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Design
Editor
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Associate Editor
Deane Madsen, ASSOC. AIA
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@deane_madsen

Assistant Editor
Sara Johnson
sajohnson@hanleywood.com
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Technology and Practice
Senior Editor
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wlau@hanleywood.com
@wandawlau

Associate Editor
Hallie Busta
hbusta@hanleywood.com
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Assistant Editor
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cmassie@hanleywood.com
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Features
Senior Editor
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Content Producer
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rmckeever@hanleywood.com

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Multimedia
Video Production Manager
Kaitlyn Rossi
krossi@hanleywood.com

Video Producer
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Design Group
Group President
Ron Spink
rspink@hanleywood.com
202.736.3431

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Dan Colunio
dcolunio@hanleywood.com
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China, Hong Kong, Taiwan
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86.13810325171

Midwest
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mgilbert@hanleywood.com
773.824.2435

Canada
D. John Magner
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Canada
Colleen T. Curran
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> *To see work from the show, such as Haus-Rucker-Co's 1968* Environment Transformer/Flyhead Helmet *(above), visit bit.ly/HippieModern.*

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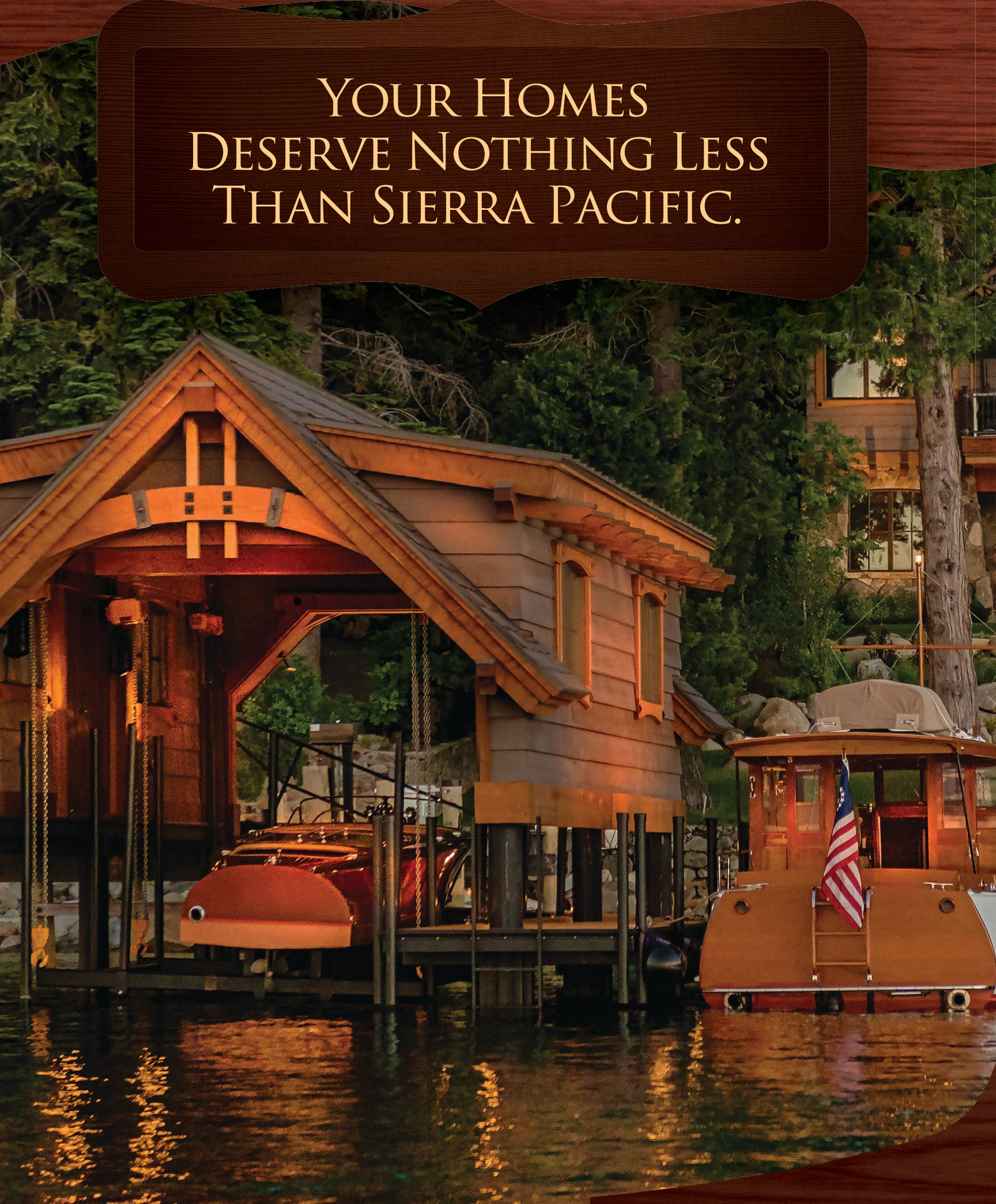

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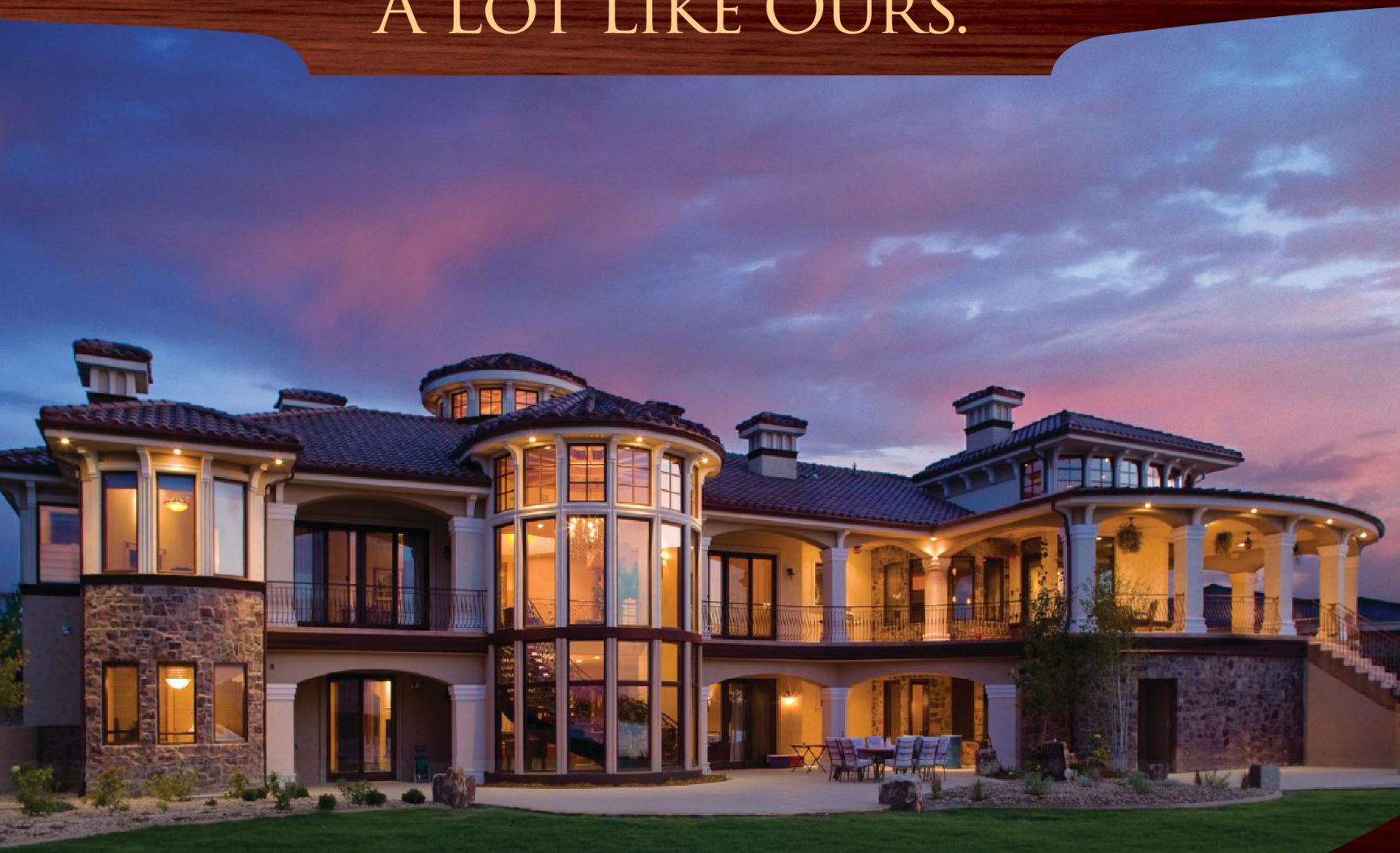

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The Way We See Now

No contemporary artists have had a more profound effect on the way we depict buildings than Bernd and Hilla Becher. The husband-and-wife team began photographing industrial buildings in their native Germany back in the 1960s, framing each individual grain elevator, gas tank, or water tower like a human portrait and grouping the black-and-white images according to their formal and typological similarities. The photos' simple power and the couple's leadership at the Kunstakademie Düsseldorf inspired a school of photography, which includes Andreas Gursky, Thomas Ruff, and Candida Höfer. Bernd died in 2007, Hilla last month, on Oct. 10.

