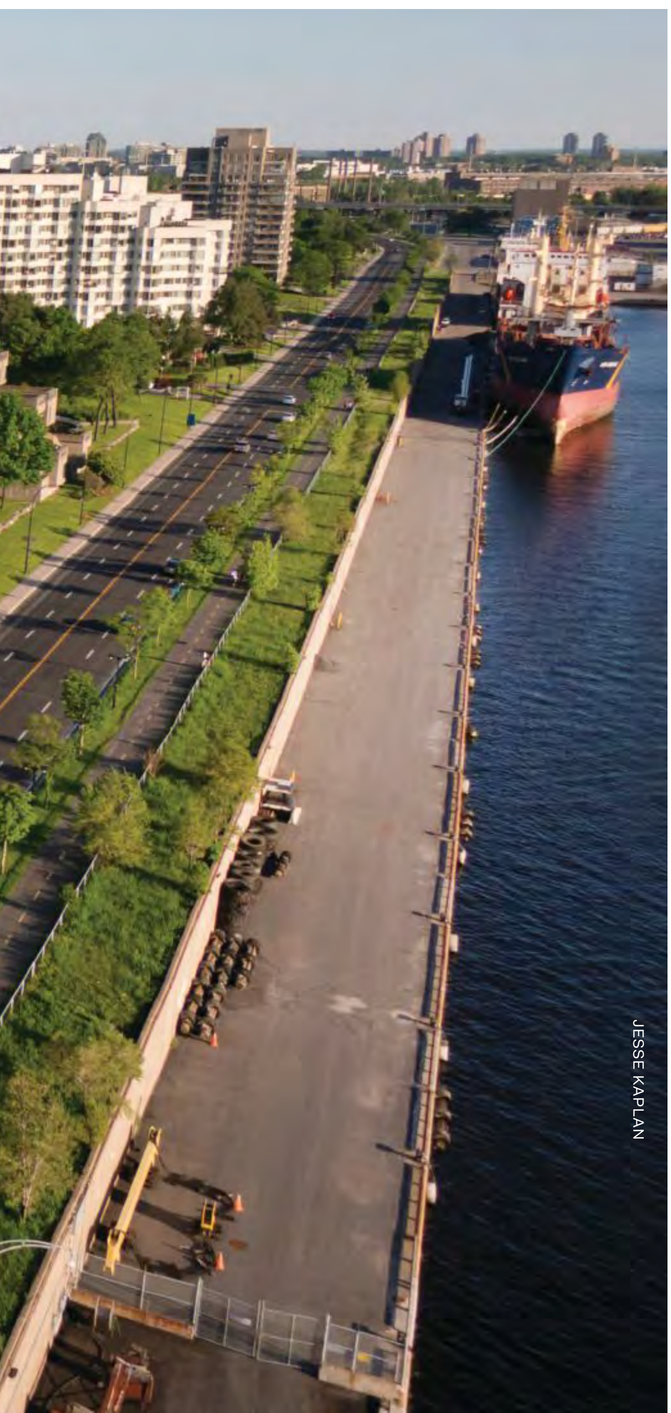
Gold Medal:
Moshe Safdie made his name with Habitat 67. But the market wasn’t ready for his pioneering concept—until now.

Habitat 67



TEXT BY KARRIE JACOBS

In the 1960s, there was no shortage of young visionaries with revolutionary architectural schemes. The difference between Moshe Safdie, FAIA, and almost everyone else was that his undergraduate thesis at McGill University in Montreal, which called for a radical hybrid of the suburban single-family home and the urban apartment building, actually got built. His plan involved stacking prefabricated concrete modules in dense, irregular geometric piles; he was thinking Italian hill town, but the end result more closely resembled the Taos Pueblo. Safdie's Habitat 67 was one of the highlights of Expo '67 in Montreal, which itself was a showcase of that era at its most utopian. (The U.S. pavilion, for instance, was a 20-story-tall geodesic dome by Buckminster Fuller.)

Safdie, who was 29 at the time, achieved more fame for his first built project—designated a heritage site by the Quebec government in 2009—than most architects ever achieve. Conspicuously inventive, formally and structurally, with an ambitious social mission, Habitat was a harbinger of the projects Safdie would design in the succeeding decades, a body of work that earned him the AIA's Gold Medal this year.

"We Have to Reinvent the Apartment"

Born in Haifa, Israel, Safdie graduated from McGill in 1961. During his years there, he received a fellowship from the housing authority of Canada. "We went wandering for an entire summer," recalls Safdie, who is now 76—"to housing projects, public housing high-rises ... Chicago, New York, all over the place. Levittown. We covered a lot of territory." Habitat was Safdie's reaction to what he saw that summer. "I came back and wrote my thesis proposal in which I said: People wanted to live in houses. We have to build denser cities. We're building a lot of apartments. We need to reinvent the apartment to give every person the quality of life of a house in a high-rise building."

For the expo, Safdie prefabricated 365 modules in a factory and stacked them asymmetrically to make apartments of different types and sizes, from 600-square-foot one-bedroom to 1,800-square-foot four-bedroom units. Each one had a roof garden. Each was entered from one of the shared pedestrian streets that ran through the complex. All of the building's components—the modules, the walkways, the three elevator cores—were load-bearing and worked together to form "a continuous suspension system."

The project, back then, was entirely unexpected. Yes, it was futuristic, but it also possessed a shaggy humanity that was often missing from visionary schemes. It was unquestionably modern, but there was also something wonderfully primal about it. The boxes resembled a mound of toy blocks, poised on the brink of tumbling into the St Lawrence River: a vision as arresting today as it was then. Habitat remains a desirable place to live; the apartments shown for sale in current real estate listings are uniformly spectacular, and sale prices are in the $400,000 to $500,000 range for typical "two cube" apartments, substantially higher than Montreal's average home price, in the low $300s.

In 1967, the acclaim was intense, but not universal. Edgar Kaufmann Jr. (whose father had commissioned Fallingwater) called it "repulsive." Ada Louise Huxtable was moved by the project's boldness. "Just about every housing and building rule, precedent, practice, custom and convention is broken by Habitat," she wrote in *The New York Times*. But she reported that because the project was such an experiment, built with untested methods, on an accelerated production schedule—"in ten months and 21 days"—it was, in some respects, a failure. "It was planned as a $42-million project of 1,000 units," Huxtable wrote. "The budget was subsequently cut to $11.5 million. It took $5 million just to develop the manufacturing plant and machinery. With the balance, only 158 units could be built. What was meant to be mass produced is virtually handcrafted sample, and costs have soared to more than $100,000 a unit."

No matter. The project was a sensation and developers everywhere commissioned the young architect to design them their own version of Habitat. By 1968, Safdie was working on mountains of modules for clients in San Juan, St. Thomas, Jerusalem, and New York City. None came to fruition.

Habitat New York is one of those what-if stories. Carol Haussamen, a real estate heiress with passion for housing and connections to the late Mayor John Lindsay, hired Safdie to design upscale developments for two possible sites, both on the East River. The initial site was at East 91st Street, but Haussamen eventually settled on a larger property between Wall and Fulton Streets. The models show a series of crazy looking 50-story triangular stacks of prefabricated volumes. Safdie compared the structural system to that of a suspension bridge: the modules, instead of fitting into a superstructure as they did in Montreal, were to be hung from cables. The complex was also supposed to include offices, retail, and parking (with a garage that was partially underwater).

What happened in New York is more or less what happened everywhere. While innovation was surely the raison d'être of World's Fairs, the marketplace had little tolerance for wholesale rule breaking. What killed the idea? "I'd say a combination of economics, resistance, and building codes," Safdie says.

There was also the matter of the changing Zeitgeist. Safdie's merger of the single-family home and the apartment complex could be read as a last ditch effort to buoy the notion of urban living at a moment when affluent North Americans were deserting the city in droves. "In the later 1970s, " Safdie recalls, "there was such a recession in terms of urban development."

Aside from one smallish apartment complex in Cambridge, Mass., the Esplanade (1989), which had a passing resemblance to Habitat, the architect who radically reinvented urban living stopped designing residential buildings and instead established a reputation for cultural projects, including the National Gallery of Canada in Ottawa (1988) and a series of Holocaust museum and memorial buildings at Jerusalem's Yad Vashem (1987–2005). "You design one good museum and one good library, and you start being stereotyped," Safdie says.

"Only In China"

In this millennium, however, the ideas that were so exciting to a young Safdie—like prefabrication and density—are suddenly fashionable again. Even the aesthetic that emerged from Safdie's nonlinear thinking—the word he now uses to describe it is "fractalized"—has become stylish; see Bjarke Ingels' 8 House in Copenhagen or West 57th in Manhattan. So it makes a great deal of sense that now, finally, almost 50 years later, commercial developers are clamoring to build projects inspired by—or, at the very least, named after—Habitat 67. Predictably, those developers are all in Asia.

"Only in China," quips Safdie principal architect Lorenzo Mattii, AIA, about one of the most exuberant Habitat-inspired projects, Golden Dream Bay, a beachside development in Qinhuangdao, China, on the Bohai Sea. It was Mattii who spearheaded a 2008 research project for Safdie Architects that, The ideas that were so exciting to a young Safdie—like prefabrication and density—are suddenly fashionable again. Almost 50 years later, commercial developers are clamoring to build projects inspired by Habitat 67.

Golden Dream Bay in Qinhuangdao, China

intentionally or not, resurrected the Habitat brand. It began innocently enough. Curator Donald Albrecht was organizing an exhibition of Safdie's work at two museums the architect himself designed: Crystal Bridges Museum of American Art in Bentonville, Ark. (2011), and Skirball Cultural Center in Los Angeles (2013). "All the models of the original Habitat were being remade for the exhibition," Safdie recalls. "Donald suggested to me that we should conclude the exhibition with a rethinking of Habitat." Says Albrecht: "My thinking was that since the original Habitat 67 was a futurist proposal, it would be good to have Moshe revisit it and its assumptions."

But the curator's request wouldn't have carried much weight if it hadn't also been the exact right moment to re-consider the project: "With respect to the mass migration of people back into the city," Mattii says, "I thought that it was certainly something worth looking at." After studying the original project and sifting through the archival material, which was housed at McGill, Mattii's team concluded that today's Habitat couldn't crack the prefab nut and be in any way affordable. "We quickly knew that we could not do the box architecture," Mattii says. "We needed to do something that was buildable with your basic construction techniques." At the same time, it still needed to look like a giant stack of single-family homes rather than conventional apartments. The goal, according to Mattii became to "build densely in a manner that it doesn't look like it's built densely."

Currently, Safdie's office has two Habitat-inspired projects that are just about done: Golden Dream Bay and a Singapore high-rise called Sky Habitat. Both are intended for a middle-class market and apply the formal qualities of Habitat to complexes that dwarf the scale of the original. Golden Dream Bay is a cluster of 15-story buildings that each has a cascading slope of terraces along one edge. The buildings are stacked in a dramatic fashion, so that the complex is actually 30 stories tall. The stacks frame 20-story-tall openings between buildings that make the development—in the photos, at least—appear porous. The design comes directly from one of the models that Mattii's research group made for Albrecht's exhibition.

The Sky Habitat complex in Singapore is a bit more conventional, a pair of 38-story towers connected by three landscaped sky bridges, with balconies arrayed along the towers' angled edges to create the appearance of cascading terraces—or, as the Safdie website says, "fractal geometry surface patterns." The balconies echo Habitat 67's generous rooftop gardens. "Plan a dinner under the stars, tend to your very own herb garden and bond with the family at home," suggests the sales material. A similar project is now planned for Colombo, Sri Lanka, and one is also underway in an unannounced location in the Middle East.

"I Told You So"

The story of Habitat 67, a revolutionary work of architecture that seemed, for a moment, as if it was really going to change the world, is almost operatically sad. "It was hurtful," recalls Safdie about the period when all his Habitat commissions fell apart. It was "painful that the idea had not proliferated, as it should have after the public reaction." And then some of his more conventional residential projects, like 1987 Columbus Center (on the site where Skidmore, Owings & Merrill's Timer Warner Center now stands), didn't get built. "So there were a lot of disappointments."

Clearly, Habitat 67 failed to change the world. Instead, over the course of five decades, the world changed on its own. A market opened up in Asia for gargantuan developments. "In my dreams, I didn't think of the densities that we're building today," Safdie says. And Asian clients have embraced formal inventions and structural gymnastics beyond anything that even the most outrageous 1960s thinkers could have imagined. Safdie seems bemused by the emergence of Habitat as a 21st-century brand, tickled by the way the Singapore developer uses photos of the original to give his own project a pedigree. Unexpectedly, this architectural opera has a happy ending: "It feels very comforting," Safdie says. "It seems like, 'I told you so.'"

Sky Habitat in Singapore

Architecture Firm Award: Ehrlich Architects' "Multicultural Modernism" embraces the spirit of place.

TEXT BY DANIELLE RAGO

"Our houses influence our other projects and vice-versa," says Steven Ehrlich, FAIA, founding partner of Los Angeles–based Ehrlich Architects. "There is definitely a cross-fertilization of thinking, materiality, and details."

Established in 1979 as a small residential studio, Ehrlich Architects now boasts 40 employees and a diverse portfolio of courthouses, libraries, university centers, and corporate work. But the firm's growth hasn't much changed its philosophy, says Mathew Chaney, AIA. "The detailing is very focused, and the relationship that you form with the client is also very intimate and personal," he says of the firm's residential work. But, he adds, "We bring that same approach regardless of the scale."

In 2013, Chaney was named a partner at the firm, along with two other long-time employees, Takashi Yanai, AIA, and Patricia Rhee, AIA. Yanai oversees residential work, and Chaney and Rhee manage commercial and large institutional work, as well as design/build projects. "In the last decade there has been a big change—identifying new partners and mentoring them," Ehrlich says.

Many of the Ehrlich's lessons remain rooted in his formative experiences right out of college in the 1970s, when he spent six years in North and West Africa traveling, teaching, and studying indigenous vernacular architecture. The moniker for Ehrlich Architects—"Multicultural Modernism"—calls for an open-minded perspective to understanding the particular culture, climate, and environment associated with each project. "The person and the place is very much an equal collaborator in the design process," says Ehrlich. "We want that dialogue, that flow."

Though the firm has expanded its geographic reach well beyond Los Angeles, a review of projects around its home city reveal this sensitive approach to the *genius loci*: an aesthetic and environmental sensibility that is deeply rooted in Southern California Modernism.

TIM STREET PORTER

Addition to Neutra Beach House, Santa Monica. Calif., 1998

This "adaptive re-imagination" project, as Ehrlich calls it, was centered around the Albert Lewin House, built in 1938 by the grandfather of California Modernism, Richard Neutra. The owners asked Ehrlich to restore the historic house. But they also purchased the adjacent lot and asked for an addition. The architects used industrial materials such as concrete, stainless steel, and glass to convey lightness and transparency. And, mimicking the curved living room of the original house, they designed a cycloidal arch atop the outdoor pavilion that connects the main house to the new addition. For Yanai, the addition becomes a way to "understand the historical part of the house in a whole new perspective."

Westwood Branch Library, Los Angeles, 2005

Ehrlich brought "a more residential-type scale" to its commission for the Westwood Branch Library, says Chaney. "We couldn't help but make it cozy." The 14,000-square-foot library serves as a bridge between the surrounding residential and commercial zones. An open plaza encourages visitors and passersby to linger in the California sun, creating a kind of public living room. Architecturally this is reinforced by the manipulation of scale and materials. Copper, burnished concrete block, channel glass, and Parklex (resin-impregnated wood) help establish a dialogue between the commercial and residential sections of Westwood.

TOM BONNER

331 Foothill Retail and Office Building, Beverly Hills, Calif., 2010

"We like to unlock the potential of a site," Ehrlich says. That's certainly true of this four-story building, which houses a local television network as well as leasable office space. The overall form, a classic modern glass box on pilotis, is punctuated with projecting volumes of earth-toned masonry that harken back to an earlier California vernacular. Steel louvers on the façades of both the office block and its parking garage hint at a broader set of sustainability strategies, as the architects have designed 331 Foothill to meet LEED Silver certification requirements.

RMA PHOTOGRAPHY

Contemporary Arts Center at the University of California, Irvine, 2011

This project, a five-story, 60,000-square-foot complex, was realized through a design/build competition. A large experimental theater and an art gallery dominate the core of the building, which is surrounded by naturally ventilated studios, classrooms, and offices. "The architecture is a very transparent diagram of what's going on inside the building," says Rhee. "Based on the massing of the solids and voids," she says, it's easy to figure out which "spaces are naturally ventilated, versus not." The end result is a very porous building with multiple terraces, landscaped courtyards, balconies, and a colonnade that reinforces the interdisciplinary nature of the school.


LAWRENCE ANDERSON

McElroy Residence, Laguna Beach, Calif., 2013

"Residential architecture resonates with us because [it captures] the personalities of everybody we work with," says Ehrlich. Indeed, the McElroy House reflects the spirit of owners Sarah and Thom McElroy, who, according to Ehrlich, "are committed to surfing and the good life." After meeting Ehrlich during a 2007 retrospective of his firm's work at the Palm Springs Art Museum, the couple realized that they had found the architect of their dream home. According to Ehrlich, "They had in their minds that we were going to build a house together." Constrained by an 11-foot height restriction imposed by the local homeowners association, the architect designed the house with living spaces organized as expansive one-story volumes. Topped by a series of floating horizontal roofs, the house features panoramic views of the Pacific Ocean.

MIRANDA BRACKETT

Twenty-Five Year Award:
Broadgate Exchange House introduced structural bravura to the City of London, courtesy of Skidmore, Owings & Merrill.

TEXT BY AMANDA KOLSON HURLEY

The Big Bang, at least the British version of it, took place on Oct. 27, 1986, when Prime Minister Margaret Thatcher deregulated the London stock market. Very swiftly after that, the City of London morphed from an insular old-boys club into a modern, global financial center. Foreign banks rushed in, and they needed somewhere to go.

Broadgate, which had broken ground a year earlier, became that somewhere. With 14 buildings planned for a 32-acre site east of the Barbican and St. Paul's, it was the largest-ever office development in Britain at the time. Working with Rosehaugh Stanhope Developments and British Rail (BR), Arup designed the initial master plan and several buildings, while Skidmore, Owings & Merrill (SOM) designed the rest.

The main challenge facing SOM was that the land, then owned by BR, was covered by tracks going in and out of Liverpool Street Station, a major commuter hub. The trickiest part of the site was the "throat" of jumbled tracks on the north side of the station. The brilliant way that SOM solved this problem in building the Broadgate Exchange House—by spanning the tracks with parabolic steel arches, which it happily exposed—has earned the firm this year's Twenty-Five Year Award. The award is given each year to a building that has stood the test of time, and the Exchange House—completed in 1991—is the first building outside of the United States to receive it.

Here we've republished the initial coverage of the project, from the September 1990 issue of *Architecture* magazine (the precursor to ARCHITECT), followed by statements from key players recalling how they created this unlikely icon.

TECHNOLOGY
& PRACTICE

London Bridge

ENGINEERING:
STRUCTURAL STEEL

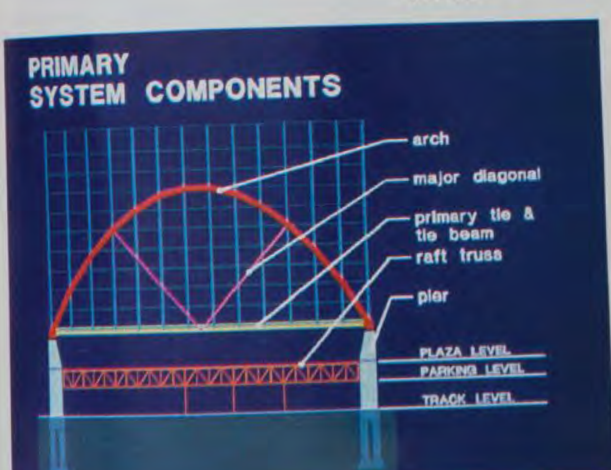
Spanning a railway, a 200-foot high office building in London links engineering demands and architectural expression.

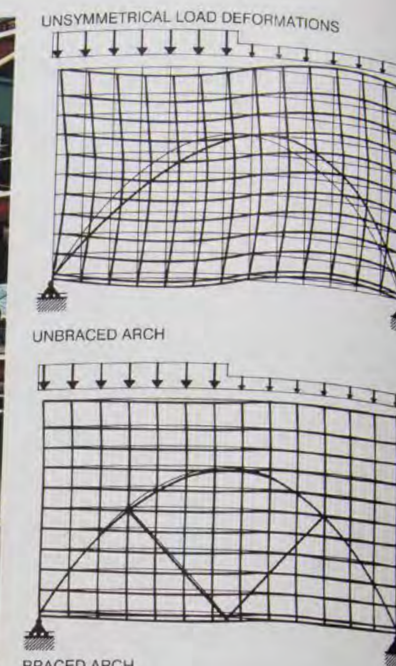
ARTISTRY AND STRUCTURE ARE JUST AS intricately meshed in Skidmore, Owings & Merrill's Exchange House as the building is woven into its congested location within the City of London. Sympathetic to a long British tradition of exposed steel, iron, and glass construction, the 550,000-square-foot structure cleverly solves the problems imposed by its site, which spans a network of functioning railroad tracks from Liverpool Street Station. To sidestep the tracks, the building's foundation had to be strategically placed, requiring a clear span of 256 feet between support piers. The successful resolution of both the building's design and its structure was achieved through the ingenious manipulation of bridge technology and exposed structural steel.

AMERICANS ABROAD

One-story trusses support a plaza over an intermediate floor level between tracks and office floors. Structural engineer Hal Iyengar and principal architect Bruce Graham, both of SOM's Chicago office, which designed and engineered the project, explored several structural systems for supporting the building above the plaza level. Combining formal dynamism, efficiency of materials, and ease of erection, the resulting structure is based on four segmented parabolic arches that span the railroad tracks. Ten floors of offices and trading space are supported by these seven-story arches, allowing for column-free floors divided into a central 49-foot-wide bay flanked by a pair of 60-foot-wide bays. Floor loads are transferred to the arches by open-web steel trusses that span the bays. The floor trusses connect directly to columns attached to the arches. The two

Exchange House's 10 stories of office and trading space are suspended over a plaza concealing train tracks below. The exposed structural-steel framework of the southern facade (right) reveals the means of support almost as clearly as a structural diagram (below).





Floor trusses span the bays within the building and connect either to girders or directly to the exterior columns. The arches are constructed of parallel steel channels (above) with an intermediate space to allow the columns to pass through the arch (facing page, top left).

Columns are evenly spaced to apply equally distributed point loads on the arches. If unsymmetrical loading were to occur, however, the unbraced arch would buckle (top). To prevent buckling, two major diagonal members are placed within the plane of each arch (above).

perimeter arches and their connecting columns, beams, and struts are entirely exposed on the exterior, and project approximately six feet beyond the wall face to display the form, connections, and function of each structural member. Diagonal struts at each floor level, constructed of steel pipes, tie back the exposed frame to end girders at the floor edges, providing lateral stiffness for the exterior columns.

Concealed behind the exterior glass face, the girders are connected to the outside arches by larger diagonal struts that allow the girders to function as intermediate ties, preventing lateral spread of the arches. For the interior arches, a girder within the plane of each arch acts as an intermediate tie. The girders and arches also function to provide lateral stiffness for the entire building in the direction of the arches. For lateral resistance against wind loads on the broad side of the building, vertical trusses constructed of cross-shaped diagonal members are located on each of the shorter building ends. These trusses are also exposed, continuing the projected-steel perimeter.

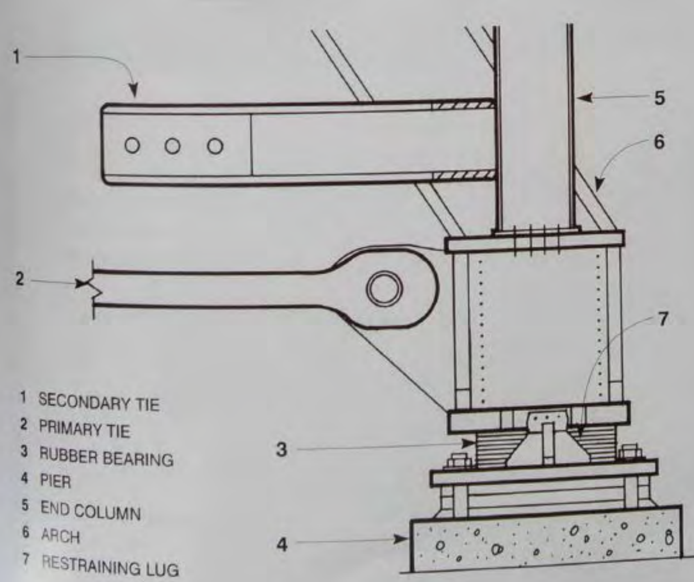
The arches are constructed of straight steel channels that are connected at nodes, which join the angled linear pieces to form a parabolic curve. These nodes also mark where the I-beam columns connect to the arches. The columns are evenly spaced, approximately 20 feet on center, to apply uniform point loads on the arch. This condition allows the applied loads to be transferred as compressive forces, limiting flexural bending of the arch. Since the arches are built up from channel segments paired back to back with an intermediate space, the columns can attach to the arch at the nodes and pass through the arch uninterrupted.

To define the edges of the arches, the flanges of the channel segments are oriented outward to create a continuous reveal. The only part of the structure to intersect the continuous lines of the arches are the transverse flanges of the nodes, also constructed of steel channels, which accent the connection points between the arch and the rest of the structure. Regularly spaced batten plates between channel members tie the separate parallel pieces of the arch together. Two major diagonal members provide lateral stiffness and resistance to buckling within the plane of each arch, in case of unsymmetrical loading. Placed on either side of the columns, each major diagonal is constructed of two parallel pipes that radiate upward from a midpoint pin connection at the primary tie to upper pin connections located on the arch. The use of built-up parallel members in the construction of the arch and its major diagonals animates the steel framework by creating multiple layers of intersecting members that overlap and slip between one another.

Exposed primary and secondary ties resist the outward lateral thrusts created at the base of each arch and transfer the load to nodes where columns, arches, primary ties, secondary ties, and foundation piers all meet. Polished stainless steel caps detail the pin connections at the base node and the splice connections joining the multiple plate sections of the primary ties, accentuating the primary ties' resistance in tension. Bearings formed by alternate layers of rubber and stainless steel plates act as springs to allow for limited vertical and rotational movement of the superstructure. The bearings on the east side are fixed to restrict lateral movement, while the opposite end permits several inches of lateral arch expansion through deformation of the rubber in the bearings. The imposed loads from the arches and ties are transferred through the bearings to above-grade concrete piers. The piers' buttress-like forms express their function in resisting the outward thrust of the arches.

Structural expression is also given free rein inside the building. The two inner arches are partially visible as they pass through two atriums located at each side of the mechanical and elevator cores. Vertically staggered in section, the atriums cascade outward from the core as they descend from the top floor, following the lines of the vaulted arch forms. In addition to exposing the structural members, the architects located modular bathrooms and fire stairs in two ancillary towers on either side of the main structure. An open fire stair is held a slight distance from

Struts (left) provide lateral support to the exterior frame by tying it back to interior girders. At the base of each arch the major structural elements join at a node (bottom left and below). Loads are then transferred to buttressed piers (above).



the main structure and suspended from the roof rather than contained within the core of the building.

To take full advantage of the architectural possibilities of exposed structural steel, SOM devised a means of fire protection that would not conceal the revealed members. Rather than adding sheet-metal flame shields to the surface of the exposed steel, which would be unsightly and reduce the purity of structural expression, SOM used state-of-the-art fire analysis techniques to convince local fire code officials that the glass sheathing could serve a combined safety and architectonic purpose. Composed of a chemically tempered fire-resistant glass of normal thickness, the dual-glazed window wall creates a fire-rated barrier, protecting the exterior steel members from the thermal stresses of heat and flames. Clear glass also aids in delineating the design's structural clarity by limiting the use of solid elements to those that serve a structural function.

By sheathing the curved lobby in glass, the granite-clad concrete piers appear to be the only solid portions of the building to touch the ground. Although the lobby seems to rest on the plaza, it does not aid in support of the building but is hung from the structure above, and adjusts vertically and horizontally accordingly to movement differentials between the independent plaza and building structures. A reveal where the edge of the lobby meets the plaza delineates its ability to move independently. Ramps to the lobby, able to adjust in slope, allow for any height differences between the lobby floor and the plaza level.

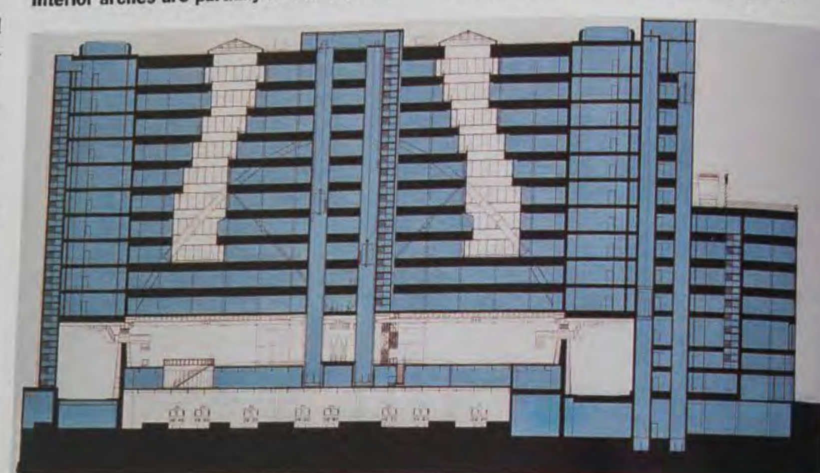
By articulating structural engineering design principles through exposed structural steel, the American-designed Exchange House elaborates a tradition of British engineering, represented by the train sheds of Liverpool Street Station. The building's architectural image is as easily followed as are the loads it transfers through its tracery of steel. ■

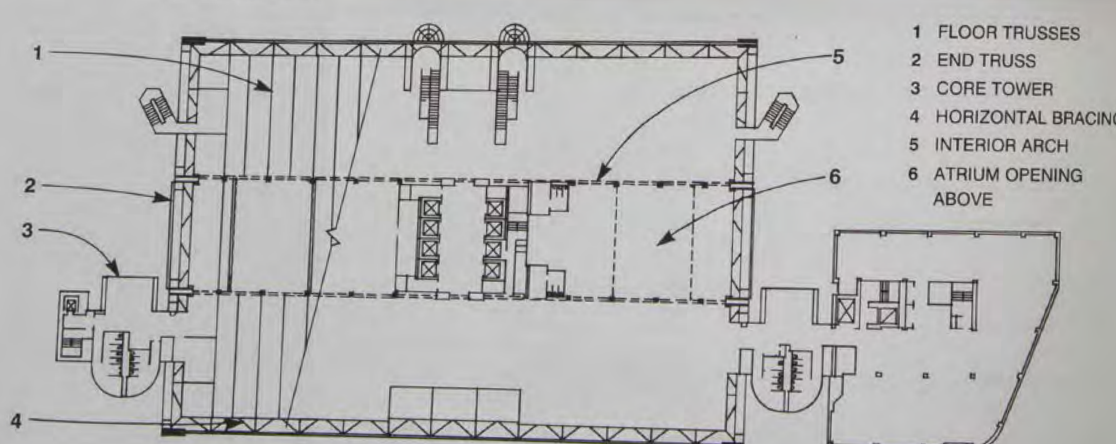
—MARC S. HARRIMAN

NIALL CLUTTON / ARCAID

NIALL CLUTTON / ARCAID

The lobby and elevators are enclosed in glass to create a sense of transparency (above), in contrast to the solid structural members. Interior arches are partially revealed in two atriums (section below). Fire stairs and bathrooms are placed in towers located at either side of the structure, rather than as service cores within the building (plan).





FIRST LEVEL

Bill Baker, structural engineering partner, SOM: The initial phases of Broadgate were built where the tracks are kind of on a grid. Then the leftover piece was where, when the trains come out of the station, they start to commingle and merge. You've got a very complicated set of tracks coming out of there. That's where the Exchange House is. You couldn't bring down regular columns and foundations on a regular grid, except on two strips that were 78 meters [256 feet] apart.

Richard Tomlinson, FAIA, retired partner, SOM: I don't want to oversimplify it, but it was one of those things where the client felt—and we felt, even from an urban-design perspective—that it would be crazy to leave a hole in the site in that location. The client said, "Isn't there any way we can put a building there?" and we said, "Sure."

The design, that's all Bruce Graham [who died in 2010]. It was his vision to span the tracks and to make a bridge a building, and a building a bridge.

Baker: If you took this building and hung it as a series of weights, it would drape to exactly this curve. We built, essentially, the natural shape of the structure. And because of that it was very economical. It wasn't a bunch of hairy transfers and trusses and girders, but these very simple arches.

When I first started to do the details, I tended to use a machine aesthetic. Bruce said no, no—it should be a structural aesthetic, a bridge aesthetic. There are no fancy, machine-like connections.

Sir Stuart Lipton, developer, former chief executive of Stanhope Properties: SOM did buildings on Bishopsgate [the road that forms the eastern edge of the site] in a sort of Beaux-Arts style. Local officials were keen to have stone façades. But when it came to Exchange House, in the middle of the site, there was no real vision from the city. So the architect was much freer.

Tomlinson: A building as a bridge over an operating railway station: Something of that magnitude had never been done before. When you innovate, every day is a surprise. The building actually spanned two boroughs. Part of it was in Hackney, the other in the City of London. Each had different building codes; each had its own fire department with its own fire regulations. One of the challenges was getting all these people together and then going through all the testing to prove to everybody, including ourselves and the client, that this was going to work the way it was imagined.

Baker: We were working around the clock because of the time difference. At the end of the day, the architects and engineers in Chicago would take a drawing, cut it up into rectangles, fax it to London, and then they'd tape it back together.

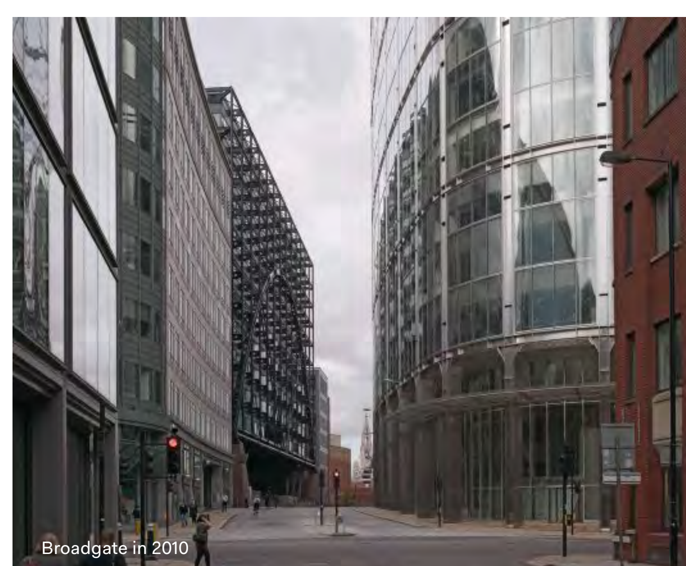
Tomlinson: I was leading the project in the London office. Getting FedEx packages every morning, it was sort of like Christmas.

Baker: The construction sequence was a big deal. We had the steel on temporary supports until we could close the arch. The engineers were worried about loads jumping around. We jacked up the entire building 50 millimeters, to be able to control the unloading of the temporary shores. Then we put the building back down again.

Tomlinson: The public realm at Broadgate is extremely important. The plaza covers all the tracks; the building only spans them. It's a great plaza. Hundreds of people gather there in decent weather. I visited a week and a half ago; it doesn't look 25 years old.

Lipton: It looks almost new today. The finishes of the building have lasted well. The façade looks terrific. It looks good because they knew how to design it.

These interviews have been edited and condensed.


Broadgate in 2010

DENNIS GILBERT/VIEW PICTURES

Topaz Medallion:
Peter Eisenman's students recount the indelible influence of his teachings—and his teaching style.

TEXT AND INTERVIEWS BY IAN VOLNER

In a career that has spanned six decades, Peter Eisenman, FAIA, has been many things—author, critic, designer, gadfly. He's also been one of the great teachers of our time, which has earned him this year's AIA/ACSA Topaz Medallion for Excellence in Architectural Education. ARCHITECT tracked down some of Eisenman's former students to get their take on his influence, both on their own work and on the field at large.

Daniel Libeskind, AIA: He was one of the seminal teachers at Cooper when I was a student there [in the 1970s], and he had a tremendous impact not only on me but on the school. He had an intellectual rigor and tenacity of mind that showed him to be a kind of an educational genius. When Chomsky first emerged, he was a Chomskian; when Derrida appeared, he embraced Derrida; he always moved ahead with trends but always developed his own thinking as well.

Tod Williams, FAIA: Eisenman and Michael Graves taught the design studio during my sophomore year at Princeton [in the late '60s]. It was truly a transformative year. Peter had been [an actual] cheerleader at Cornell and is something of a sports addict; with his incredible energy and enthusiasm, he's always goading his students into friendly rivalries, whether by singing their school songs or tempting them to challenge his own theories and teaching pedagogies. Peter would occasionally attend my football games and track meets and, as with many of us, he could easily get under my skin: "Williams, you gotta choose sports or architecture!" But I always felt this decision was mine and that, either way, Peter would remain supportive and challenging.

Anthony Vidler: It was 1960. I was going up to Cambridge University as a first-year undergrad in architecture school, and Peter arrived as a first-year Ph.D. student. We met in the first-year studio where Peter was an instructor. Britain in the '60s—with the likes of Colin Rowe, Jim Sterling, and Peter and Alison Smithson—was an extraordinary place, and Peter found a kind of vacuum when he came back to the U.S. That formed the basis of the Institute for Architecture and Urban Studies, where Peter gathered as many architects as he could possibly find in the American firmament who were also thinking and speaking about architecture not just as a professional question, but also as a theoretical, critical, formal, and ethical one. It was a polemical place, but also open, a major instrument in furthering architecture as a cultural practice.

Harrison Fraker, ASSOC. AIA, 2014 Topaz recipient: I met Peter in 1963, during my senior year at Princeton. He was our studio teacher, and he came bouncing in smoking this little corncob pipe. What was fascinating was the contrast between his tweedy personality and the fact that he was tough as nails. Over his career Peter has been both the conscience of architecture and one of its most bad-boy provocateurs. For me, he's always represented that you're not making architecture if you don't have some generative idea about what's driving your formal propositions. Many of us admire and respect him for that, but we have also shaped our careers as a critique of many of his ideas. When I got the Topaz last year, I said that my whole career has been about trying to reconcile the very complicated relationship between form and performance, especially environmental performance. That mission emerged both as a result of, and as a reaction, to Peter's position.