> *To see classic photos by Bernd and Hilla Becher, visit bit.ly/HillaBecher.*

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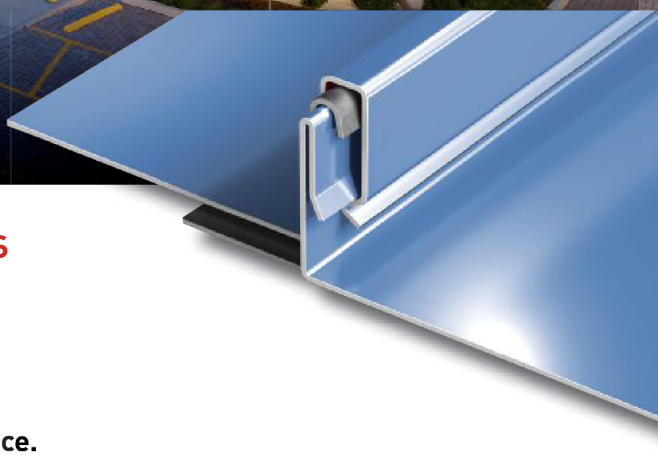

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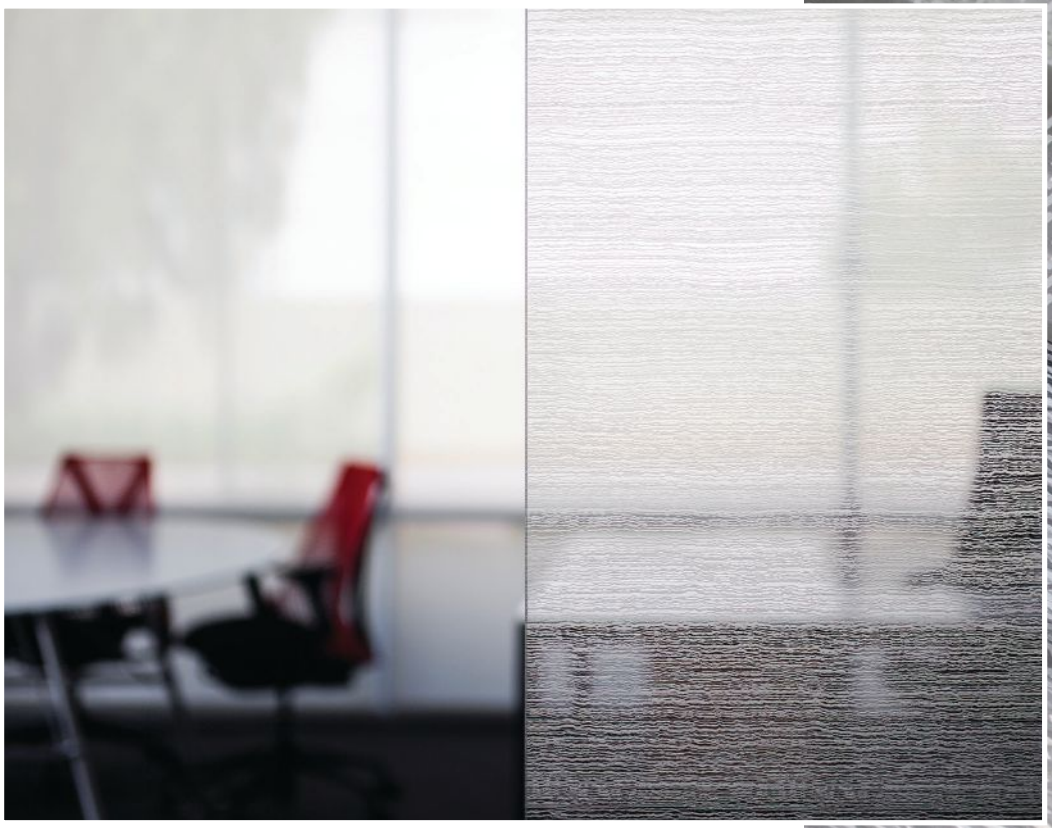

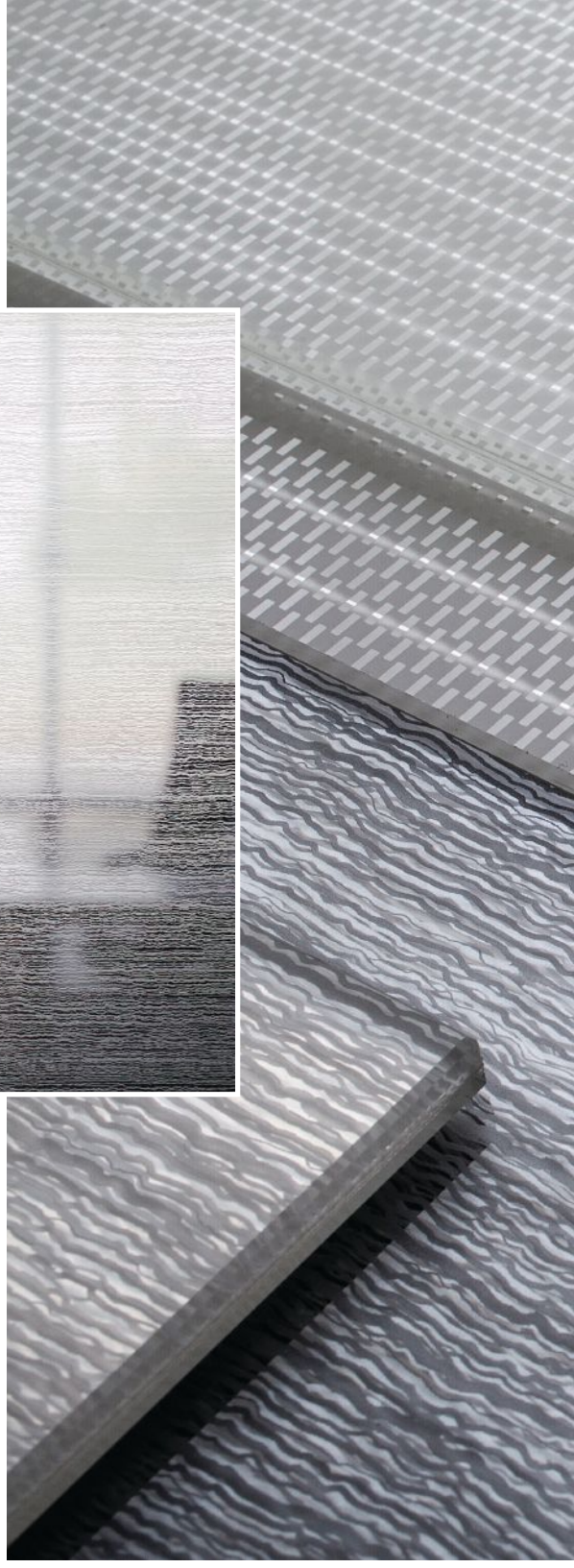

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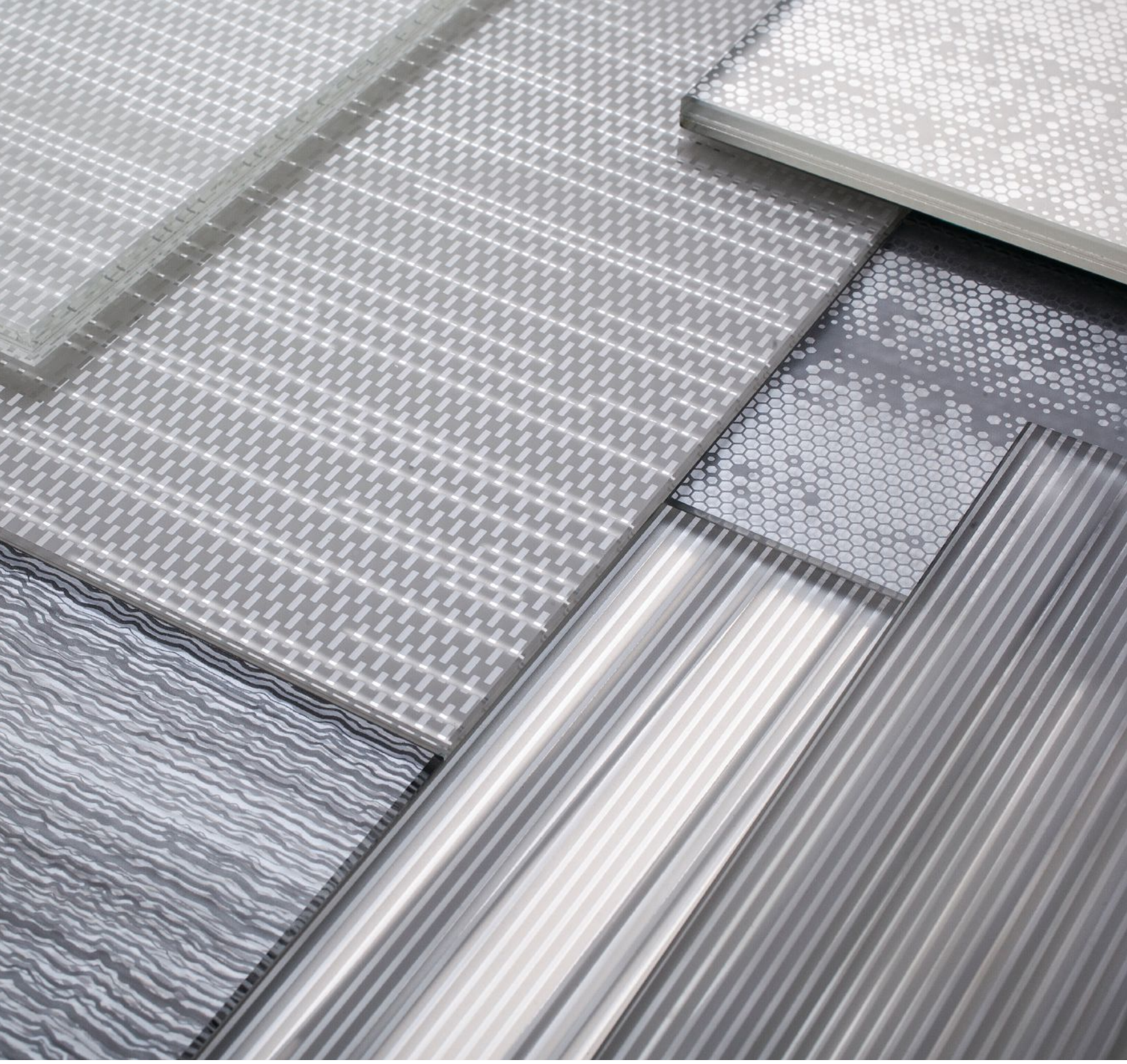

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The Sociologist's Eye

If you're curious how a sociologist might interpret the built environment, Pinkcomma has a pretty good answer. The Boston design gallery has organized an exhibit of photos by David Schalliol, who has a Ph.D. in sociology from the University of Chicago and teaches at St. Olaf College in Northfield, Minn. In the tradition of Bernd and Hilla Becher (see page 18), Schalliol often photographs freestanding structures in urban settings. "These buildings and their environs demonstrate how socially influenced investment cycles affect the visible aspects of our built environment, urban neighborhoods, and community relationships," he explains.