Palmyra Geraki, AIA: The moment I stepped into his first-semester core lecture course [in Yale University's undergraduate architecture program in the late 2000s], I immediately understood that Peter's was by far my most interesting course. One day, Peter interrupted class to tell me that my questions were stupid, that I was not to speak again until the end of the semester, and that my drawings should be doing the talking. Several of my classmates came up to me after, surprised that I hadn't run out of the classroom crying. But I was practically beaming. Peter freaking Eisenman had taken time during a lecture to publicly challenge me. In my memory this is a special moment, not only because Peter took the bait and decided to challenge me back, but also because it changed the way I approached my work. Until then, I had always used words to express my ideas. Staying silent was not easy. Learning to produce work that spoke for itself was harder.

Alan Balfour, 2010 Topaz recipient: Eisenman's true character became clear very early in my time at Princeton when he wore a large "Goldwater for President" button around the studios in '64, infuriating all us liberals. It was only later that we realized that was his intention—provocation. He remains the great and perhaps the only true iconoclast in our discipline—unrivaled, unrepentant. And that is his gift to me and to countless others. No other figure in the last half of the 20th century has so brilliantly and intelligently produced a systematic, disciplined critique of the given traditions and values of architecture.

Peter Eisenman circa 1976 at the Institute for Architecture and Urban Studies, the alternative school he founded in New York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Institute Honor Awards

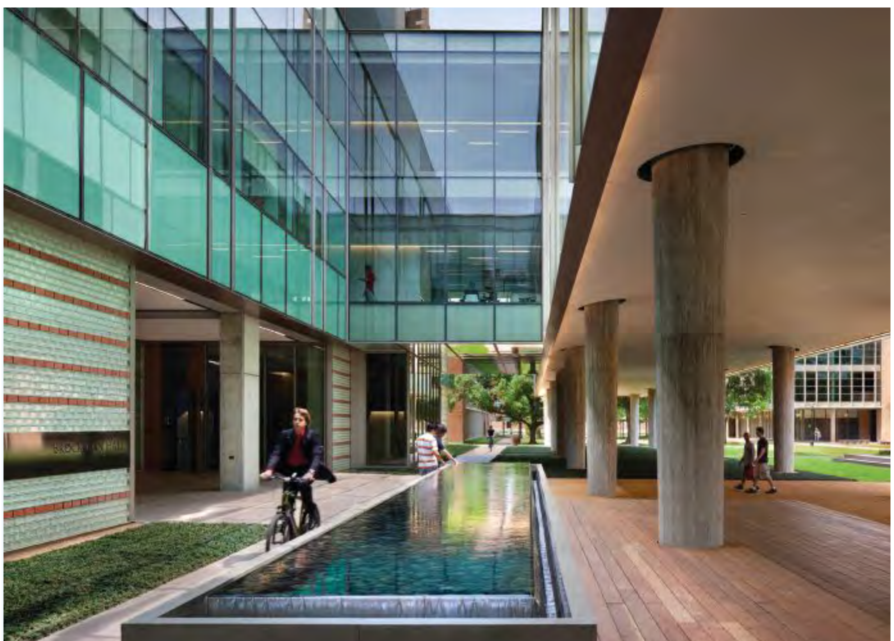
Architecture

ERIC STAUDENMAIER

28th Street Apartments
Los Angeles
Koning Eizenberg
Santa Monica, Calif.

Jury: "Located in an underserved community, this building has made a significant impact on the neighborhood. The skillful restoration and adaptive use of the historic YMCA building is complemented by the respectful proportions and modern forms of the new building."

Institute Honor Awards: Architecture



Brockman Hall for Physics
Houston
KieranTimberlake
Philadelphia

Jury: "This project is a total knockout in every way—from the incredible planning to the spectacular detailing—yet it is extremely simple and very flexible."

California Memorial Stadium & Simpson Training Center
Berkeley, Calif.
HNTB Architecture
Kansas City, Mo.
Studios Architecture
San Francisco

Jury: "The new addition is light and airy, with a lot of glass, and being able to see the original stadium through it is a nice tribute. The project is technically innovative, especially the seismic retrofit, which allows the two halves of the stadium to move separately during seismic events."

TOP: PETER AARON/OTTO; BOTTOM: TIM GRIFFITH

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Institute Honor Awards: Architecture

Cambridge Public Library
Cambridge, Mass.
William Rawn Associates, Architects
Boston
Ann Beha Architects
Boston

Jury: "Every inch of the original Van Brunt building has been thoughtfully restored and repurposed. An exciting teen library occupies reconceived stack areas, and the imposing historic rooms now offer modern library services."

Danish Maritime Museum
Helsingør, Denmark
Bjarke Ingels Group
Copenhagen

Jury: "In a nautical environment nothing is flat, it's always moving, and visitors will feel like they are flowing through the building in a logical and graceful way."

TOP: ROBERT BENSON; BOTTOM: RASMUS HJORTSHØJ

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Institute Honor Awards: Architecture

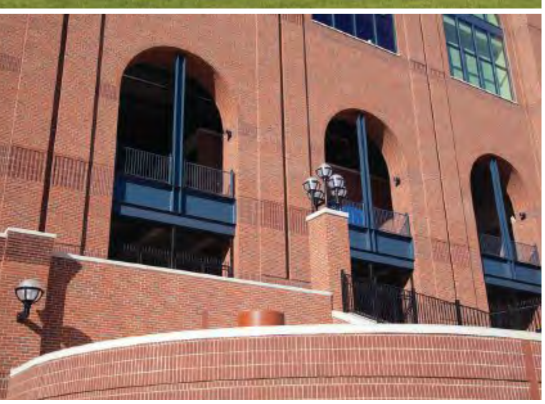
John Jay College of Criminal Justice
New York
Skidmore, Owings & Merrill
New York

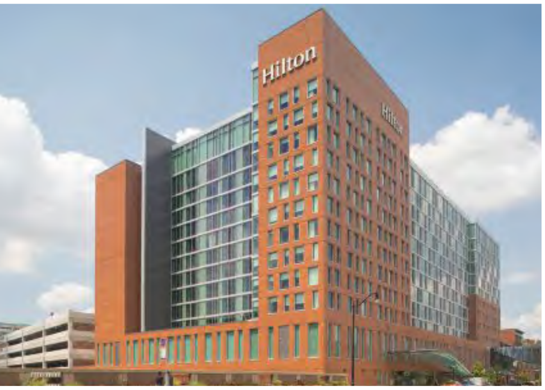
Jury: "This massive programmatic space has created an entire village—from a beautiful and happy daycare to a full-service kitchen and dining facility, mock courtrooms, and full-science laboratories. The diversity of space is impressive, and it is hard to imagine that it could be done better."

Krishna P. Singh Center for Nanotechnology
Philadelphia
Weiss/Manfredi Architecture/Landscape/Urbanism
New York

Jury: "All science buildings should be this good. The innovative structural design to achieve the cantilevered forms is noteworthy."

TOP: BRETT BEYER; BOTTOM: © ALBERT VECERKA/ESTO




Hilton

Institute Honor Awards: Architecture

LeFrak Center at Lakeside
Prospect Park
Brooklyn, N.Y.
Tod Williams Billie Tsien Architects | Partners
New York

Jury: "Every design decision was made so as to ease use for patrons and also minimize the impact on the park. This is a beautiful, natural spot for visitors to enjoy a sensory experience."

Sant Lespwa, Center of Hope
Outside of Hinche, Haiti
Rothschild Doyno Collaborative
Pittsburgh, Pa.

Jury: "The representation of what design can do and how it can build community is evident for this climate and this community. The way this project sustainably translates energy and architecture to this community is praiseworthy."

TOP: MICAHEL MORAN/OTTO; BOTTOM: SARAH SPANAGEL

Institute Honor Awards: Architecture

United States Courthouse
Salt Lake City
Thomas Phifer and Partners
New York
Naylor Wentworth Lund Architects
Salt Lake City
CRSA Architecture
Salt Lake City

Jury: "The clarity of the building scheme and the way it relates to the surrounding context are impressive in a modern civic landmark. The skin is extraordinary, with the patterns and density of louvers responding to the solar orientation."

Wild Turkey Bourbon Visitor Center
Lawrenceburg, Ky.
De Leon & Primmer Architecture Workshop
Louisville, Ky.

Jury: "Quite a lovely yet simple building, evocative of the regional vernacular. The siting is extraordinary, and at night, the building is lit up like a lantern on the hill, visible from near and far."

TOP: SCOTT FRANCES/OTTO; BOTTOM: DE LEON & PRIMMER ARCHITECTURE WORKSHOP

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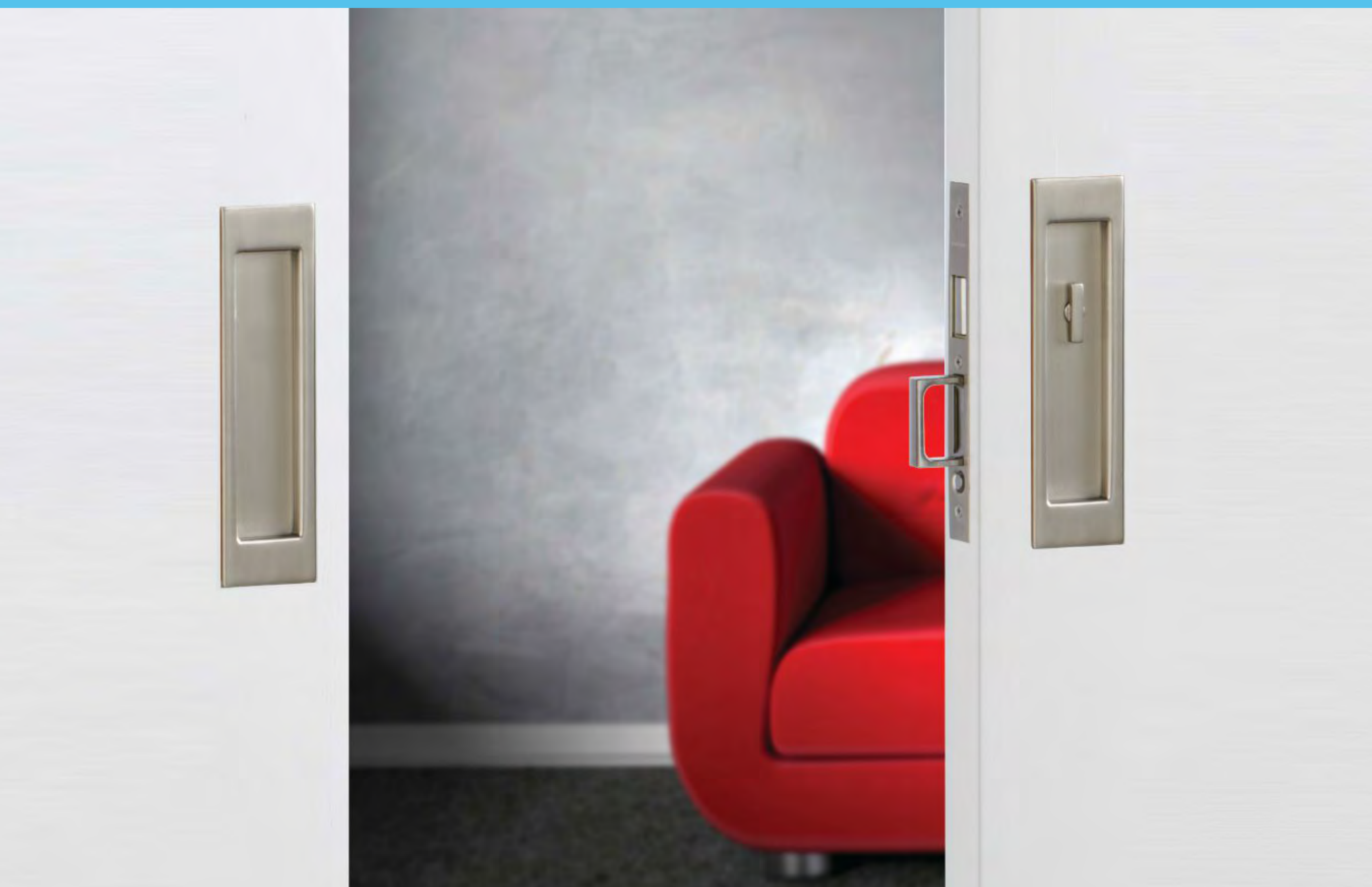
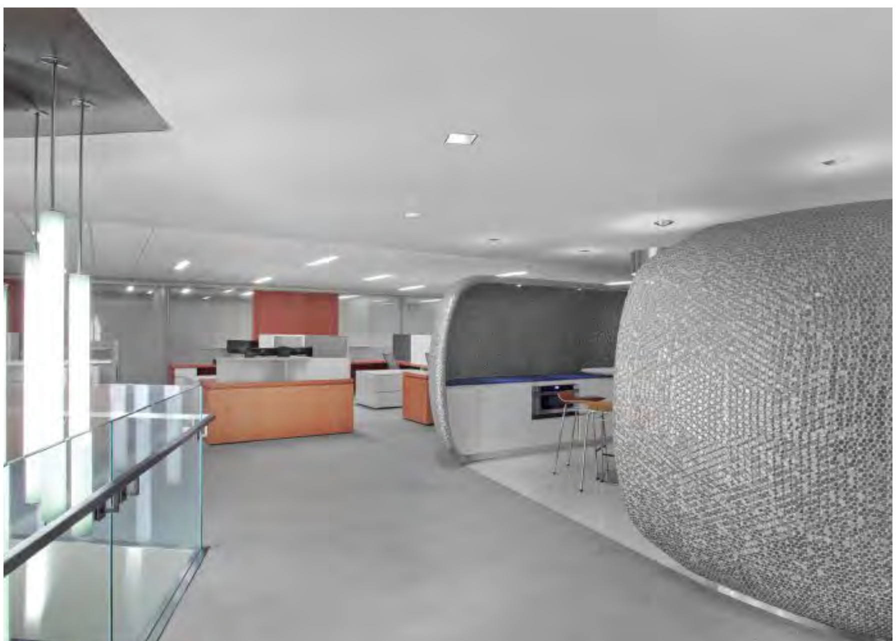
Yasmeen Lari / Heritage Foundation Pakistan, PAK



Institute Honor Awards: Interior Architecture



Arent Fox
Washington, D.C.
Studios Architecture
Washington, D.C.

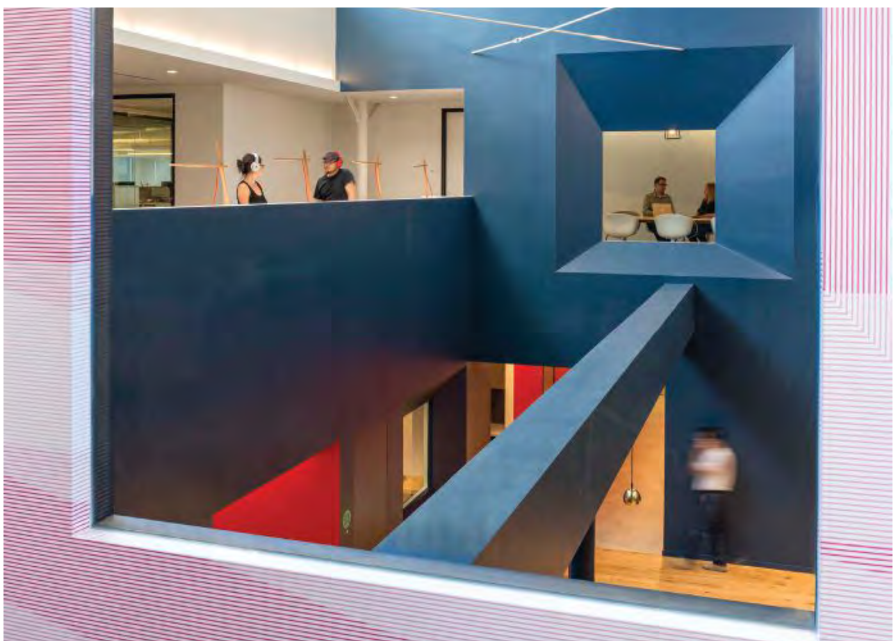
Jury: "The translucent glass stairway, light fixtures, and the silvery coined tile on the café are delightful."

The Barbarian Group
New York
Clive Wilkinson Architects
Culver City, Calif.
Design Republic Partners Architects
New York

Jury: "This is an ingenious transformation of a generic office component: the table."

TOP: ERIC LAIGNEL; BOTTOM: MICHAEL MORAN/OTTO

Institute Honor Awards: Interior Architecture



Beats By Dre Headquarters
Culver City, Calif.
Bestor Architecture
Los Angeles

Jury: "We love the young, hip vibe—the design is not over the top and could be relevant for a long time."

Crystal Bridges Museum of American Art, Museum Store
Bentonville, Ark.
Marlon Blackwell Architects
Fayetteville, Ark.

Jury: "The store is sympathetic to the original architecture of the museum, yet has its own identity."

TOP: JASPER SANIDAD; BOTTOM: TIMOTHY HURSLEY

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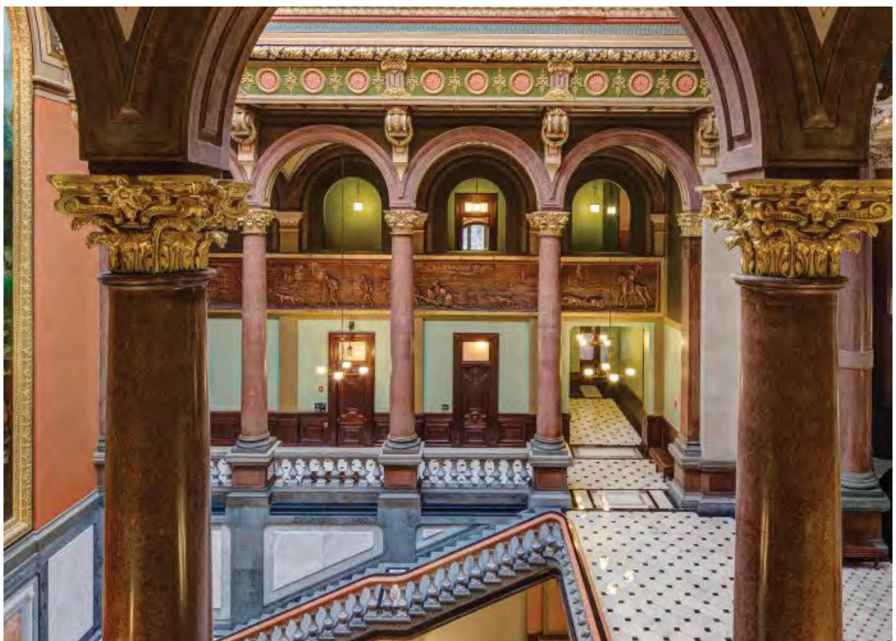
Institute Honor Awards: Interior Architecture



Illinois State Capitol
West Wing Restoration
Springfield, Ill.
Vinci | Hamp Architects
Chicago

Jury: "This sensitive restoration seamlessly integrates modern building technologies and re-establishes the elegance of the original 19th-century building."

Louisiana Sports Hall of Fame and
Northwest Louisiana History Museum
Natchitoches, La.
Trahan Architects
New Orleans

Jury: "The 1,100 unique cast stone elements combine to create a singular interior surface, nearly geologic in scale and intent. This kind of organic interior takes a deft, skillful hand, and it is an amazing technical achievement."

TOP: TOM ROSSITER; BOTTOM: TIMOTHY HURSLEY

Institute Honor Awards: Interior Architecture

National September 11
Memorial Museum
New York
Davis Brody Bond
New York

Jury: "The space honors those who perished; even if you didn't know what it stood for, it would still evoke an overwhelmingly emotional response."

Newport Beach Civic Center and Park
Newport Beach, Calif.
Bohlin Cywinski Jackson
San Francisco

Jury: "The design evokes the feel of the ocean, and having light and transparency throughout is really great."

TOP: JAMES EWING/OTTO; BOTTOM: NIC LEHOUX

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Institute Honor Awards: Regional & Urban Design

Beijing Tianqiao Performing Arts District Master Plan
Beijing
Skidmore, Owings & Merrill
Washington, D.C.

Jury: "The project has dedicated significant resources to both the old and the new—it attempts to keep the old and find a strategy to work with it."

The Big U
New York
Bjarke Ingels Group
Copenhagen
Jury: "[Rising sea levels are] such a pressing issue, so to have this kind of solution presented in such a clear way is remarkable."

TOP: SOM/CHRISTOPHER GRUBBS/SQUINT/OPERA; BOTTOM: DANIEL ACKER/BLOOMBERG/BIG TEAM


Lighting that goes where your imagination takes it.
Up a wall, across a ceiling, down to a pendant right in front of you. All in a single, clean line.

Institute Honor Awards: Regional & Urban Design

Government Center Garage Redevelopment
Boston
CBT Architects
Boston

Jury: "The plan reuses the garage in a positive way, shaping the new buildings around it to connect to the city. Without having said so, the project builds upon other urban design investment—mainly, the Greenway and the Big Dig—the city has made."

Target Field Station
Minneapolis
EE&K, a Perkins Eastman Company
New York

Jury: "This is a powerful piece of work, illustrating how a transit point can become more than a transit station."

TOP: LIFANG; BOTTOM: MORGAN SHEFF

Pterodactyl
Culver City, Calif.
Eric Owen Moss Architects

INTERVIEW BY AARON BETSKY
PHOTOS BY TOM BONNER

For decades, your conquest of the Hayden Tract in Culver City has been happening in pieces. Is Pterodactyl—a rooftop addition—the final piece?
Eric Owen Moss, FAIA: Like a city, the Hayden Tract projects didn't really have a beginning or middle, and don't really have an end. There are several other projects underway or planned in the area.

It was done, initially, in a very piecemeal way. Pterodactyl creates a sense of unity in five pieces, though it is deceptive. You enter under the Stealth (2001) and there are buildings called Slash and Backslash (1999), the Umbrella (1999), and then this one, which is really just a garage, built in 2001, 2002, with the intention of finishing it later. Pterodactyl was the most difficult: It's the most technically complicated, and we had to wait for the rents to rise enough for it to make sense from a development standpoint.

This is the first area along the Hayden Tract that feels like you are creating a campus with exterior relationships between buildings.
It's not Harvard Yard. It's a little bit rougher. But I was in the Pterodactyl at 9:00 on a Friday night, and the place was packed. The tenant is a media company, and there were men and women with their children, dogs, there's a bar with beer on tap, ping-pong, and they're going like hell. They were working on a water conservation advertising campaign with all of these so-called Millennials piled into every nook and cranny of the place, and it's terrific.

For years, the discussion about Culver City has been: "You invent it, it's nowhere, nobody cares." But over time, people started to understand it as a venue for media, advertising, the arts. There's a sense here that creativity is more important than pushing paper, and all of that integrates with the architecture. The workplace begins to relate the different components to each other across the outdoor space—a piazza if you don't want to call it a campus.

Workplaces have changed radically. Creativity becomes integrated with the architecture. You've been doing that for a long time, but have you made it more visible here?
I think what's appealing for me is the evolution of the workplace—it has to do with technology, the size of spaces that people need, and the fact that they move around. In Pterodactyl, the ground floor is pretty much an open plan. The second is broken down into nine "boxes" that are more privatized and have their own personalities. There's another piece, which is harder to read in the drawings but very readily understood when you're in the building itself, which is a bridge that allows you to walk the length of the building.

I think a building like that lends itself to a different sociology—it works. It seems odd that we would be involved in a discussion about how something works. It's considered banal and prosaic. But actually, it's very appealing to go in there and to see it. I think the configuration of the building facilitates the energy and enthusiasm of the people who inhabit it.

Speaking of banality, in some ways this is a conventional composition, with a forecourt, an entrance emphasized by symmetrical parking ramps, and then, above that, an honorific element which looks like a pediment turned upside down and fractured. A modern-day temple front.
It depends whether you believe that the world keeps getting different or that the world recycles. I saw it more like the mouth of the lion or the tiger—there's a piece hanging over you, which is showering you with flowers or could be a guillotine. You could probably make a case that both ideas have some truth to them.

This building is complex because of the aggregate of simple components. The trick is how you put them together. For example, the western side of the building is, by intention, pulled past the edge of the garage to obviate the scale of the garage and to minimize the automobiles' context.

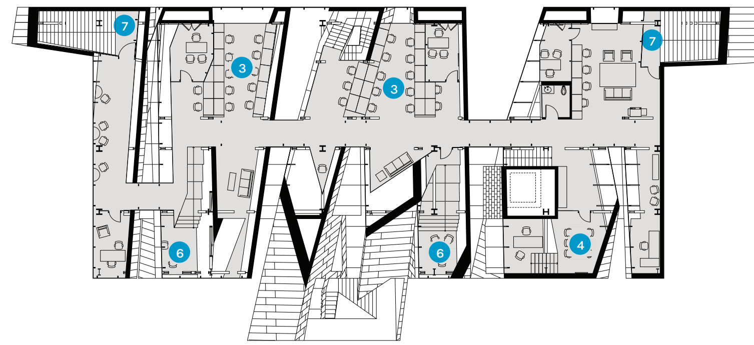
It only gives you fragments that let you imagine the larger volume, so there is complexity in the reading of it.
The technical pieces that make each "box" are, as a theoretical proposition, straightforward elements that are used in many buildings with predictable results. But here we're using something that is understood as a form in a predictable way and producing a very different anomalous spatial result while producing an operationally simple and intelligible interior. So it's simple, and then it isn't, and then it is.

There is a moment inside where an I-beam jams into a corner, then flips up and asserts itself into the middle of the workspace. Can we intuit some relationship between that instance and the chaotic order of the Hayden Tract?
I don't think it's chaotic. If you're a little bit patient, there is a sense of how this got to be what it is. I could go through and say this piece belongs to that, this is made out of plastic because of this ... but I think that kind of logic belongs in an auditorium lecture. I think it narrows the prospect for architecture.

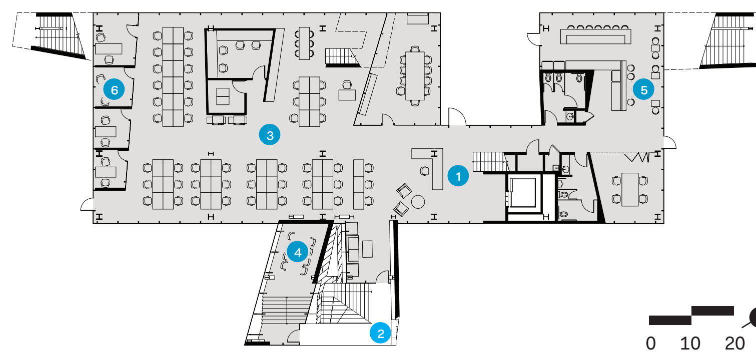
This is a discussion about culture, about how ideas move, about how architecture can either facilitate content because the client says it has to be that way, or it can interrogate it in some way. This building is both an interrogator and a facilitator of content because it has to be used. One doesn't have to preclude the other.

Previous Spread: Pterodactyl's western façade overlooks a parking lot framed by four other Moss projects: The Umbrella (at right), Slash (at left) and Backslash, and Stealth. The new office and exterior stair projects out and over an existing parking garage.

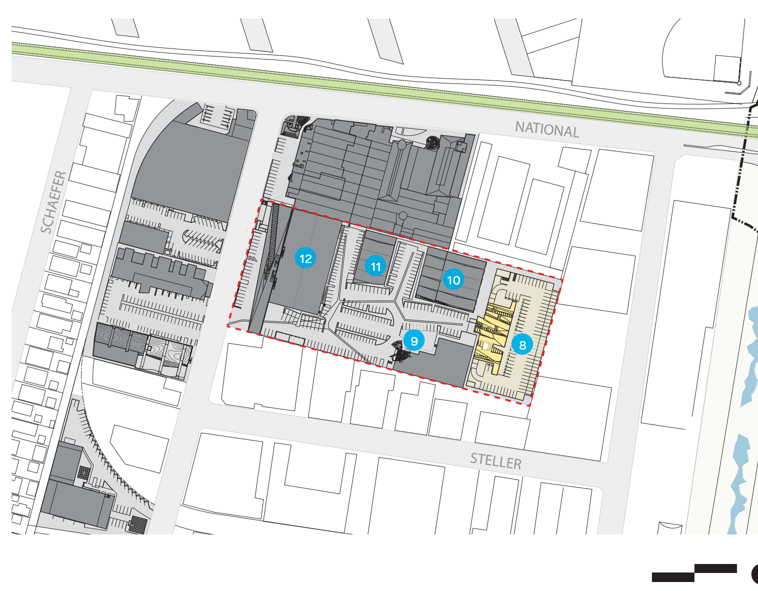
Second-Floor Plan



Ground-Level Plan



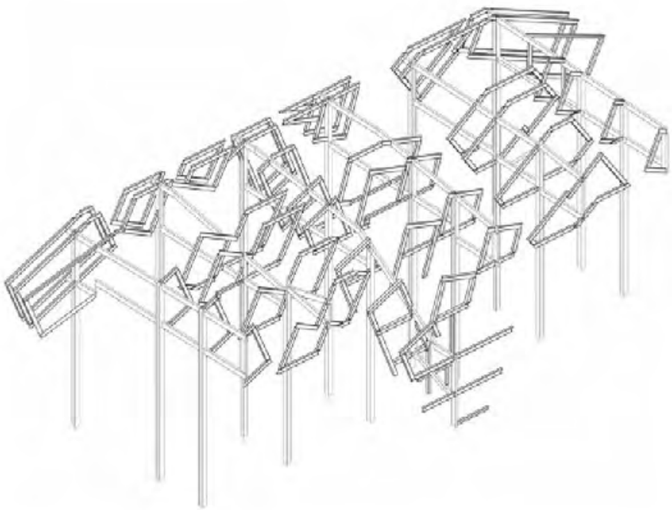
Site Plan



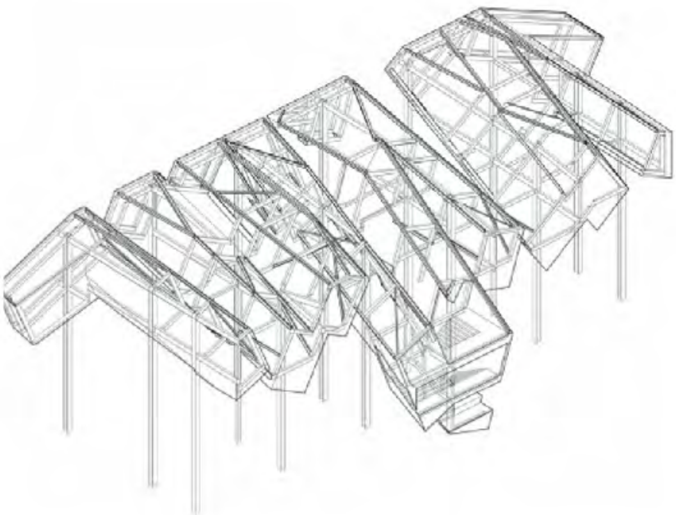
1. Lobby
2. Stair from parking below
3. Open office
4. Conference
5. Café
6. Private office
7. Entry from surface parking
8. Pterodactyl
9. Umbrella
10. Slash
11. Backslash
12. Stealth

The east façade rises from the roof of the garage and is clad in Rheinzink sheet metal panels and PPG Solarban 70XL glazing.

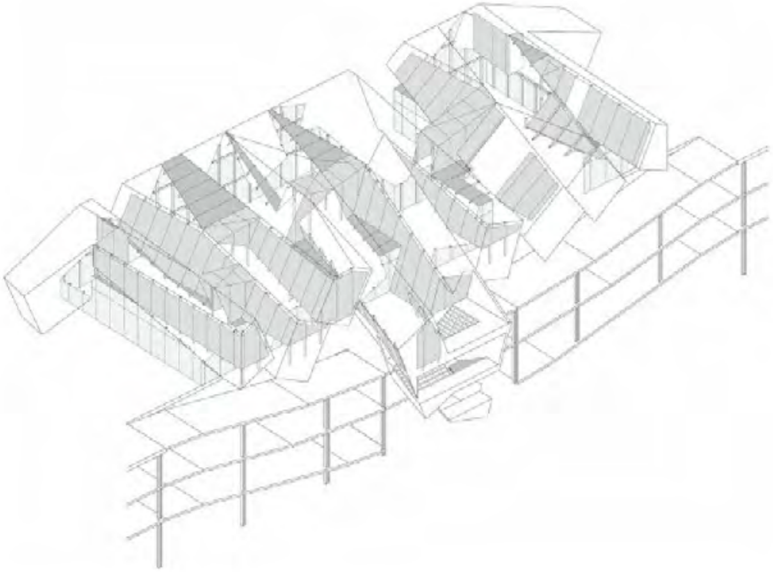
Primary and Frame Steel Diagram



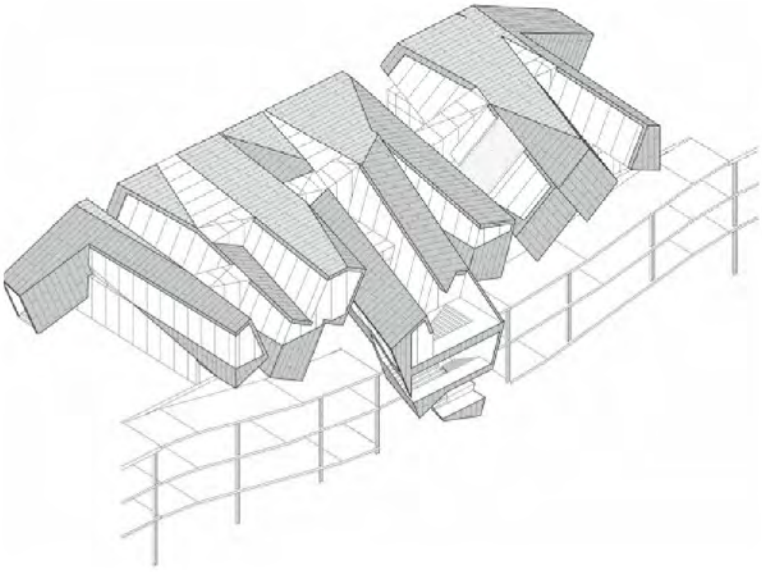
Secondary Steel Diagram



Glass Envelope Diagram



Sheet Metal Envelope Diagram



Opposite: A stair projects from the west façade, offering access to offices and partly obscuring the existing parking garage.

Above: A café at the southern end of the building opens onto the garage roof; the sloped metal volume at right is one of two enclosed staircases (one at either end of the new structure) that offer access to the upper office floor.

Above: A passageway runs the length of both floors; on the lower office level, a glass-walled conference room opens onto the entry plaza.

Opposite: The more fragmented floor plate of the upper office level offers the opportunity for double-height spaces.

Project Credits
Project: Pterodactyl, Culver City, Calif.
Client: Frederick and Laurie Samitaur Smith
Architect: Eric Owen Moss Architects, Culver City, Calif. · Eric Owen Moss, FAIA (principal); Dolan Daggett, Raul Garcia, Zarmine Nigohos, Kyoung Kim, Vanessa Jauregui, Karen Shueh, Scott Nakao, John Bencher, Eugene Glekel, Yi-Hsiu Yeh, Corinna Gebert, Holly Deichmann (project team)
Mechanical Engineer: Fruchtman & Associates
Structural Engineer: Nast Enterprises · Hooman Nastarin
Electrical Engineer: Silver, Roth & Associates
General Contractor: Samitaur Constructs · Peter Brown, Tim Brown, Bo Brown
Furniture/Accessories: Gensler
Size: 16,663 gross square feet
Cost: Withheld


CREATIVE DIRECTIONS:

In office interiors, exposed structural steel members frame the irregular geometries of the building volume.

National Center for Civil and Human Rights
Atlanta
The Freelon Group and HOK

TEXT BY KATIE GERFEN

PHOTOS BY ALBERT VECERKA/ESTO


RIGHTS
YOUNG

Civil and human rights are immense, and immensely important, topics—far too much for one organization, let alone one building, to encompass. Which is why the National Center for Civil and Human Rights focuses on "the understanding and exploration of the individual's role in civil and human rights," says CEO Doug Shipman. "We're not trying to embody every moment or issue, but to tell the stories of individual people who have been involved in these movements, so that visitors can understand their perspective and be inspired by their story." Which is why, he says, the intimate scale and spirit of the building designed for the institution was of paramount importance.

Enter Phil Freelon, FAIA, then of the Freelon Group (his firm has since joined Perkins+Will). The team of Freelon Group and HOK won a 2008 competition for the center in part because of their conceit of a curved building representing interlocking arms—a symbol of unity and solidarity. "We believe that architectural design, when appropriate, should be representative of the mission of the institution," Freelon says.

The design as built responds to both the client's input and the Great Recession (which put the project on hold twice). The 42,000-square-foot building takes advantage of its steeply sloping site with an exterior stair that joins two public plazas. The main, south entrance is on the second of three levels, through a glass façade between two canted, Trespa panel–clad walls. "The subtle change in the size and tonality of the panels might suggest the diversity of people and cultures coming together," Freelon says.

Inside, "we wanted the visitor to choose the order in which they view the exhibit spaces," Shipman says. The second-floor lobby leads to the civil rights galleries on the same level, the Martin Luther King Jr. papers on the lower level (which also has a group and special events entrance), and human rights galleries upstairs. Exhibits are rotated out every three to four months to keep up with national and world events.

Lighting in the galleries is controlled, but the public spaces are flooded with daylight, including an overlook at the top of the central stair that is designed to give visitors a place to stop and reflect. From within, the sloping exterior walls are expressed most vividly in the third-floor human rights galleries, where "the leaning walls add gravitas to the powerful and sometimes difficult stories being told," Freelon says.

"We hoped that it would be a very authentic experience," Shipman says. "But the most exciting thing for me is how many notes I get, how many young people come up to me and say, 'This is the first time I've really been interested in these topics—it's never really hit me. This is the first time it's been personal.'"