> David Schalliol: Selected *is on view through the end of the year; for more images visit bit.ly/DavidSchalliol.*

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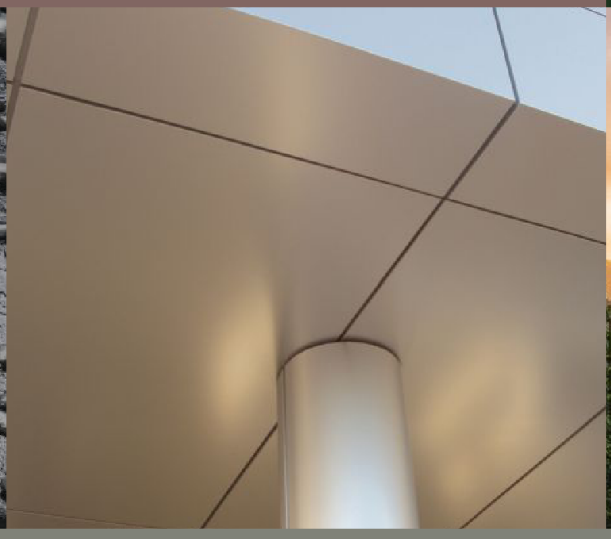

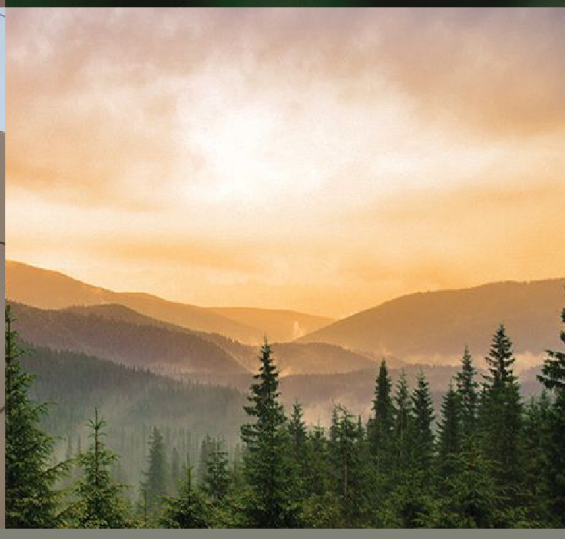

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TIMOTHY SOAR

When the Context Is Modern

Every year, the Royal Institute of British Architects awards the Stirling Prize for "the U.K.'s best new building." This year's recipient is, strictly speaking, six buildings, but they have a great deal in common. By embracing modularity, London-based Allford Hall Monaghan Morris sympathetically updated the leafy 1950s modernist campus of the all-girls Burntwood School, in the local borough of Wandsworth. The architects organized the four teaching pavilions, gymnasium, and performing arts hall on a 7.5-meter (24.6-foot) structural grid, which is reflected in the façades' faceted precast-concrete panels. —DEANE MADSEN

> *For more on the Stirling Prize–winning Burntwood School and the other five projects that made RIBA's shortlist, visit bit.ly/2015Stirling.*

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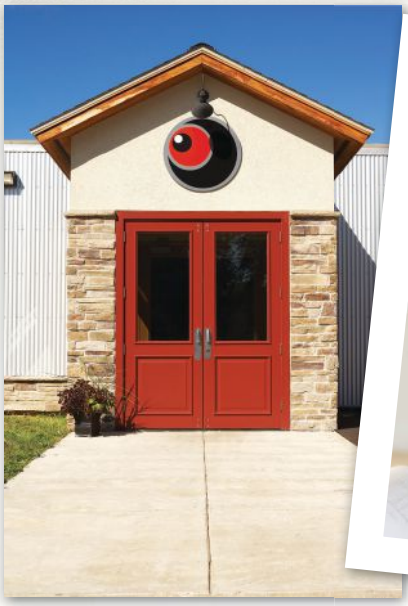

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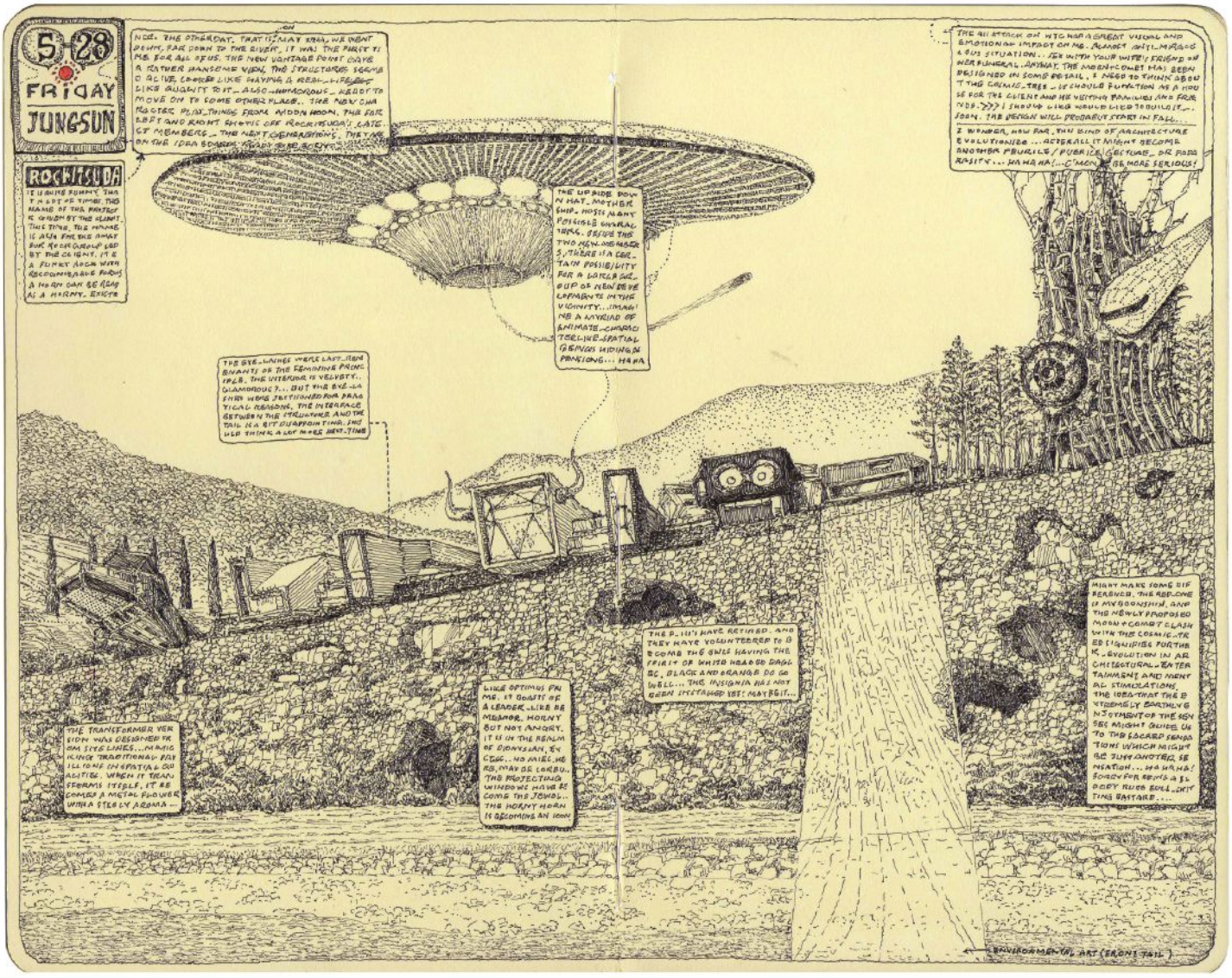

It's a Bird ... It's a Plane ... It's Architecture

Architecture and comics have enjoyed a long, strange relationship, with architects using cartoons to convey their ideas (Bjarke Ingels' *Yes Is More* [Taschen, 2009]) and cartoonists critiquing architecture and urbanism (pretty much anything by Ben Katchor). With *Architecture in Comic-Strip Form*, the National Museum–Architecture in Oslo, Norway, traces the interdisciplinary action over the course of a century, from early moderns Le Corbusier and Winsor McCay to contemporary talents such as Jean Nouvel, HON. FAIA, and Chris Ware. The exhibition remains on view through Feb. 28.