Third-Floor Plan

Second-Floor Plan

First-Floor Plan

1. Lower lobby and prefunction space
2. Martin Luther King Jr. papers and exhibit
3. Mechanical
4. Event space
5. Ivan Allen Plaza
6. Pemberton Place
7. Main lobby
8. Gift shop
9. Gallery
10. Overlook
11. Broadcast center
12. Offices

0 20 40

Previous Spread: Main entrance, showing exterior panels by Trespa

This page: Lobby seating area with donor wall and wood flooring by Nydree

OPPOSITE: MARK HERBOTH

Above: Human rights gallery, with acoustical ceiling by Eurospan

Opposite: Stair leading from lower-level galleries to main lobby

View from the north, showing the lower Ivan Allen Plaza and entrance for special events and tours

Project Credits

Project: National Center for Civil and Human Rights, Atlanta
Client: National Center for Civil and Human Rights
Project Manager: Gude Management Group in partnership with Cousins Properties
Design Architect: The Freelon Group, Atlanta · Phil Freelon, FAIA (design architect)
Architect of Record: HOK, Atlanta
Landscape: HOK
Plaza Sculpture: Larry Kirkland Studio
Lighting Consultants/Exhibit Lighting: Fisher Marantz Stone
Structural Engineer: Walter P Moore and Sykes Engineering
Civil Engineer: Long Engineering
M/P Engineer: Newcomb & Boyd
Electrical: Davis Pullen Engineers
Contractor: H.J. Russell & Co., C.D. Moody Construction and Holder Construction, Joint Venture
Cost Estimator: Cost Plus
Exhibit Design: Rockwell Group
Exhibit Fabricator: Design & Production
Size: 42,000 square feet
Cost: Withheld

Musée des Confluences
Lyon, France
Coop Himmelb(l)au

TEXT BY JOSEPH GIOVANNINI
PHOTOS BY SERGIO PIRRONE

Some careers do not survive their own success. Architects who made their reputations with small buildings designed when their firms were boutique operations often can't translate their ideas and language to a larger scale, especially when a commission demands monumentality. The failure is all the more conspicuous when the young Turks morph into deans of the profession. How do they sustain the energy level of break-out invention and/or outright iconoclasm when their struggling studio goes corporate? It's hard to startle the bourgeoisie when you've given up the guitar and now drive a Porsche.

The answer for Wolf Prix, HON. FAIA, principal of the Viennese firm Coop Himmelb(l)au, is that even though he's now charioteering around with 400 horsepower, he's kept the guitar. Car and guitar really represent different versions of the same energy, and energy is at the root of his design philosophy. Decades ago, he famously said about his fragmented work, "When you break something, energy comes out."

Coop Himmelb(l)au was one of the seven firms that participated in the Museum of Modern Art's Deconstructivist Architecture show in 1988. Although the curators lumped all of these firms together under the same banner, the architects actually represented different ideologies.

Prix wasn't reading Derrida. He brought both his own Viennese cultural traditions to the drafting table and his own originality. The traditions included a unique blend of influences: He tapped into the Freudian subconscious, referenced his architectural mentor Günther Feuerstein's interest in subjectivity and physical experience rather than just rational and economic issues, and translated Karl Popper's theses of open systems and open societies into open architecture. Not least of those influences was his interest, as a guitarist, in Keith Richards' torrid riffs. Prix espoused an experiential architecture that would intensify feeling.

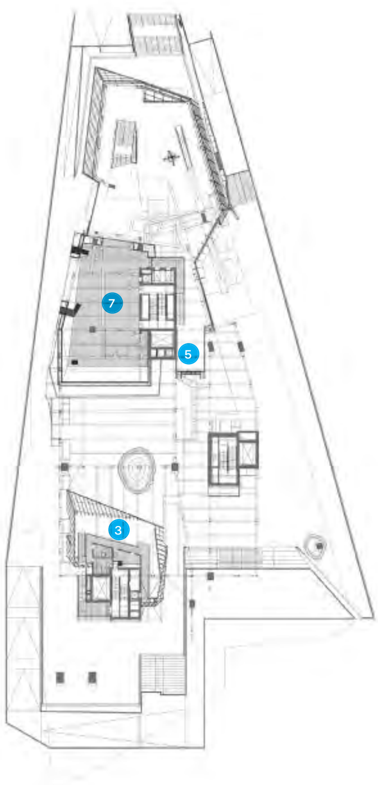
In 2001, Prix won a competition to design the Musée des Confluences in Lyon, France, sited at the end of a peninsula where the mighty Rhône and Saône rivers converge. The Guimet Natural History Museum, an interdisciplinary institution specializing in anthropology, ethnology, and the natural sciences, was attempting to recast its staid reputation. Following a long-standing national policy of decentralizing and democratizing culture, the museum was leaving the city center to spark urban renewal in a rust-belt zone with no trappings of cultural elitism. By moving out of an academically correct Beaux-Arts building, which represented the classical values of hierarchy, order, and harmony, the directors were escaping the formalism of official French culture, rooted in Cartesian rationalism

Ground-Floor Plan

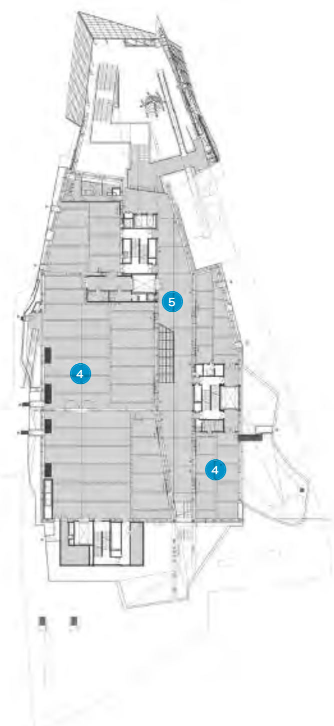
Previous Spread: View from the northeast of the glass-and-metal curtainwall as seen from a pedestrian bridge

1. Entrance
2. Lobby
3. Café
4. Exhibition hall
5. Circulation
6. Studio
7. Bookshop

Mezzanine-Level Plan

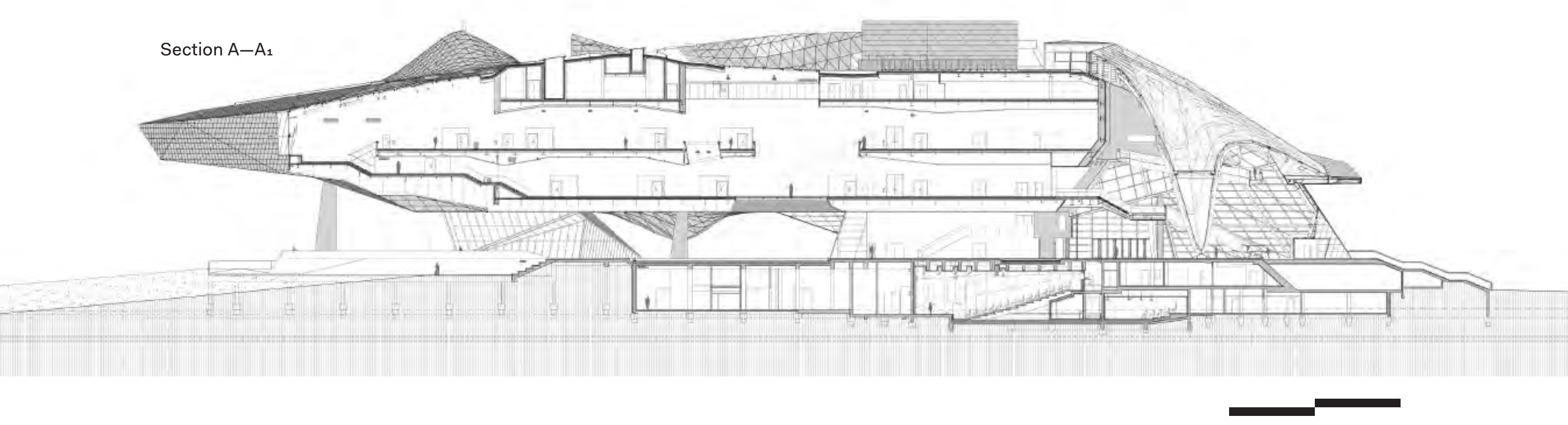


First-Floor Plan



Second-Floor Plan

Section A—A$_1$



Opposite: A sculptural support column (at left) merges with the tessellated museum volume to create a passageway between the city and the riverfront.

Above: View from the A7 highway of the museum's northwestern corner, where a staircase leads up to the entrance.

A single, three-story steel-and-glass funnel merges all of the lobby's complex crystalline roof structure to a single load-bearing point.

and Newtonian universalism. Lyon itself was long the capital of French Gaul, its Euclidean geometries still visible in the impressive ruins of its ancient amphitheater and theater.

With its scientific exhibits, the museum was ready to shift paradigms from the Greeks and the Enlightenment to Einstein. It was open to an architecture that was based on a different order, one which acknowledged the non-linearity and complexity made intelligible by a new digital culture.

Prix's winning scheme embodied the shift. He had already spent decades exploring the notion of energy embodied in architecture, and decades ago said, "Architects have always dreamed of building clouds." The computer enabled the vision—a faceted, voluminous cloud clad in anodized aluminum, with an entrance housed in an angular glass crystal. Without a center, symmetry, or any other controlling geometry, the non-hierarchical design was Einsteinian in the relativity of its parts, more $E=mc^2$ than x,y,z. The coincidence between the nature of the museum's scientific exhibits, which include displays of eruptive clouds forming galaxies, and the design of the building itself was "beautiful," according to Michel Côté, the former head of the museum.

Beyond theory, the design had to make the cosmic local. At the urban scale, the building's location next to a highway into the central city required that it be a monument legible at 60 mph. Opposite a pedestrian and tram bridge, it had to appeal to people walking at 3 mph. It was also a gateway into a park lined with promenades along riverbanks. While monumental, it also had to be porous, tying into the skein of pedestrian promenades on the bridge and along the riverfronts. Additionally, the high water table required lifting most of the building above grade on a service podium, with a high center of gravity. The long, narrow site lent itself to a linear building, with an entrance at the narrow end.

There was virtually no architectural context, no charming tangle of medieval streets, no neighborhood of properly aligned French façades. If anything, the context was a force field of movement and flow—the varying flow of highway traffic, and the flow of the two rivers forming unpredictable eddies as they converged.

The site was perfectly suited to Prix's concept of architecture that is broken into parts that are organized dynamically within an energy field. Arguably, the fractal geometries of his anti-formalist formalism were an opportunistic and empathic response to the site, both capitalizing on, and adapting to, its various characteristics. His open architecture and new geometries could meet the multiple demands and opportunities posed by the transportation systems, rivers, and roadways without imposing a single geometric system. Rejecting Euclid and Descartes was enabling and practical.

After a long bureaucratic and political delay, and then four years of construction, the museum opened in December. A wide flight of stairs invites visitors up to a spacious three-story lobby within a steel-and-glass crystal, where a funnel of glass unexpectedly dives down into the space, looking like the top half of a wormhole. In an environmentally conscious twist, the funnel actually serves as a steel-saving column for the glass crystal. The lobby gives access not only to the building but to the site: Without taking off their coats or buying tickets, visitors can walk straight through to the park in back—which will be completed by Coop Himmelb(l)au this spring.

Or they can walk up another inviting flight to the second level, where a tempting ramp spiraling around the wormhole connects the two floors of galleries. They are all organized on either side of wide, long pedestrian streets that connect the front of the museum to pay-off views of the river confluence.

Like Le Corbusier, Prix designed a peripatetic building with *promenades architecturales* around which architectural events, like ramps, overviews, and long urban and natural vistas entice visitors. In the tradition of the Parisian shopping galleries appreciated by Walter Benjamin, it's a journey of reflection that allows cultural browsing in the cavernous galleries. Each of the black-box galleries, some sized for dinosaurs, can be closed individually, letting curators change exhibitions without disrupting adjacent spaces.

This museum that houses Jurassic-era behemoths is itself the new behemoth in town. Too new and radical for easy digestion, it is the subject of controversy, not unlike the Eiffel Tower in its time. Some commentators have hailed it as evidence of a new enlightenment in the digital age that is bringing France, or at least Lyon, into the 21st century. Others have railed against what they perceive to be architectural chaos.

Whether ugly or beautiful, the building succeeds, but not just as a museum. It has become an event in the cityscape, an oneiric urban object inspiring curiosity—and perhaps even wonder—in the collective urban imagination. Challenging the status quo, it causes visitors and passersby to think about what architecture has been in this city, what it might be, and how it relates to the displays inside. It succeeds because it is now the institution's largest exhibit, a subject and a didactic provocation for the interdisciplinary learning that is the mission of the museum itself.

Skylights allow daylight into the central circulation space between galleries.

Stuffed mammals in one of the museum's black-box galleries

Project Credits

Project: Musée des Confluences, Lyon, France
Client/Owner: Département du Rhône
Architect: Coop Himmelb(l)au | Wolf D. Prix & Partner, Vienna, Austria · Wolf D. Prix, HON. FAIA (design principal/CEO); Markus Prossnigg (project partner); Tom Wiscombe, AIA (design architect); Mona Bayr, Angus Schoenberger (project architects); Thomas Margaretha, Peter Grell (project coordination); Christopher Beccone, Guy Bébié, Lorenz Bürgi, Wolfgang Fiel, Kai Hellat, Robert Haranza, Alex Jackson, Georg Kolmayr, Daniel Kerbler, Lucas Kulnig, Andreas Mieling, Marianna Milioni, Daniel Moral, Jutta Schädler, Andrea Schöning, Mario Schwary, Markus Schwarz, Oliver Tessmann, Dionicio Valdez, Philipp Vogt, Markus Wings, Christoph Ziegler (project team, Vienna); Patrick Lhomme, Francois Texier, Philippe Folliasson, Etienne Champenois, Alexandru Gheorghe, Niels Hiller, Emanuele Iacono, Pierre-Yves Six (project team, Lyon)
Local Architects: Patriarche & Co. (planning); Tabula Rasa (execution); Chabanne & Partenaires (project management)
Construction Survey: Jean Pierre Debray
Costs: Mazet & Associés; CUBIC · Jean-Luc Minjard
Structural Engineering: Bollinger + Grohmann Ingenieure; (design); Coyne et Bellier, VS_A (execution)
HVAC: ITEE-Fluides
Security Fire Consultation: Cabinet Casso & Cie
Acoustics: Cabinet Lamoureux
Media Consulation: Cabinet Labeyrie
Lighting Consultation: Har Hollands
Landscape Design: Coop Himmelb(l)au; Egis
Construction: Vinci Construction
M/E/P: Axima Seitha
Plumbing: JMoos
Window Fabrication: Blanchet
Size: 46,476 square meters (500,263 square feet)

> *For a full list of credits, visit architectmagazine.com*

Lancaster University Engineering Building
Lancashire, England
John McAslan + Partners

INTERVIEW BY ALAN G. BRAKE
PHOTOS BY NICK GUTTRIDGE

The new engineering building is the third structure that you have designed at Lancaster University, but you also designed the master plan to update the 1960s campus. How does the new building fit into the larger plan?
John McAslan, INTL. ASSOC. AIA: The master plan identified new buildings, replacement buildings, and refurbished buildings, and its first iteration goes back seven or eight years. It was not just looking at building new structures and remodeling existing ones, but also at the landscape and how to connect elements and associated facilities—in total about $500 or $600 million worth of construction to be spread over a decade more. The engineering building was identified for a location close to a series of other associated facilities, on the site of a redundant sports hall which was demolished as part of our project.

This is a publicly funded university without a huge capital budget. Where did their commitment to good architecture and good planning come from?
Lancaster is one of the post–World War II universities where there was a commitment to publicly funded higher education. A very good firm, Shepheard Epstein Hunter, was the master planner and architect for a number of the original buildings. Their work started a commitment on behalf of the university to good post–World War II architecture, and robust, well-made higher education buildings; even through successive facilities departments they've always hired good architects. Lancaster is not a highly endowed university—their level of endowment is very low, especially compared to U.S. universities. If you take every university in Britain, including Oxford and Cambridge, the total endowment of all of them together is less than the endowment for the University of Texas, which is more than $25 billion. Sixty percent goes to Oxford and Cambridge, so the total endowment for every British university except Oxford and Cambridge is about $8 billion, which is nothing—it's a tough call to get good buildings out of that.

There's a real clarity and simplicity to the engineering building. How does the building itself express some of the ideas of engineering?
The route that we took was to try and reflect the precision of the engineering through the precision of the architecture, and for that precision to be reflective of the way the original campus was built, which was out of concrete and brick in the robust language of post–World War II materials. The engineering building was quite bespoke in its volumes and its loadings and its servicing requirements, but it needed also to be reasonably generic and adaptable to future needs.

The detailing on this building seems simple, but with a materials palette that clearly shows a lot of care.
It's a very simple palette of handmade natural materials—concrete, wood, and glass. And it's consistent with the palette that we've developed for the previous buildings on the site and that are articulated elsewhere on the campus. It's a modestly scaled concrete frame, with a brick façade. But there is a lot of natural ventilation through openings on the perimeter, both natural vents in the perforated panels and within the façade system. There are really no suspended ceilings so we get the advantage of height, volume, and nighttime cooling throughout.

Your work is all very modern in style, and as you say, relates to the midcentury campus, but there also seems to be a nod to classicism in the exposed concrete frame. Do you see that in the proportions of the building?
However you define classicism, I think the engineering building is quite a carefully proportioned building. Its principal reference is the postwar architecture of not just that university but similar universities that were state-funded, and, in fact, a bit like our national health service—the great development of social endeavor after the war. It's reflecting the kind of spare, modernist, and honest aesthetic that was determined with those social movements. It's not a Brutalist aesthetic. It's not the Paul Rudolph or Denys Lasdun architecture of the postwar era, it's an architecture that was slightly more modest and understated. There is a kind of classical language there, an understated competence and integrity in the architecture. There are no frills or funny bits. It's just a modest, robust structure; hopefully fit for its purpose, but with enough care in its materiality and its realization to make it a building of quality rather than just a functional box.

What has it been like for you to watch this project evolve over time, and to continue to realize some of the ideas that you initiated 10-plus years ago?
Most architects want the relationship to be more than a single-building relationship. You want a chance to do more work. And it's funny, when we did our first little building on the campus, we assumed that would be it. And then we then got a second building. When we went for this interview, we sort of just assumed we wouldn't get it, but we secured it. It was a real demonstration from the client of their faith in what we've done. Maybe we won't secure another one for a bit, but I think it's key to be able to develop a relationship with a single client and to feel that it is one that is evolving. To have that kind of ongoing relationship is really valuable.

Second-Floor Plan

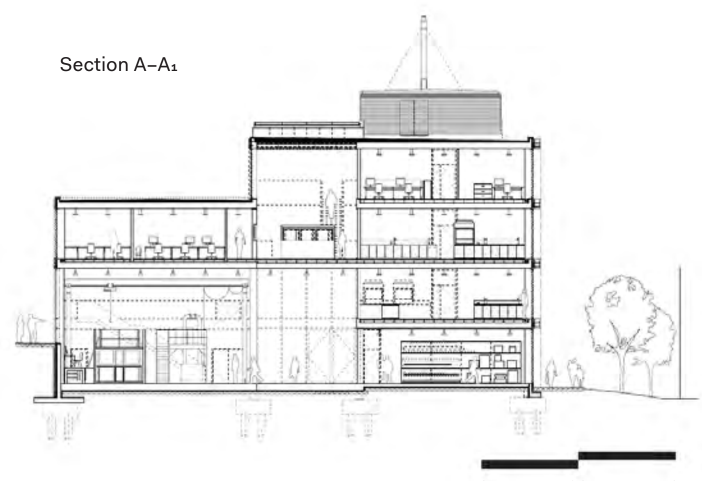
Third-Floor Plan

Fourth-Floor Plan

Fifth-Floor Plan

Ground-Floor Plan

Section A–A₁



1. Entry plaza
2. Lobby atrium
3. Laboratory
4. Workshop
5. Storage
6. Office
7. Team project center
8. Undergraduate drop-in area
9. Plant

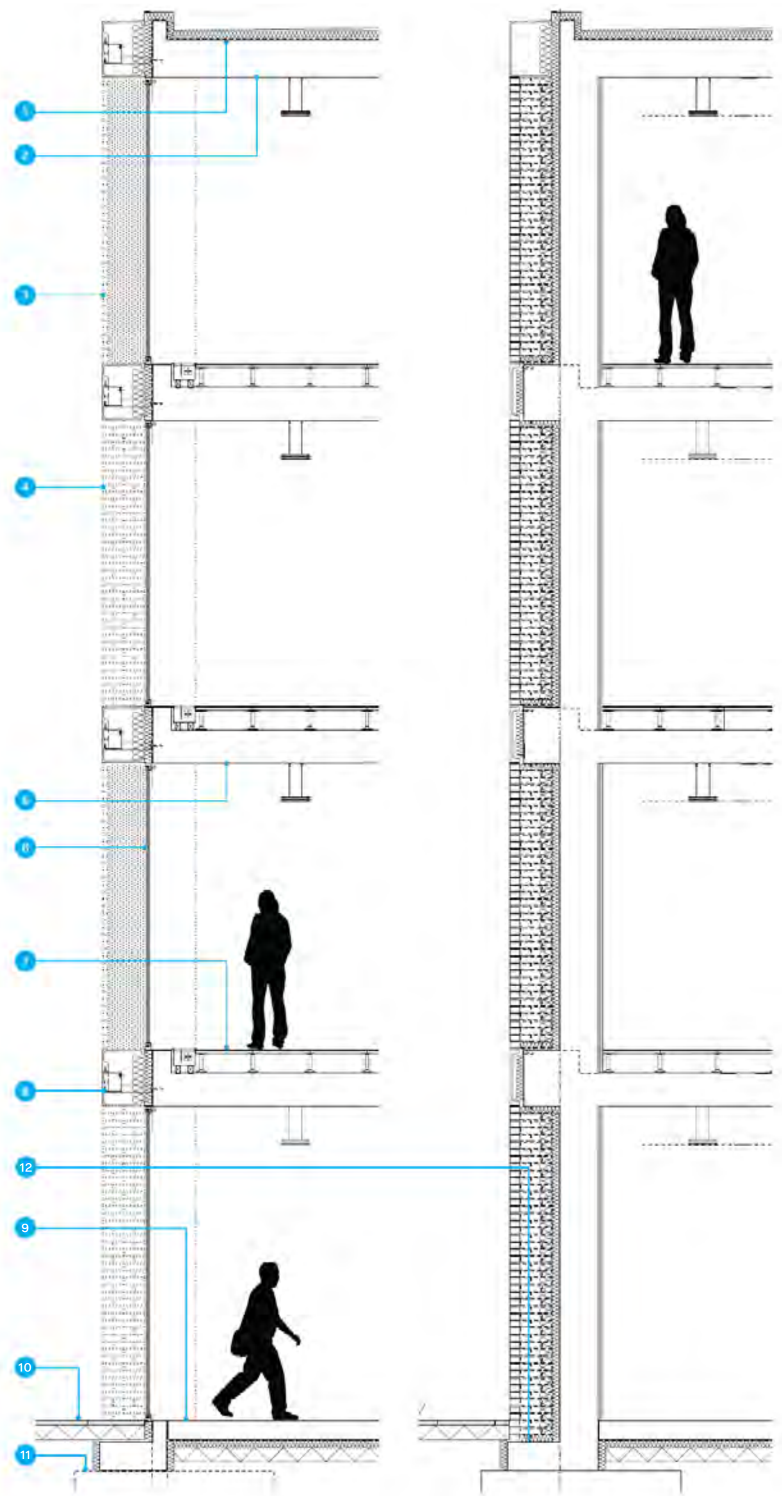
Opening Spread: The entrance atrium features polished concrete floors from Steyson Granolithic Contractors. A wood-lined staircase rises toward the ceiling four stories up, which is clad in solid oak battens with a black felt backing and insulation.

This image: The building exterior is a mix of brick from Traditional Brick & Stone and glass-fiber-reinforced concrete from GB Architectural Cladding Products. Around the Technal windows, which incorporate Saint-Gobain glass, is a perforated screen from WPL.

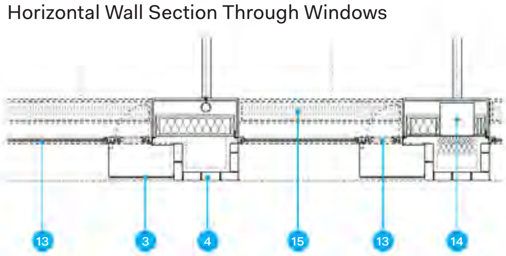
Opposite: The labs and workshops (like this main workshop on the ground floor, are outfitted with rubber flooring from Nora. A building management system, lighting controls, and HVAC from Ameon Building Services maintains the proper environmental controls for each space.

Wall Section Through Windows

Wall Section Through Masonry



Horizontal Wall Section Through Windows



1. Liquid membrane roof
2. Exposed concrete soffit
3. Perforated aluminum panel vent box
4. Brick pier with full fill cavity insulation
5. Concrete floor slab
6. PPC fixed-frame aluminum window
7. Raised access floor
8. Precast GRC cladding
9. Ground bearing floor slab
10. Paving
11. Foundation
12. Buried concrete toe for masonry
13. Insulated vent box door
14. Concrete column
15. Trench heater

0 2.5 5

Project Credits
Project: Lancaster University Engineering Building, Lancashire, England
Client: Lancaster University
Architect: John McAslan + Partners, London · John McAslan, INTL. ASSOC. AIA (chairman); Tony Skipper (project director); Paul Hughes (project leader); Chris Seviour (architect); Tim Marjot (architectural assistant)
Interior Designer: John McAslan + Partners
Mechanical/Electrical Engineer: AECOM
Structural/Civil Engineer: Curtins Consulting
Construction Project Manager: Faithful & Gould
General Contractor: Eric Wright Construction
Landscape Architect: John McAslan + Partners
Concrete Consultant: David Bennett Associates
BREEAM Assessor & Sustainability Consultant: GWP Project Services
Size: 4,701 square meters (50,601 square feet)
Cost: $12.52 million (£8.4 million) (construction cost); $18.26 million (£12.25 million) (total cost)

Benjamin P. Grogan and Jerry L. Dove Federal Building Miramar, Fla. Krueck + Sexton Architects

TEXT BY EDWARD KEEGAN, AIA
PHOTOS BY NICK MERRICK © HEDRICH BLESSING

Located about 20 miles northwest of downtown Miami, the Benjamin P. Grogan and Jerry L. Dove Federal Building in Miramar, Fla., provides an integrated hub for FBI activities in South Florida. The Krueck + Sexton–designed complex comprises three structures that form east–west bars with courtyards in between. The 20-acre site lies less than 6 miles east of the Everglades, on "improved" land that was actually part of the immense natural wetland less than a century ago. Chicago architects Ron Krueck, FAIA, and Mark Sexton, FAIA, recognized the potential for restoring much of the site to its natural condition, an ecologically correct decision that also helps secure the facility through the simplest of means: Why shouldn't alligators be enlisted to protect those who protect us?

Two office buildings, one six stories and the other seven stories, are connected by a bridge and supplemented to the north by a lower-scaled annex and parking garage that supports an extensive photovoltaic array, providing 20 percent of the complex's energy needs. The concrete-framed buildings are designed to LEED Platinum core-and-shell standards through material use and smart siting. "It costs you nothing to orient the building correctly," Sexton says. The architects mitigated primary solar gain by placing fire stairs at the east and west ends of the office structures. Located behind carefully pleated glass façades, the stairs are spacious and encourage healthy use by the occupants.

Developed through the U.S. General Services Administration's Design Excellence program, the 383,000-square-foot complex consolidates nearly 1,000 FBI employees who had previously worked in several locations throughout the Miami area. Open offices receive ample natural light deep into the core due to the slim 60-foot width of the buildings—a dimension more typical in Europe. The buildings' undulating north and south faces contrast with the faceted curtainwalls at the east and west, and along the façades facing the courtyards between the structures. The pleated expression extends themes based on Mies van der Rohe's seminal but unbuilt 1920s projects that have been previously explored by Krueck + Sexton in buildings like Chicago's Spertus Institute for Jewish Learning and Leadership. "We're highly intrigued with reflections," Krueck says.

The east and west courtyards are subtly different. The main entrance is at the eastern end, where an open colonnade under the north building creates a wider ground plane that invites visitors in shaded comfort. The larger west courtyard is a protected outdoor amenity strictly for employees.

Sexton notes that one of the toughest things about entering a building in South Florida is that you're initially cold and blind due to the difference in temperature between the sunny and steamy outdoors and the over-conditioned and comparatively dark interiors. The architects address this abrupt change by orchestrating an entry sequence that allows people to adapt in stages—moving from the parking lot that might be 90 degrees and 10,000 footcandles through a series of more sheltered spaces before entering the building proper. "It goes down 5 degrees, then 3 degrees, then 2 degrees," Sexton says. "And the footcandles go down, too."

Early in his career, Krueck abandoned the postmodern world of architecture and trained for five years as an artist; that background has since informed his approach to design. One such influence has been Roy Lichtenstein. Here in Miramar, subtle patterns on the building—from the fritting on the glazing to the perforations in the metal sunscreens—reflect the dotted pop art technique that the painter typically employed. The relatively clear glass skin might, at first glance, seem colorless, but "it's almost like a chameleon," Krueck says. "It takes on the color of the light."

The metal sunscreens, which are laid out in a diamond pattern, were developed with Atelier Ten. While they're predominantly deployed on the south façade (as well as the east and west façades of the bridge that separates the two courtyards), their principal use isn't for shading, but rather to reflect light onto the interior ceilings, cutting the lighting energy load. And their layered composition adds another dimension to the otherwise two-dimensional façades. "There's a depth to them," Krueck says, "depending on the light." The thinness of these elements, coupled with their perforations, keep the building's glassy elevations uncluttered. "We liked the idea of a highly secure building being light and transparent," Sexton says.

The building also "had to be iconic," Sexton says. But what does that mean in 2015? The architecture has a strong presence, which is no small feat given the FBI's complex program. Indeed, the building stands as a stunningly ethereal testament to the state of the art in contemporary office buildings. It actually transcends the goals of the Design Excellence program to improve the quality of federal architecture, and sets an example for what private developers could build, if they moved beyond simplistic pro-formas. Krueck + Sexton provide qualities of interior space—namely daylight, views, walkability, and energy efficiency—that should inspire us to expect more from every office building constructed in the United States. And that's a lesson we should all embrace together.

Previous Spread: View from the west, with parking structure and annex at left

Site Plan

Section A–A_1

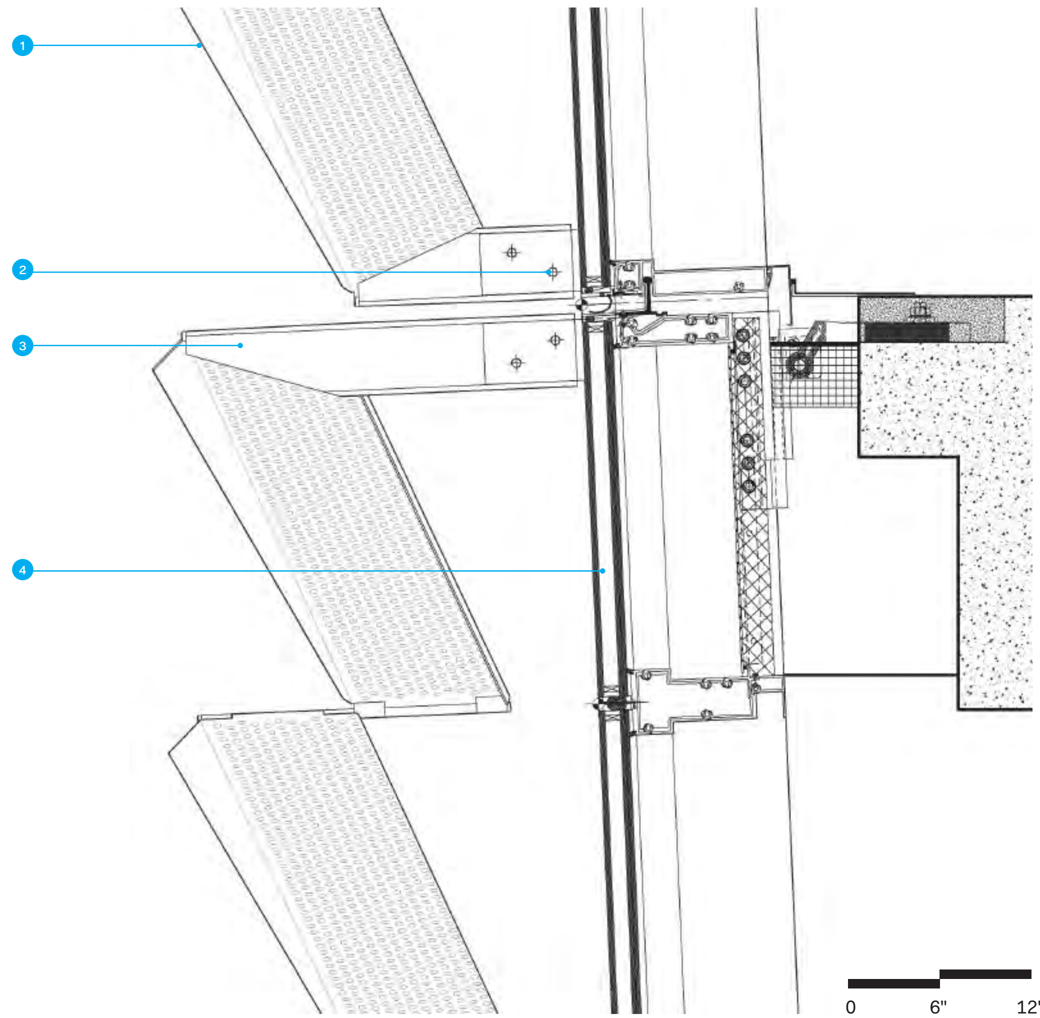
Typical Office Floor Plan

1. Office buildings
2. Parking structure and annex
3. Restored wetlands
4. Open office
5. Perimeter circulation
6. Conference
7. Fire stair
8. Connector bridge
9. Courtyard

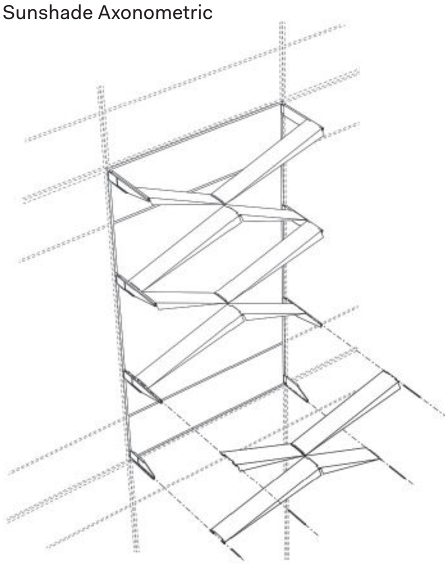
South fritted glass façade with restored wetlands in foreground

The east courtyard, with main
visitor entrance at right

Façade Section Detail



Sunshade Axonometric



1. Perforated aluminum sunshade
2. Preinstalled metal tabs at mullions
3. Unitized solar shade bracket
4. Blast- and hurricane-resistant high-performance unitized glazing system

Project Credits
Project: Benjamin P. Grogan and Jerry L. Dove Federal Building, Miramar, Fla.
Client: U.S. General Services Administration

Bridging Design Team
Bridging Design Architect: Krueck + Sexton Architects, Chicago
M/E/FP Engineer: WSP Flack + Kurtz
Structural Engineer/Building Envelope Consultant: Thornton Tomasetti
Civil Engineer: Miller Legg
Landscape Architect: Curtis + Rogers Design Studio
Lighting Designer: George Sexton Associates
Environment and High-Performance Design Consultant: Atelier Ten
Protective Design: Hinman Consulting Engineers
FP/Life Safety: Rolf Jensen & Associates
Security Systems: Sako & Associates
Acoustical/AV/IT: Dugger & Associates
Vertical Transportation: Jenkins & Huntington
Cost Consultant: Toscano Clements Taylor

Design/Build Team
General Contractor: Hensel Phelps, Derek Hoffine
Design/Build Architect and Interior Designer: Gensler
M/E Engineer and Lighting Designer: Syska Hennessy Group
Structural Engineer: Walter P Moore
Civil Engineer and Landscape Architect: Atkins
Geotechnical Engineer: Professional Service Industries
Construction Manager: Jacobs
Blast Analysis: Hinman Consulting Engineers
Curtainwall Assemblies: Gordon H. Smith
Size: 383,000 square feet
Cost: $194 million

Opposite: Perimeter circulation on an office floor, with view of sunshade system

This Image: Lobby with glass stair

Corning Museum of Glass
Contemporary Art + Design Wing
Corning, N.Y.
Thomas Phifer and Partners

TEXT BY THOMAS DE MONCHAUX
PHOTOS BY JAMES EWING/OTTO

The vase spent years holding flowers in the reception area of Thomas Phifer and Partners' New York office before it had its moment in the sun. "We've had it for as long as I can remember," recalls director Thomas Phifer, FAIA. "It's the bigger one by Alvar Aalto, with the subtle curves. We were trying to learn about glass, so we took it downstairs onto the sidewalk, right onto Varick Street."

The sidewalk experiment was prompted by the commission to add a 100,000-square-foot, $64 million wing for contemporary art and design to the Corning Museum of Glass in Corning, N.Y., a company town where the eponymous glassmaker has been headquartered since 1868. The addition features a 26,000-square-foot, single-level gallery over lower-level offices and adjoins an industrial shed from the former Steuben Glass Factory that has been converted to a 500-seat glassblowing demonstration theater.

The administrative campus is already a timeline of the architectural applications of glass, as is the museum building: the 1951 glass-block and curtainwall International Style original by Harrison & Abramovitz; Gunnar Birkerts' 1976–1980 addition, all mirrored angles and tinted curves; and Smith-Miller + Hawkinson's 2001 galleries and admissions lobby, a study in cable-stayed structures and fractured-seeming geometries.

Down on Varick Street, Phifer was especially interested in sunlight. "It was really bright that day," he remembers, and once they took that vase outside, "this thing that we hadn't ever totally paid attention to just came to life."

Because, unlike most artwork, the glass objects in Corning's collection would sparkle unharmed in sunlit display, and because they were to be shown primarily in the round rather than against walls, the conventions of museum enclosures could be rethought. "Usually you're deflecting light to the walls," Phifer says, "but here we wanted to push the light straight down. So we started looking at beams as a way to channel light to the floor."