MOON HOON

> *For more images by artists in the exhibit, such as Korean architect Moon Hoon (above), visit bit.ly/ComicStripArchitecture.*

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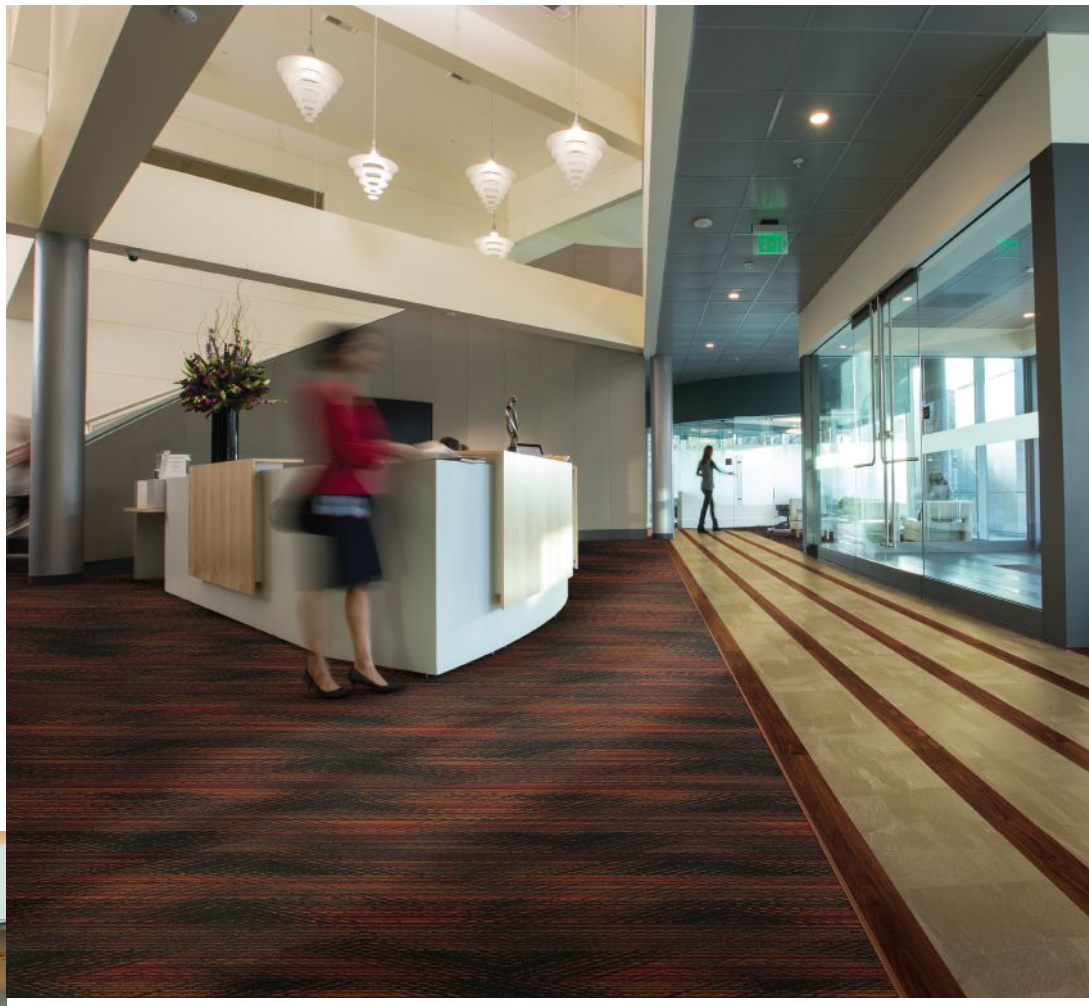

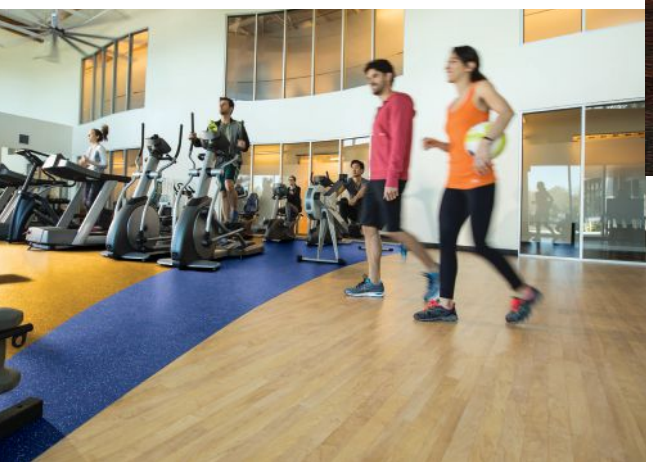

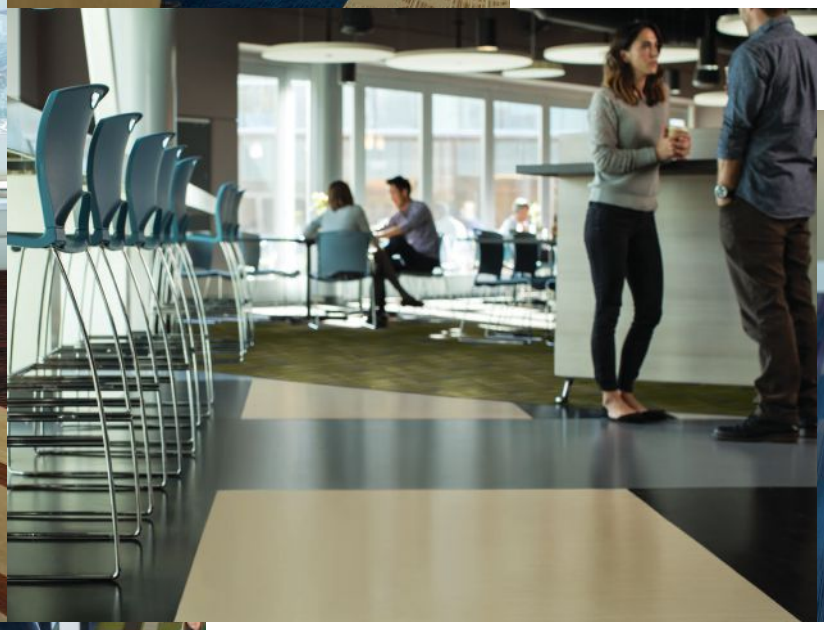

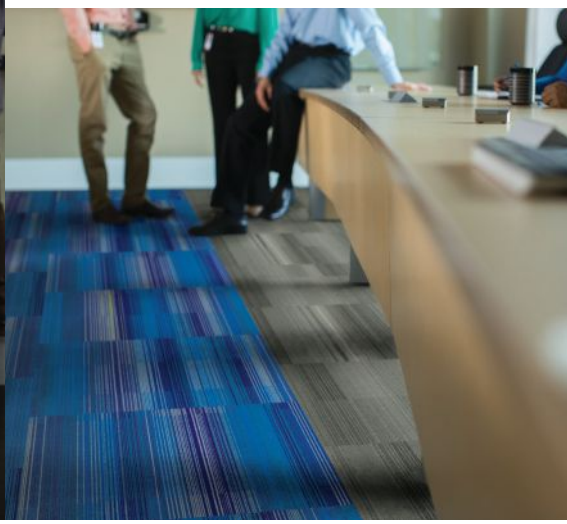

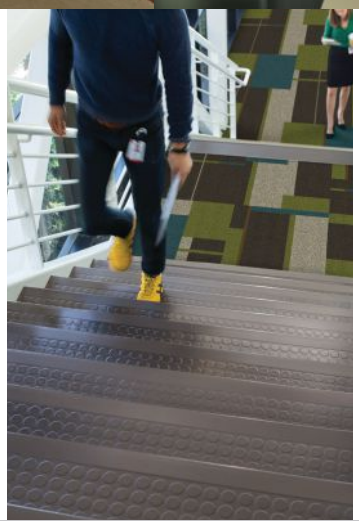

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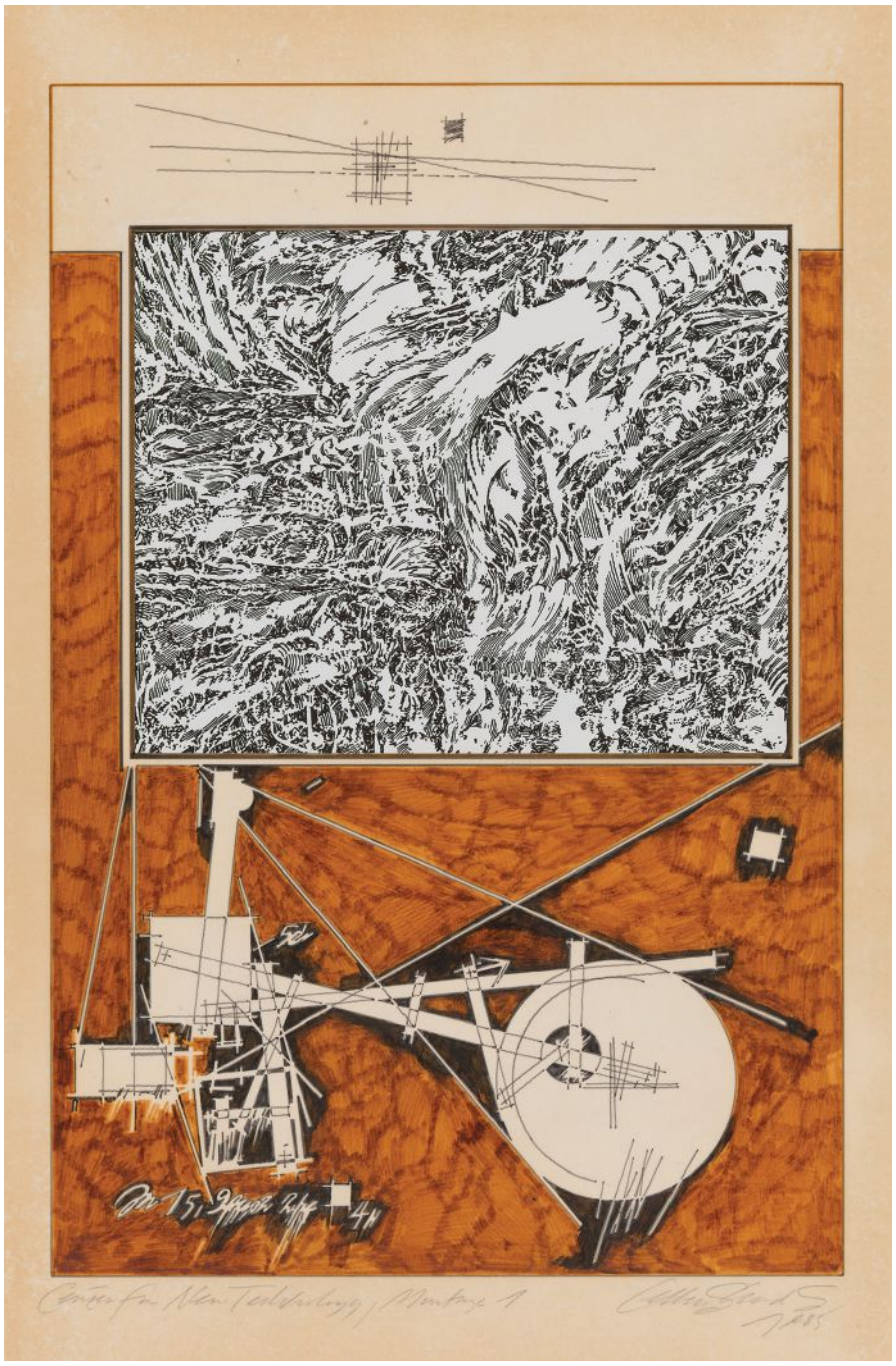

An Acquisitive Academic

Drawing Ambience: Alvin Boyarsky and the Architectural Association, an exhibition at the Cooper Union in New York, features work that Boyarsky amassed as chairman of London's Architectural Association School of Architecture, from 1971 until his death in 1990. It was a remarkable moment in architectural education, and a great time to collect work by students and colleagues. Boyarsky taught, and taught with, such luminaries as Zaha Hadid, HON. FAIA, Frank Gehry, FAIA, Daniel Libeskind, AIA, Rem Koolhaas, HON. FAIA, Bernard Tschumi, FAIA, and Lebbeus Woods (whose 1985 *Center for New Technology, Montage 1* is above). —CAROLINE MASSIE

> *For more images from* Drawing Ambience*, visit bit.ly/AlvinBoyarsky.*

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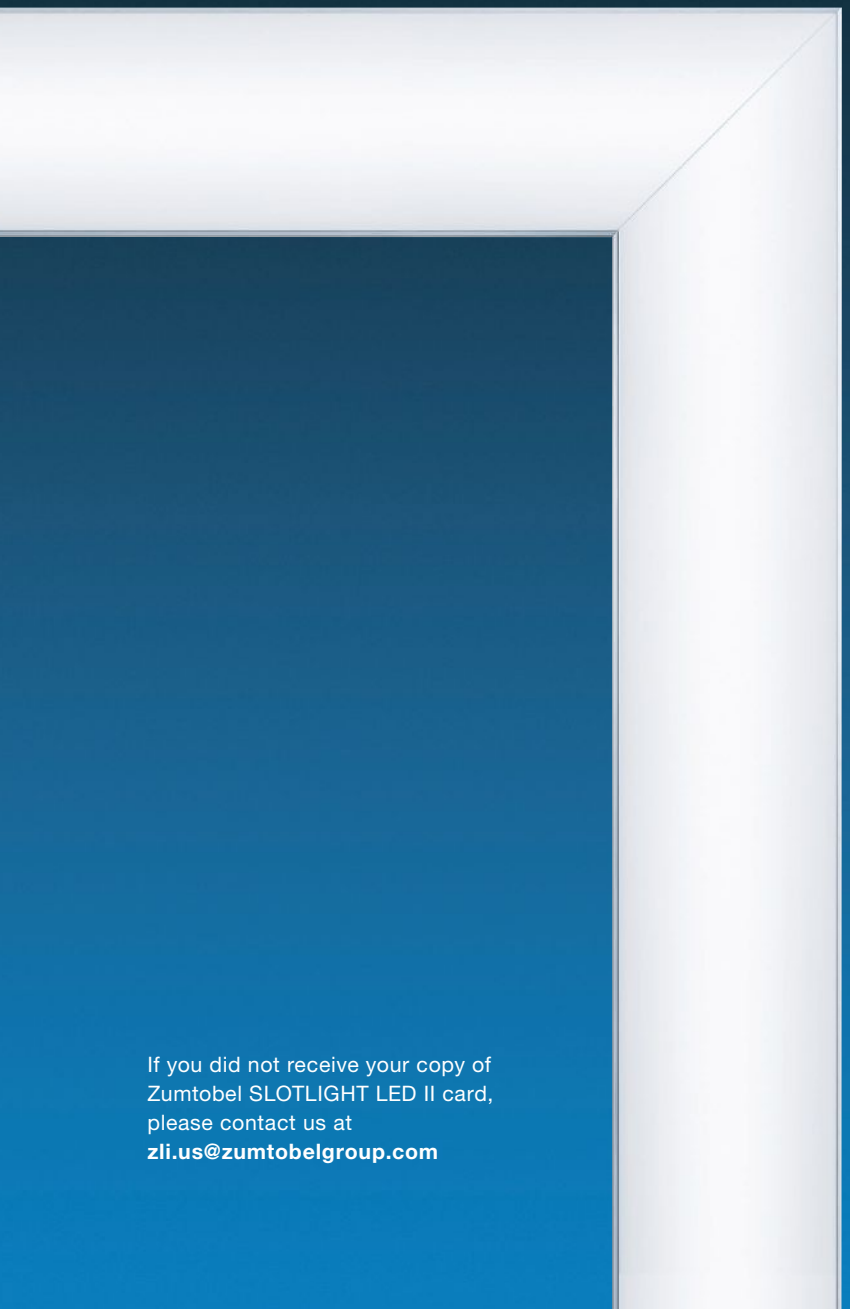

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Best Practices: Unexpected Profitability in Work Abroad

TEXT BY NATE BERG

In an increasingly global market, exports can be a critical part of a firm's business model. Various tax incentives and programs intended to encourage economic growth are available to architects, making exporting services not only easier but also more profitable.

In 2011, five years into an economic slump in Puerto Rico, designers Ricardo Álvarez-Díaz, AIA, and Cristina Villalón thought about moving their San Juan–based firm, Álvarez-Díaz & Villalón, to Miami. But then, in 2012, Puerto Rico passed Act 20, which lowers the corporate income tax rate to 4 percent for local companies that export services. Suddenly, it made more sense to stay.

Álvarez-Díaz & Villalón then started getting commissions in Latin America and the Caribbean. Those led to projects further afield—in the Middle East. Its overseas work increased, as did its local projects. Now, about 25 percent of the firm's work is outside of Puerto Rico, but that work accounts for more than 50 percent of its invoices.

"As soon as you start getting work someplace else, people that may have known you for years will look at you again like, 'Whoa! These guys, apparently they're great for some reason because someone else is hiring them. We should take a look at them again,'" Álvarez-Díaz says. "Automatically it gives you credibility locally."

In the U.S., firms can establish an interest–charge domestic international sales corporation (IC-DISC), a separate corporate entity that allows a company to filter profits from exports, converting taxable income into long-term capital gains that get redistributed in the form of dividends taxed at a lower rate.

"[Y]ou're basically getting a dividend treatment on the tax of what would otherwise be ordinary income," says Dean Zerbe, a Washington, D.C.–based national managing director of the tax services provider Alliantgroup. An IC-DISC benefits business owners by allowing overseas profits to be taxed at dividend gains rates of 23.8 percent rather than individual rates that can be as high as 39.6 percent, resulting in tax savings of roughly 15 percent.

> "When it comes to international work, getting there and making those initial contacts [are] the hardest step[s] in the process."
>
> —Robert Junk, AIA, founding principal, Jünk Architects

For firms doing work overseas, "it's really a no-brainer," Zerbe says. "It's shocking how many [firms] don't know about it. Probably 80 percent of the companies that are eligible aren't taking advantage of it."

Kansas City, Mo.–based Jünk Architects recently formed a IC-DISC for its growing practice in designing radiology facilities abroad. So far, the firm has only used IC-DISC tax savings on a few relatively small billings, but Jünk Architects founding principal Robert Junk, AIA, expects to see significant savings on projects in the pipeline. The IC-DISC savings "make it more palatable to be going after some of these bigger projects that we're looking at" in foreign markets, Junk says.

Jünk Architects has benefited from other programs at the federal and state level that helped it begin exporting services. Through the Missouri Department of Economic Development's Global Market Access Program, Junk received partial reimbursements for the costs of attending a major trade fair in Dubai that put his firm in contact with key players in the booming medical facilities industry in Saudi Arabia. State Trade and Export Promotion grants available through the U.S. Small Business Administration also helped defray costs like travel, booth registration, and translation of marketing materials. "When it comes to international work, getting there and making those initial contacts [are] the hardest step[s] in the process," he says.

Though venturing into foreign markets can seem precarious, these programs and incentives can help architecture firms to reduce the risk of looking beyond their own country's borders.

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Detail:
Lattice Roof, Onagawa Station

TEXT BY TIMOTHY A. SCHULER

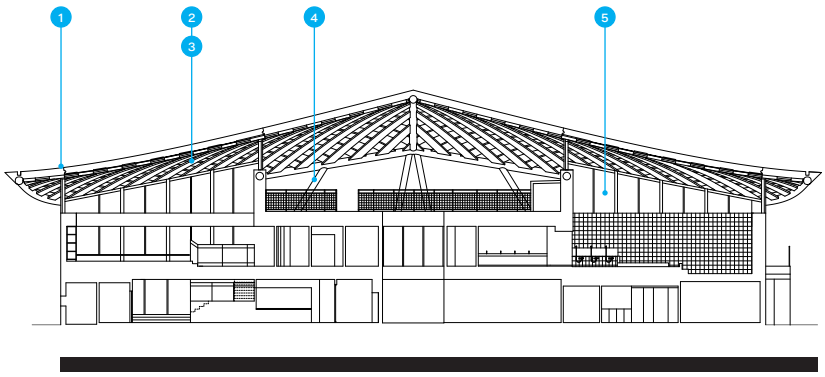
It only took minutes for a tsunami wave to reduce Onagawa Station in Miyagi Prefecture, Japan, to a pile of rubble on March 11, 2011. Four years later, a new train station by Shigeru Ban, HON. FAIA, opened about 500 feet inland from the original building footprint. Topping the three-story, 9,682-square-foot structure is a gently sloped, white membrane roof, inspired by the outstretched wings of a seabird and supported by a wooden lattice, a signature of Ban's work.