Working closely with structural engineers Guy Nordenson and Associates, Phifer topped the gallery volume with slender precast concrete beams, each 3½ inches wide and 4 feet tall, running north–south on 3-foot centers below a pixelated array of variously transparent, translucent, and opaque roof panels. Here, Phifer's signature big roof has transformed from a filter, as at his North Carolina Museum of Art in Raleigh (2010), to an amplifier. "Usually, in galleries, we're trying to get to 30 footcandles of brightness, and as low as 10 for works on paper," Phifer says. "Here we have a range of 400 to 500. The more the better."

Below that orthogonal array of beams and skylights is a striking counterpoint: a sculptural enclosure of sinuously curved 20-foot-tall by 2-foot-wide cast-in-place concrete walls. The white-plastered gallery walls (which also handle air, with outlets along their tops and returns through doorway soffits), create a building-within-a-building of galleries for the permanent collection and rotating exhibitions.

"The shape of the vase never occurred to me here, at least consciously," Phifer reflects, despite the seeming formal resemblance. "It was an intuition about these very soft rooms, about the softness of glass when it's made, about walking into a cloud."

The curves produce an edgeless cyclorama effect within each gallery, suspending displays of often brightly colored glass objects in lightness and whiteness. Where the doorjambs in the curving walls between galleries face sightlines from the primary entrance and perimeter circulation, they gradually taper to a near-knife-edge, further dematerializing the massive structure.

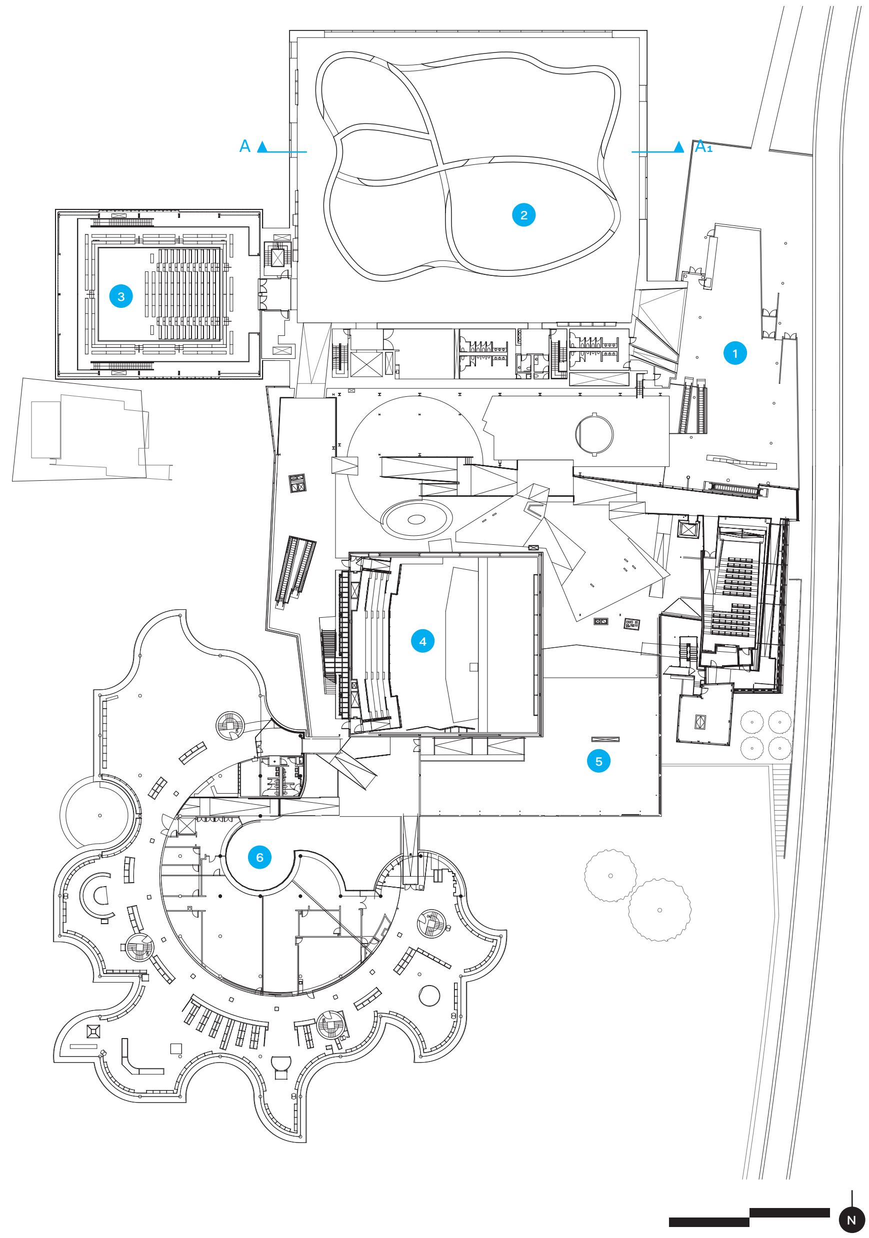
"I love Brice Marden's work," Phifer says. "I began to look at his paintings very closely—he takes these ribbons of color, he connects them and directs them. I love the interactions with the edge of the painting, that wonderful tension there."

Entry from the existing lobby is positioned at just such a point of tension: the southeast corner of the new wing, where the addition's rectangular plan slots into the existing structures along its southern edge, accommodating service spaces in a deep boundary between old and new. "The addition had to weave itself in there in a careful and seamless way, to get everything knitted together," Phifer says.

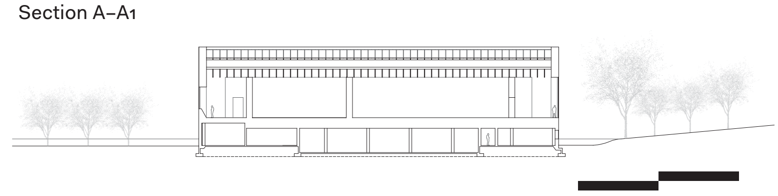
"So you turn right from the lobby and go through a 20-foot-deep tapering portal. It's an experiential thing. We wanted to protect the integrity of the existing spaces, so there's this metaphorical gasket in between, this moment of pause." That moment of pause addresses the widest of what Phifer calls the addition's "porches," or the perimeter circumambulation between the rectilinear exterior walls and the undulating gallery enclosure, which overlooks a newly landscaped garden and directs the eye to the entrance of the glassblowing theater beyond.

Just as the new wing's curvaceous central structure is withheld from the perimeter, the seating and stage in the theater are set back some 6 feet within the historic structure's existing walls, reinforcing the experience of suspension and lightness established in the galleries. Phifer retained the distinctive bunny-eared roof-ventilator profile of the existing building, recladding the entire structure in dark corrugated aluminum, *Opening Spread:* North façade, with black Factory Ventilator at right and roof of Smith-Miller + Hawkinson wing at left

Gallery Floor Plan



Section A–A1



1. Admissions Lobby
2. Thomas Phifer and Partners, North Wing Addition, 2015
3. Steuben Glass Factory Ventilator, renovated by Thomas Phifer and Partners, 2015
4. Smith-Miller + Hawkinson Addition, 2001, 2012 (renovation)
5. Harrison & Abramovitz, 1951
6. Gunnar Birkerts Addition, 1976

creating a counterpoint in the landscape to the sleek and pale new wing—a sooty lump of coal next to a milky block of ice.

The seeming simplicity of the gallery block's icy façades relies on considerable technical complexity. Because the deep interior walls "provide lateral stability like the core of an office tower," Phifer says, the exterior walls can be lightweight—exceptionally so in a window wall of 1-inch-thick low-iron panes of laminated glass, each about 20 feet tall by 10 feet wide, which runs without mullions some 144 feet along the new wing's north side.

"There's a heroic scale to the panes and the smallest possible joints between them," Phifer says. The addition's 140 façade panels, prefabricated in Germany, serve equally as window and wall, differing only in the transition of their PVB laminar interlayer, from clear within the sections of vision glass to opaque for the rest of the wall structure—which is, as Phifer puts it, "as white as white is white."

"That same glass goes from being rainscreen to being weatherproofing," the architect adds, "so all the solutions happen behind the glass around the head, jamb, and sill of those windows, to create that moment of expanse without a frame. That detail is really the whole building right there."

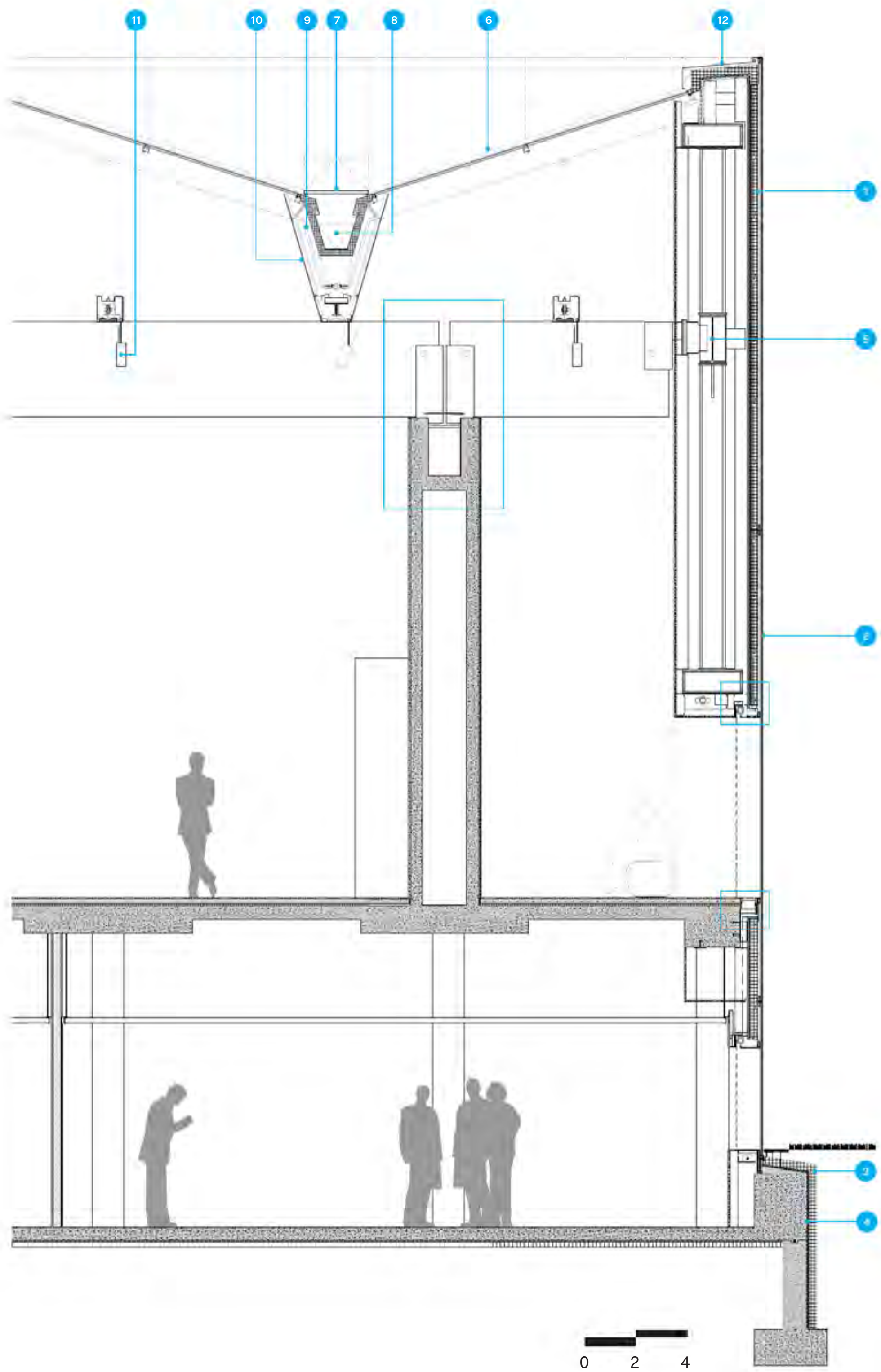
That gods, and devils, are to be found in such details is a truism attributed to Ludwig Mies van der Rohe, the early modernist and proto-minimalist master of glass architecture. In Phifer's recent work, such as his recently completed United States Courthouse in Salt Lake City (see January 2015, page 142), he establishes a new kind of minimalism—not of refusal and removal, but of strategic synthesis in which fewer forms perform greater functions. Here in Corning—in those concrete beams whose vanishing narrowness directs both loads and light, in those internal walls whose curving depth accommodates both structure and air-handling—less does more.

Although Phifer's work, with its zest for components and arrays and alloys and polymers, visibly falls within a high-tech tradition, it resists the mannered hyperformalism into which many of the genre's founders have now lapsed. The result at Corning is an intricate simplicity and an expansive restraint, serving neither a Puritan abstemiousness nor a polemical economy, but supporting a maximal sensory experience of literally visual and figuratively physical lightness. One in which the curated artifacts and landscapes provide the essential spectacles and illuminations. It's a vase that makes you see the flowers.

Opposite: East façade, with entry plaza of Smith-Miller + Hawkinson wing in foreground

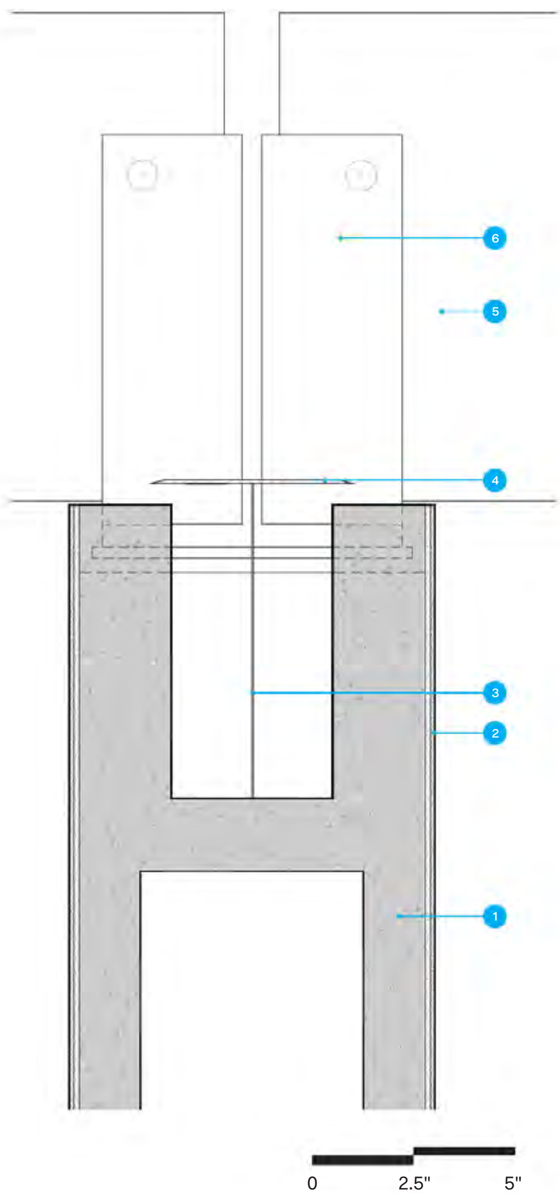
This Image: Daylit galleries enclosed by curved concrete walls

Wall Section Detail

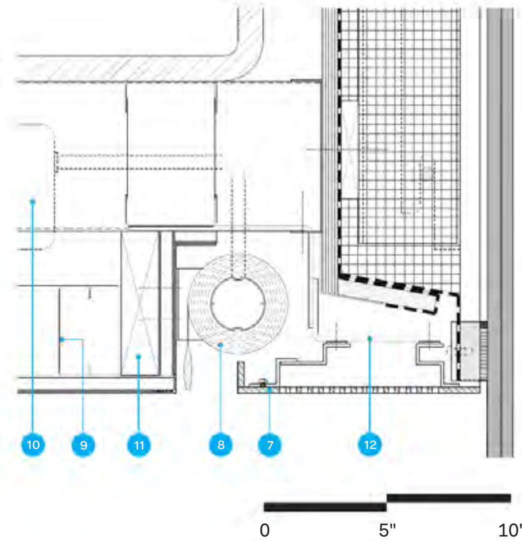


1. Custom glass rainscreen system
2. Laminated glass
3. Rigid insulation
4. Below-grade waterproofing/flashing
5. Structural-steel framing
6. IGU at gallery skylight
7. Custom hinged maintenance walkway
8. Custom insulated gutter system with heat trace
9. Fire protection piping
10. Painted aluminum panel cladding
11. Light fixture and track
12. Painted aluminum coping

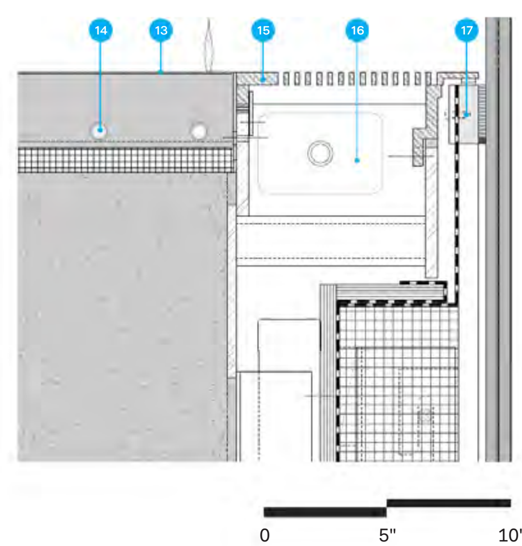
Column-and-Beam Detail



Shade Assembly Detail



Perimeter Heating Assembly Detail



1. Cast-in-place concrete
2. Plaster
3. Mechanical ductwork
4. Removable custom-profiled aluminum plate for airflow
5. Structural precast concrete roof joist
6. Shoe assembly
7. ¼" aluminum cover plate
8. Motorized roller and shade
9. Interior framing and bracing
10. J-box for shade motor
11. Wood blocking
12. Painted bent metal plate
13. Concrete floor topping
14. Radiant flooring
15. Removable ½" aluminum grille
16. Fin-tube radiator
17. Façade movement joint

Galleries, with knife-edged dividing wall and lighting integrated between concrete ceiling fins

Project Credits
Project: Corning Museum of Glass Contemporary Art + Design Wing, Corning, N.Y.
Client: Corning Museum of Glass
Architect: Thomas Phifer and Partners, New York · Thomas Phifer, FAIA, Gabriel Smith, FAIA (directors); Adam Ruffin, Katie Bennett (associate directors); Remon Alberts, Bethany Mahre, Brad Cooke, Mo Gagnon, Gerry Gendreau, Eric Ho, Isaiah King, Brad Kingsley, Joanna Luo, Stephen Varady, Colin Ward (project team)
Structural Engineer: Guy Nordenson and Associates
M/E/P/FP Engineer: Altieri Sebor Wieber
Landscape Architect: Reed Hilderbrand
Façade Consultant: Heintges
Daylighting/Lighting Design: Arup
Climate Engineer: Transsolar
Civil Engineer/LEED Consultant: O'Brien & Gere
Waterproofing Consultant: Simpson Gumpertz & Heger
Environmental Graphics: 2x4
Cost Consultant: Stuart-Lynn Co.
Spec Writer: Construction Specifications
Acoustics and AV Design: Jaffe Holden
Theater Design: Theatre Projects
Construction Management: Gilbane+Welliver, joint venture
Size: 100,000 square feet
Cost: $64 million

Perimeter circulation along north wall


MADE IN AMERICA
This Steel Fabricator Has a New Assistant
Used to be you had to move paper. Lots of it. A change here, a change there. Run out to the plant, make sure everyone's on the same page. Reprint the drawings. Distribute them. Heck, the paper cost could put you at a loss. And the time involved!
Jake Thomas suddenly found himself the owner of Thomas Steel. So when this third generation was called into action to lead his team, he quickly found out he needed some changes. The process was inefficient.
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Like saving money – around six figures. Like saving time – thousands of hours. And Jake says it's just the beginning. "What iPads do more than anything else is expedite networking," he says. "It puts us all on the same page. And that's a competitive advantage in any business."
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Residential:
House in Shichiku
Kyoto, Japan
Shimpei Oda Architect's Office

TEXT BY SARA JOHNSON
PHOTOS BY NORIHITO YAMAUCHI

Constructed on narrow lots, the traditional *machiya* townhouses in Kyoto, Japan, are often compared to *unagi no nedoko*, or an eel bed, because of their long, thin shape. Osaka-based Shimpei Oda renovated one of these dark eel bed houses into a light-filled, live/work space for a couple.