The lattice comprises laminated veneer lumber (LVL) arches made from Japanese larch. Yasunori Harano, project architect for Shigeru Ban Architects, and his team worked with local timber subcontractor Key-Tec Co. to slice the 3.5-inch-deep LVL beams lengthwise to warp each half to the desired curvature and roof height, before layering them back together during the construction.

To determine where to drill the bolt holes in the pre-bent wood, the team also created a 3D model of the lattice structure that included the final location of each bolt in the curved LVL beams.

The roof structure features 76 crisscrossing arches, with many spanning more than 55 feet. Each arch intersection in the lattice is secured with the same custom bolts that connect the stacked LVL layers. The wooden bolt heads are arranged in alternating geometric patterns.

The reopening of Onagawa Station coincided with that of the Inishomaki railway line, reconnecting the seaside town to the rest of the country.



1. White membrane roof
2. 24" × 3.5" LVL curved beam, sliced into two layers and stacked
3. Ø16mm wood bolts (not shown)
4. Structural support members
5. Curtainwall glazing

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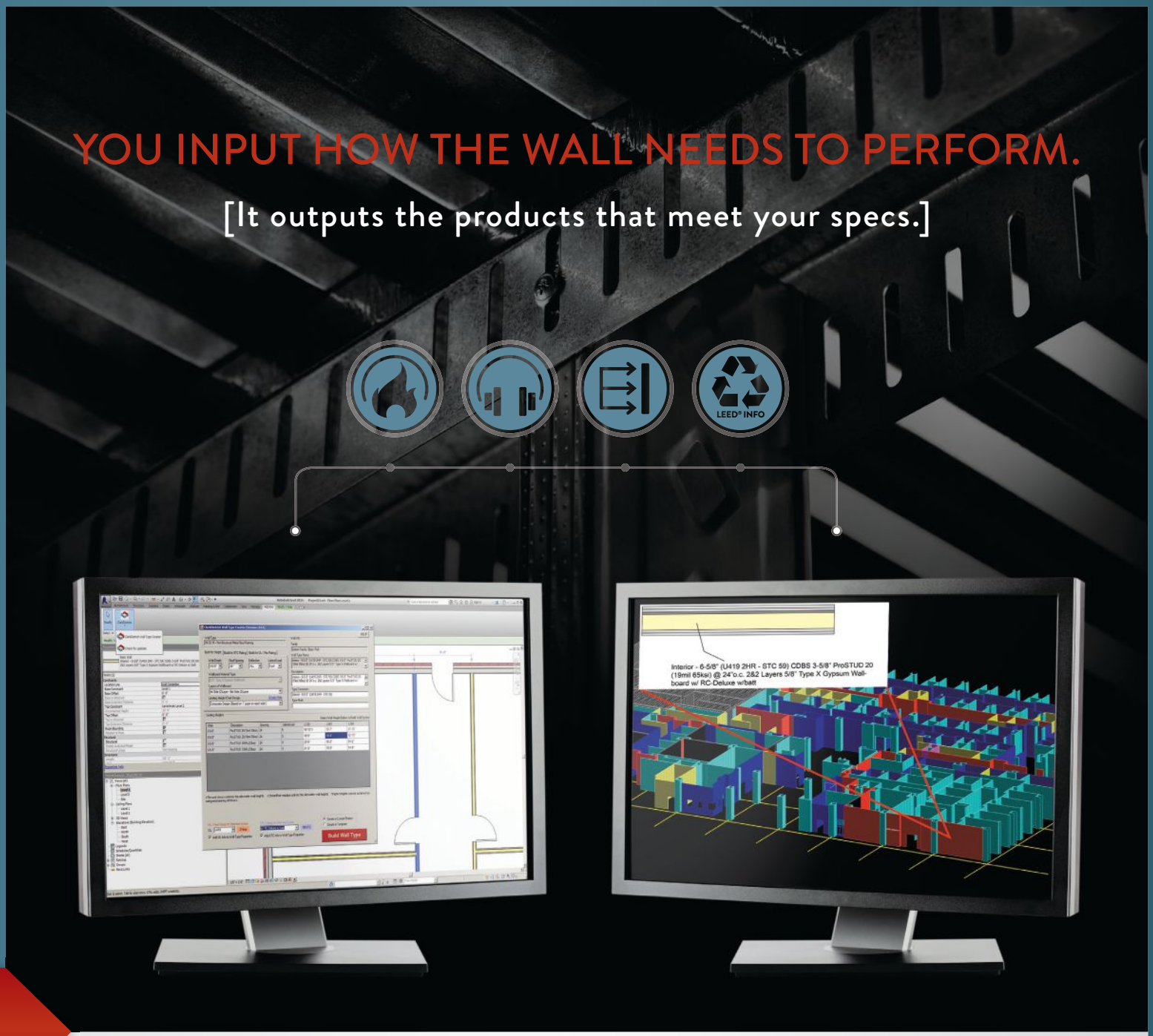

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Software: Five Tools to Test Building Performance

TEXT BY MICHAEL KILKELLY

A new round of simulation tools puts the power of building-performance analysis—long the domain of engineers and energy consultants—into the hands of architects. In the past, designers seeking energy-modeling software had to sacrifice accuracy for ease of use. Recognizing these constraints, several software companies have developed tools and plug-ins that integrate almost seamlessly into existing BIM software and facilitate early-and-often checks. Below are five such products to consider.

1

Sefaira Architecture, by Sefaira

Works with: Autodesk Revit and Trimble SketchUp

Cost: Varies

Sefaira provides interactive building-performance feedback through its Sefaira Architecture plug-in, which calculates and graphically displays metrics, including daylighting factors, energy use intensity, and energy use breakdown by building system, in real-time on a performance dashboard.

The Element Performance chart, which is integrated into the dashboard for convenient access, offers more in-depth insights on how building components, such as walls and windows, affect overall heating and cooling loads. The Daylight Visualization tool shows the distribution of natural light throughout the building. Similarly, the Direct Sunlight Analysis tool quantifies the amount of direct sunlight each space receives throughout the day.

Sefaira's Web app, which uses the cloud to process and analyze models with the EnergyPlus simulation engine, provides a faster and more in-depth analysis of the building model while allowing for straightforward comparisons between design options.

2

Vabi Apps, by Vabi Software

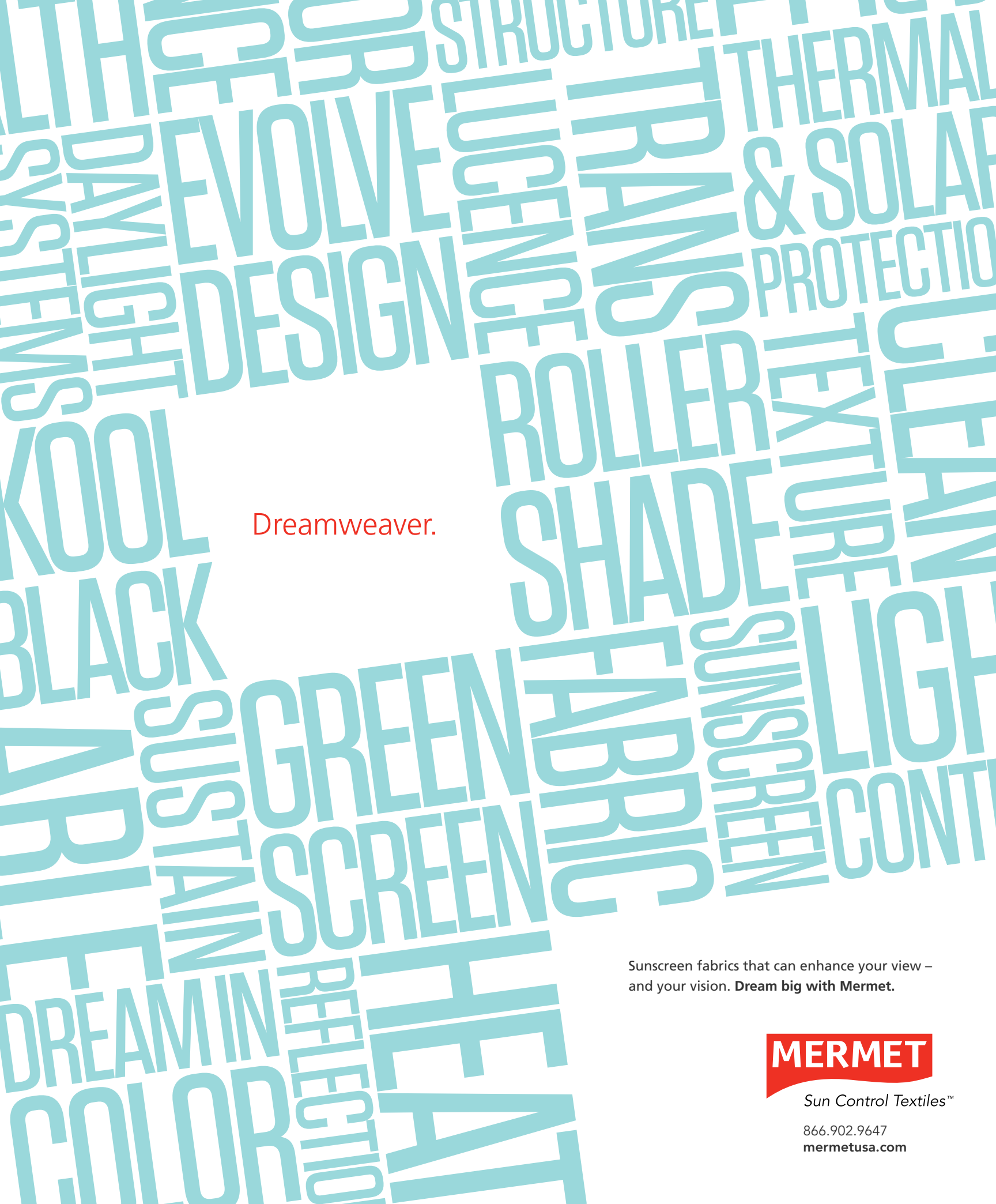
Works with: Autodesk Revit

Cost: $9.99 to $29.99 a month

Vabi Software provides a suite of apps for calculating and visualizing a project's environmental, financial, and programmatic performance. The Thermal Comfort Optimizer calculates ideal heating and cooling set points for each room in a building, while the Daylight Ratio Evaluator calculates the amount of daylight a space is receiving and highlights rooms that do not meet requirements. The Energy Assessor, which is forthcoming, estimates the project's monthly and yearly energy use and costs.