The 979½-square-foot House in Shichiku is a mere 13½ feet wide and nearly 42 feet long, and is the first eel bed house that Oda—who founded his firm in 2008—has worked on. The original house, which he estimates was completed between 1920 and 1940, was in need of seismic retrofitting and renovations. "The structure of the house had become unstable by repeated extension and reconstruction," Oda says.

The renovation added several interior walls, which form distinct rooms in addition to shoring up the house structurally. "I proceeded with the project by considering ways to improve earthquake resistance," Oda says, "and also thinking about furniture and the client's art works."

The first floor originally contained an office, bath, and garage with steel shutter doors; Oda redivided the space into a kitchen and dining area, bath and laundry spaces, an entrance foyer, and a studio and gallery that opens to the street. In place of the shutters, Oda inserted a wood entry door and steel-framed window, which can partially open for access to the studio so the wife, a painter, can host exhibitions. A sliding glass door opens from the kitchen onto a garden.

Painted steel stairs lead to a second story, which contains two rooms on either side of an open space designed to serve as an office for the husband, a furniture dealer. Oda moved the staircase from the north side of the house to the south, which allows light to filter into the foyer from a second-story window. While currently a one-bedroom house, the other upstairs room is designed to be converted into a second bedroom if the need arises.

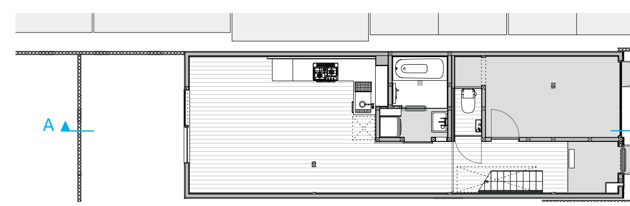
Throughout the house, Oda created a visual distinction between old and new. "To visualize the history of the house, I left the existing columns and beams as they were, and painted reinforcing materials and new structural elements white," Oda says.

The original wooden beams project through new interior walls, and are left exposed where possible. The wooden structural members are complemented by oak floors in the water closet and living spaces; elsewhere, fiber-reinforced plastic waterproofing was used for the bathroom flooring, and trowel mortar flooring was used in the lavatory, studio, and entrance.

Aside from the first-floor façade, the house's exterior was left intact, leaving little indication from the street of the pleasant, light-filled surprise inside.

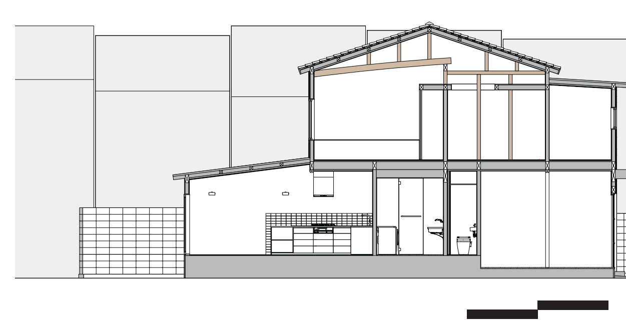
Previous Page: View of exterior and new first-floor façade (left)

Ground-Floor Plan



Second-Floor Plan

Section A–A_1

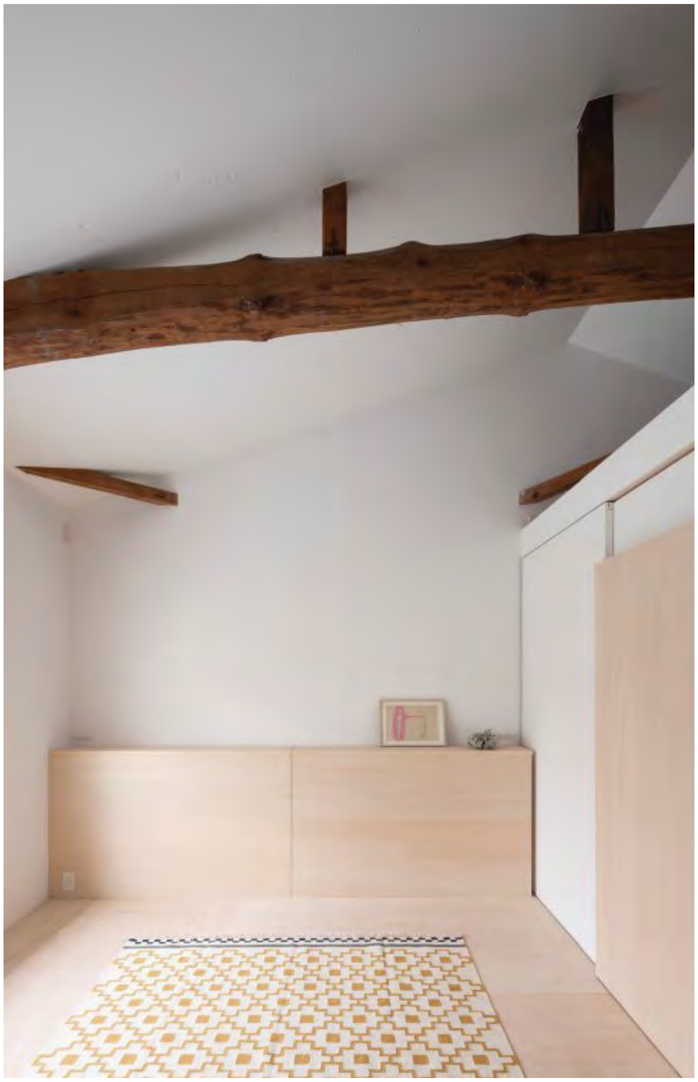



REVEAL SYSTEM


SECURITY DOORS


DRAINABLE HOUSEWRAP

Entrance foyer with view of painted steel stair



Top: Master bedroom

Bottom: Kitchen and dining area

Project Credits
Project: House in Shichiku, Kyoto, Japan
Client: Withheld
Architect: Shimpei Oda Architect's Office, Osaka, Japan, Shimpei Oda
Structural Engineer: S3 Associates · Ichiro Hashimoto
General Contractor: Kyowa-techno
Size: 980 square feet
Cost: $59,400

Materials and Sources
Appliances: Harman; Double
Bathroom Fixtures: Grohe; Kaldewei; Toto; Inax; Panasonic
Kitchen Fixtures: Inax
Lighting: Daiko; Maxray; DN Lighting

Exposed beams in second-floor office

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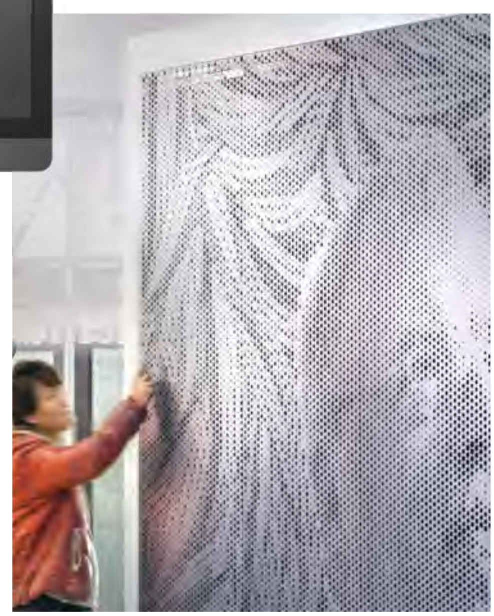

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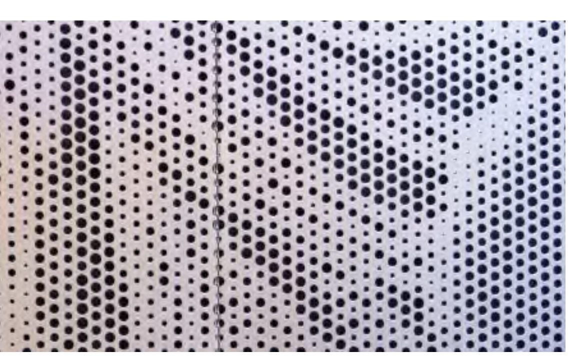

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* **Zahner Patent No. 7,212,688 B2,** Transferring an image to a building using a plurality of metal panels.

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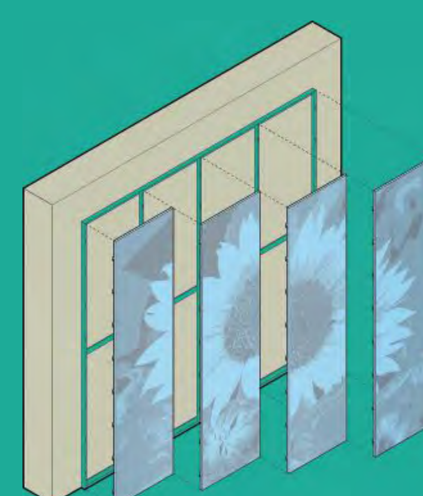
1. Create a free account with **ShopFloor.™** (You can use the code below to get a dedicated support staff on your team).
2. Launch the ImageWall™ app. *Note: You may be asked to install a browser plugin called Unity which powers the ShopFloor™ apps.*
3. Design your heart out. The app has an **"Upload Image"** button, allowing you to create designs using your own photographs, drawings, or images.
4. When your design is complete, set up a purchase order within the app, and Zahner will fabricate and ship the panel system to your door.



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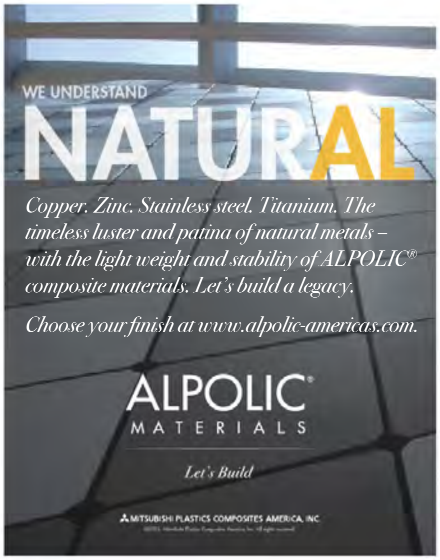

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Editorial: All Grown Up and Nowhere to Go

Millennials can't catch a break, or so the story goes: Graduated into the worst job market in living memory and saddled with unprecedented school debt, they are stuck in mom and dad's basement without the wherewithal to buy a house of their own. According to John Burns Consulting, those student loan payments cost the housing industry $83 billion in sales in 2014.

Fortunately, the storyline may be changing. *Bloomberg Business Week*, *The New York Times*, and *Money* all report that as the economy improves Millennials will finally begin to pursue homeownership en masse. The catch, as young house hunters may discover, is that entry-level options, in the $200,000 range, are limited.

Destination cities such as New York, San Francisco, and Washington, D.C., are simply priced out of reach. Concurrently, we're witnessing the rise of the NORC, or naturally occurring retirement community. Boomers around the country are embracing the idea of aging in place and opting to remain in their homes, which reduces both resale inventory and the likelihood of remodeling jobs from recent purchasers.

The new construction landscape is just as grim. "More and more builders have been chasing that luxury and 55-plus buyer, and all of that stuff is at higher price points," John Burns Consulting's Rick Palacios Jr. tells *Builder*, ARCHITECT's sister magazine, in an eye-popping feature titled "Are New Starter Homes History?" Furthermore, Palacios says, "It's really difficult, given what land prices moved up to, for a builder to make that entry-level product pencil out."

It's not that home builders are avaricious. In his story, *Builder* deputy editor Les Shaver enumerates a host of factors that make the starter home a financial nonstarter, including zoning that prohibits density and the rising cost of materials, land, and labor.

So if the free market can't meet the pent-up demand for starter homes, whether old or new, where are Millennials to turn? It's tempting to imagine Good Design swooping down and saving the day singlehandedly, like Superman or Wonder Woman (but in an all-black unitard, of course).

There is precedent. As in 1927, when a league of 17 early modernists—among them Corb, Gropius, and Mies—industrialized the building type with the Weißenhof model housing estate in Stuttgart. Or in 1967, when AIA Gold Medalist Moshe Safdie wedded prefabrication and prehistoric settlement patterns at Habitat in Montreal (page 172). But neither would've been built had the architects' radical ideas not aligned with the policies of the governments footing the bills.

Nowadays, architects must reconcile a myriad of powerful interests—not just those of the client, but of bankers, planners, community groups, the trades, and on and on. It's a tall order, but it's also an opportunity for the profession to take a leading role. Already, architects are poised to make major contributions, in areas such as prefabrication and energy harvesting.

Demand for low-cost housing is only going to increase with time. According to a recent Better Homes and Gardens Real Estate survey of Post-Millennials aged 13 to 17, a full 97 percent of respondents believe they will one day own a home, and 82 percent say it is the most important part of the American dream. Architects can help make that dream a reality.

STEPHEN VOSS

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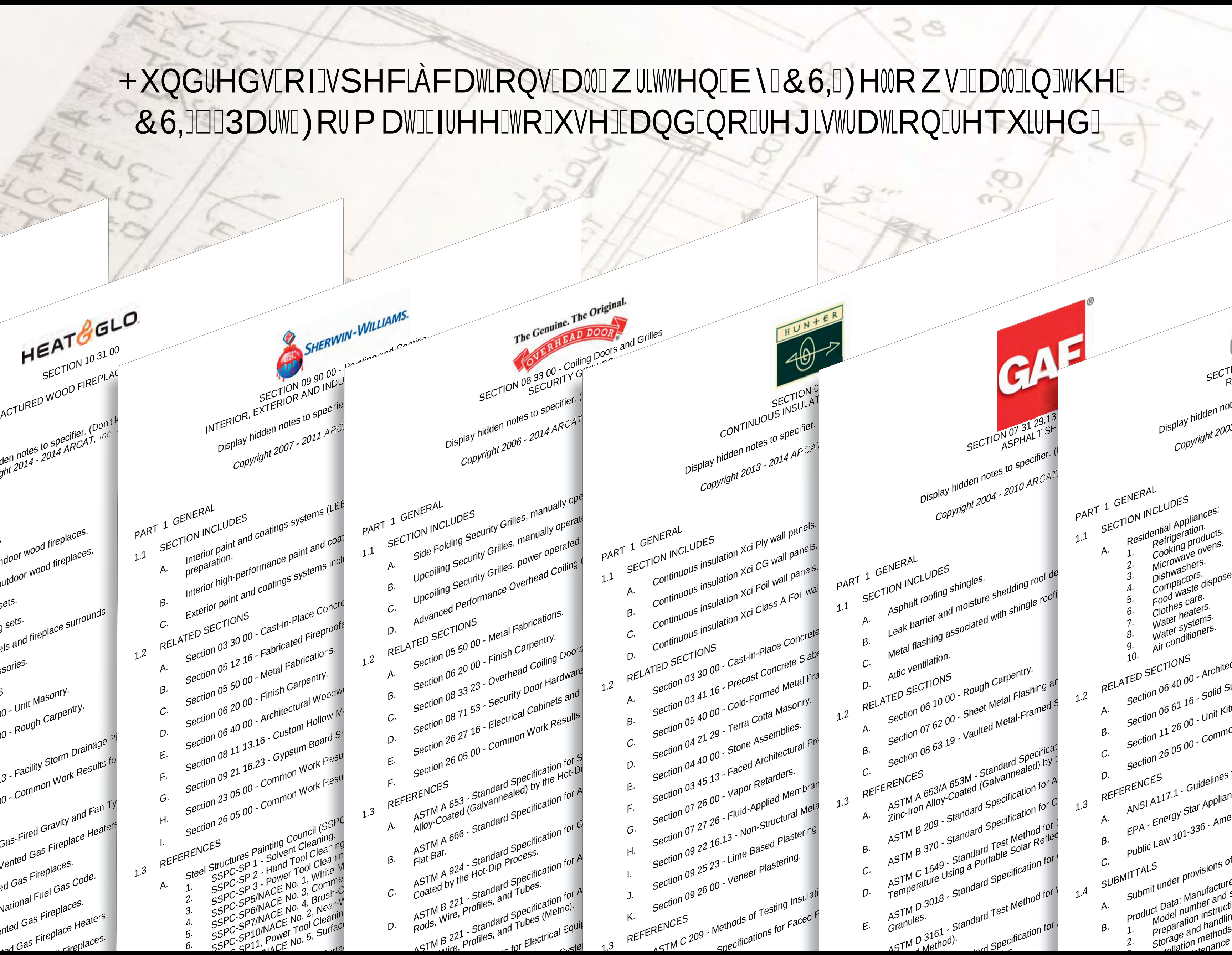

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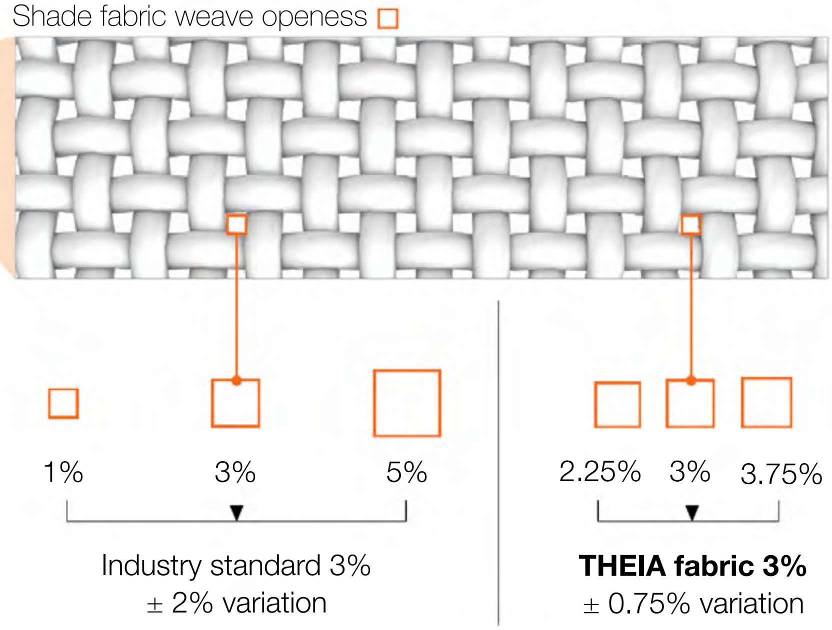

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