Results from all of the developer's apps are summarized on a single interface, Vabi's building performance dashboard, which tallies an overall score based on each criteria for a project. While Vabi Apps do not provide as much detail as some of the other products listed here, their affordability and ease of use are a plus.

> *To read more about these software tools, visit bit.ly/bldgperformance.*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Software: Five Tools to Test Building Performance

3

Green Building Studio, by Autodesk
Works with: Autodesk Revit and any software that exports to gbXML
Cost: Included in Autodesk Subscription program

Green Building Studio (GBS) is available as a stand-alone cloud-based service or as part of Revit's add-on Energy Analysis tools. Using the DOE-2.2 analysis engine, this service provides a very detailed analysis and, as a cloud service, runs quickly on Autodesk's servers.

Ordinarily, the DOE-2.2 engine requires a thorough description of a building's envelope and mechanical systems. However, GBS makes assumptions for many of these parameters using ASHRAE standards, allowing architects to focus on the design areas that have the most significance on the building's overall energy footprint. Along with energy consumption, electricity use, and annual carbon emissions, GBS also estimates the building's Energy Star score, points for glazing factor and water credits for the U.S. Green Building Council's LEED rating system, and solar energy potential.

One downside to the cloud-based approach is that the analysis is provided in a report format rather than interactively in the model itself. However, the GBS report viewer does allow for side-by-side comparisons of simulation results.

4

OpenStudio, by the National Renewable Energy Laboratory
Works with: Trimble SketchUp
Cost: Free

Available both as a stand-alone application and SketchUp plug-in, OpenStudio is an open-source software that provides a visual, user-friendly interface for the EnergyPlus analysis engine—a console-based program that reads and writes only text files. The SketchUp plug-in generates building geometry formatted specifically for input into EnergyPlus. After the geometry is created, users can define material properties, systems, and zones in the OpenStudio application. Once the model is fully attributed, they can then run multiple simulations with the Parametric Analysis Tool (PAT), test different configurations, and obtain life-cycle cost information.

Because OpenStudio is open source, it does lack the support and documentation provided with commercial software. It also doesn't work well with existing SketchUp models. Rather, for best results, design teams must model the building envelope in SketchUp using specific OpenStudio rules and requirements. That said, the resulting data from the analysis is extensive and the PAT provides a quick and easy way to compare options.

5

IES Virtual Environment for Architects, by Integrated Environmental Solutions
Works with: Autodesk Revit, Trimble SketchUp, Vectorworks, and any software that exports to gbXML
Cost: Contact IES for more information

Integrated Environmental Solutions (IES) offers a range of energy modeling tools based on the Apache simulation engine. IES Virtual Environment (IESVE) for Architects is an architect-friendly version of the developer's base IESVE product, which is targeted to engineers and energy-modeling professionals. Using a plug-in for Revit, SketchUp, or Vectorworks, architects can export their models to the IESVE application for analysis and then simulate water usage, daylighting, solar shading, energy use, and heating and cooling demand. A simulation report conveys results through charts and diagrams.

This program performs a thorough building analysis, but it is not as user-friendly as some of the other options listed here, nor does it provide the real-time feedback that is helpful during early design stages. Also, since IES is based in Scotland, the software references European energy standards though it will calculate potential LEED credits.

The Outsourcing Option

BIM IQ Energy is a building-performance simulation service provided by Oldcastle BuildingEnvelope using material data generated from Oldcastle's BIM IQ Render plug-in for Revit. The service uses a proprietary energy-simulation engine to calculate building performance quickly and provide immediate feedback to designers. Because simulation specialists handle the number crunching, architects do not need to master yet another software program to estimate their project's energy performance. *Contact Oldcastle for pricing.*

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Sustainability: Projects that Clean the Environment

TEXT BY ALICE LIAO

Sustainable design typically focuses on energy, water, and material conservation, but the following projects are tackling air and water pollution firsthand while increasing public awareness of pollution's consequences on human health and the environment.

Phoenix Towers, by Chetwoods Architects

When completed in 2018, this mixed-use development, designated as an environmental supercity in Wuhan, China, will feature of a pair of yin-yang skyscrapers that can generate their own power, recycle waste, and improve water and outdoor air quality. In the taller of the structures, multiple purification systems powered by renewable-energy sources will filter outdoor air and lake water. To aerate the lake, water will be cycled in and out of the tower using energy harnessed from photovoltaic cladding and wind turbines, according to Laurie Chetwood, chairman of U.K.-based Chetwoods Architects. Filtered air- and water-circulation systems driven by a thermal chimney and evaporative cooling from the surface of the lake will condition the building.

Pier 35 EcoPark, by The Living, in collaboration with Natalie Jeremijenko

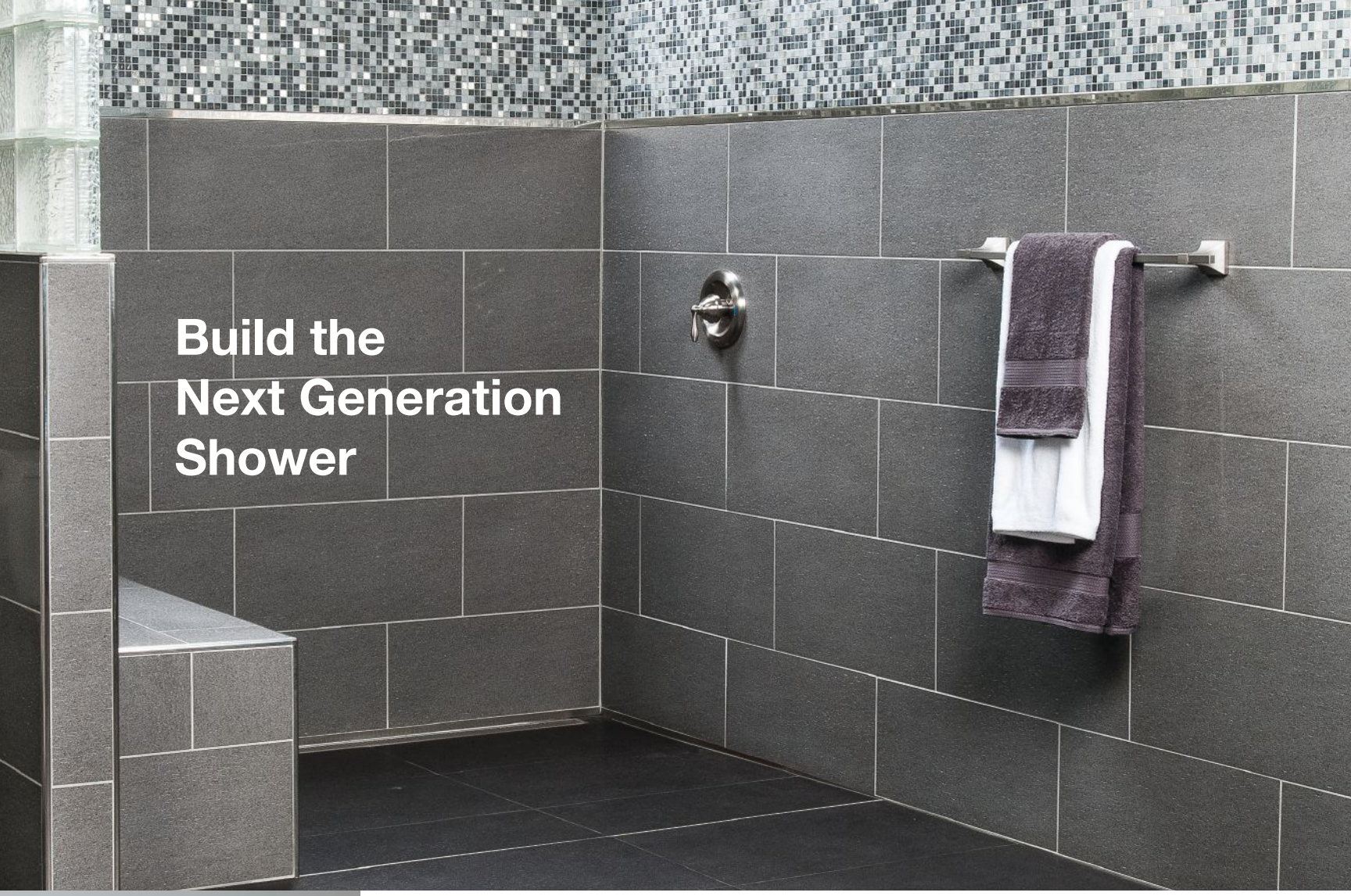
Scheduled for construction in 2016, this permanent, interactive installation will track the health and aquatic activity of the East River in New York. Submersible sensors will indicate water quality and the presence of fish through LEDs, while a mussel choir (shown at right) will sing about their environment as they filter water. The frequency and amount at which mussels open their shells are "a great indicator of water quality," The Living principal David Benjamin says. Shifts in pitch, timbre, and tempo will signal these changes in the river.

Smog Free Tower, by Studio Roosegaarde

"Why do we accept air pollution?" That question led artist Daan Roosegaarde and his Rotterdam, Netherlands–studio to build a 23-foot-tall tower around a massive outdoor-air purification system. The aluminum structure captures fine and ultrafine smog particles within a 24- to 82-foot radius, depending on weather, producing a bubble-shaped zone of clean air. A patented positive-ionization process purifies up to 1 million cubic feet of air per hour. The captured particulates are compressed and then encapsulated inside glass-cube jewelry, available for purchase through the project's KickStarter campaign.

TOP TO BOTTOM: CHETWOODS ARCHITECTS; THE LIVING; PIM HENDRIKSEN

> *Learn more about these and two additional projects that are actively cleaning the environment at bit.ly/beyondGreen.*



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Product Spec: Improving Insulation

TEXT BY BRIAN LIBBY

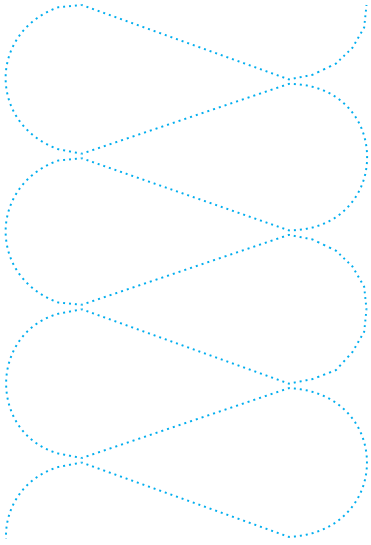
The passage of increasingly stringent energy codes and an industry-wide push for greener materials are motivating insulation manufacturers and building scientists alike to rethink the product's role in the wall system. The following three factors are poised to change how insulation is made, sold, and installed.

Stricter Energy Codes

The 2012 and 2015 versions of the International Energy Conservation Code include climate zone–specific requirements for insulating and sealing commercial and residential buildings. Though the two versions have largely the same criteria, they depart significantly from the 2009 code with regards to wall-cavity insulation. For metal- or wood-framed walls, projects must now achieve a thermal resistance of at least R-13 in the cavity, and have a continuous exterior insulation layer with an R-value from 3.8 in the warmest climate zones to 17.5 in the coldest, says Ryan Meres, a senior code-compliance specialist at the Institute for Market Transformation, a Washington, D.C.–based nonprofit. Alternatively, wood-framed projects can opt to have just an R-20 cavity.

"Cavity insulation insulates between the framing members, but continuous insulation insulates over [them], preventing thermal bridging through the much lower R-value framing material," Meres explains. While fiberglass batts, cellulose, and spray foams are common for the cavity, rigid foam board is typically used for the continuous portion, a pairing that has architects reworking the math on their approach to wall systems.

"We want these continuous insulations, but in their use we're violating the rules we were taught," says Lucas Hamilton, a building science applications manager at Pennsylvania-based building products manufacturer CertainTeed. Adding continuous insulation to the outside of the wall cavity changes how air and water move through it, potentially trapping moisture in the wall and requiring versatile air and moisture barriers to keep the cavity dry as temperature and humidity change year-round. It also requires new testing, like the National Fire Protection Association's standard 285 to observe new combustible materials in typically non-combustible wall applications.



Better Materials

Insulation's ingredients are also becoming more efficient. Spray-foam makers, such as Canadian manufacturer Icynene, are adding low-VOC insulation to their lineups to cut re-occupancy times down to a few hours following installation. Graphite is being added to plastic-foam mixes, which multinational chemical producer BASF found can cut heat transfer by up to roughly 20 percent. More insulation products made with plant-based materials like waste wood, cork, and kenaf (a cousin of hemp) are on the horizon, reports Cleveland-based market research firm the Freedonia Group and a July report in the journal *Sustainable Materials and Technologies*.

Systems Thinking

Manufacturers are also helping project teams understand the complexities of the new wall-system requirements by packaging insulation, cladding, and weather barriers into wall assemblies that can be specified like a product. Owens Corning's CavityComplete, BASF's HP+, and Dow's Thermax wall systems, for example, integrate multiple products and can be customized to meet a specific R-value. Says Hamilton: "You'd never buy a car by ordering your brakes from Ford and your chassis from General Motors, yet we do that with houses [and other buildings] all the time and expect them to work. If you can work out the wall system in advance and provide that packaged performance, that's a goal we see everyone shooting for."

> *For the full story on how energy codes are driving the insulation market, visit bit.ly/insulationproducts.*

Next Progressives: Family

TEXT BY SAM LUBELL


Oana Stanescu and Dong-Ping Wong

New York–based design firm Family couldn't have a more appropriate name. Partners Oana Stanescu and Dong-Ping Wong collaborate and communicate seamlessly, as if each was an extension of the other. Although they often approach projects from different angles, they arrive quickly at the crux of a problem together. "We understand what a partnership is," Wong says, adding that the duo also share a goal of producing "architecture as a productive piece of the city"—not architecture for its own sake, nor esoteric architecture, but ambitious architecture that makes a difference and "has a point to it."

Wong grew up in San Diego and studied architecture at the University of California, Berkeley, received his M.Arch. from Columbia University, and worked at OMA, EHDD, and REX. Stanescu, who hails from Romania, earned her architecture degree from that country's Polytechnic University of Timișoara, before working at OMA, Herzog & de Meuron, Architecture for Humanity, SANAA, and REX.

Wong and Stanescu met at REX in 2006, where the two were emboldened by the experience of working on major projects—such as Museum Plaza in Louisville, Ky., and Oslo Vestbane in Norway (projects about which Wong jokes, "We had no right to be doing those sorts of things at our ages")—to form Family in 2009. Since then, the firm has completed a number of design experiments to test what's possible, both in architecture itself and in the agency needed to make it happen.

The most well-known example of Family's audacity is Plus Pool, a speculative plus-sign-shaped structure that will float in New York's East River, filtering river water through a three-level purifying system for safe swimming. Designed in partnership with PlayLab, a New York firm with which Family will soon share office space, Plus Pool's cross shape allows for different uses in each leg, from lap swimming to lounging.

The project is also, not coincidentally, visually stunning. "We knew we'd never be asked to do something like this," Wong says. But their initial public relations blitz—they debuted the project with a website and marketing campaign in 2010—resulted in worldwide media attention and was followed by two successful Kickstarter campaigns, raising more than $300,000. The pool is now essentially a done deal, with enthusiastic backing from the city and its residents. Site selection will happen next year, and completion is set for 2019. Major international cities, from Berlin to Sydney, are now clamoring for their own Plus Pools.

The initial seed money to conceive Plus Pool came from Family's win of a 2010 competition to design a contemporary art museum and pedestrian bridge in Maribor, Slovenia. The building turns the conventional museum courtyard inside out, pinching the exterior in several places to carve out intimate public spaces. The walking bridge is not straight, but circular, creating its own unique waterfront in a city that's largely lacking one.

The duo's ambition also extends to residential design and entertainment. Family created the dynamic mountain-and-sun stage for Kanye West's 2013–14 Yeezus tour, and their next venture is to reimagine the suburban lifestyle and banal housing developments by creating a contemporary, environmentally conscious, 40-unit housing block in San Diego.

By holding fast to the notion that "family" extends to cities at large, the firm has been able to "work on things [we] believe in," Wong says. It also takes discipline: Several developers approached Family to create Plus Pools for private use, but Stanescu and Wong refused, determined to see their contribution made in the public realm.

"It always comes back to how our work can be generous, give back, and relate to a much larger audience than the people in a single building," Stanescu says.

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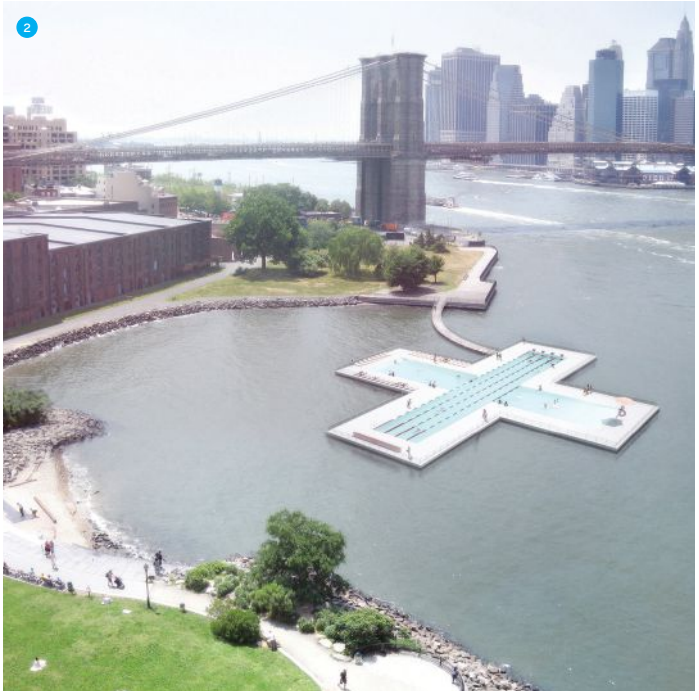

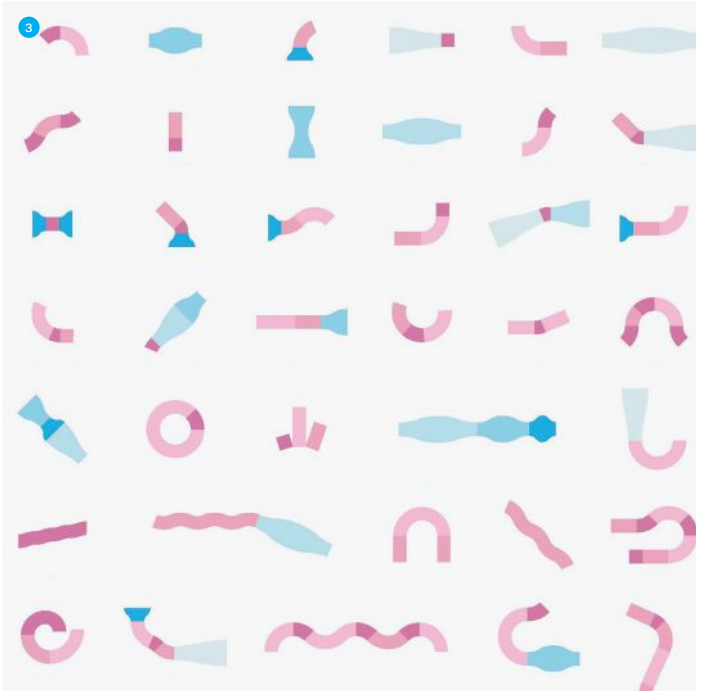

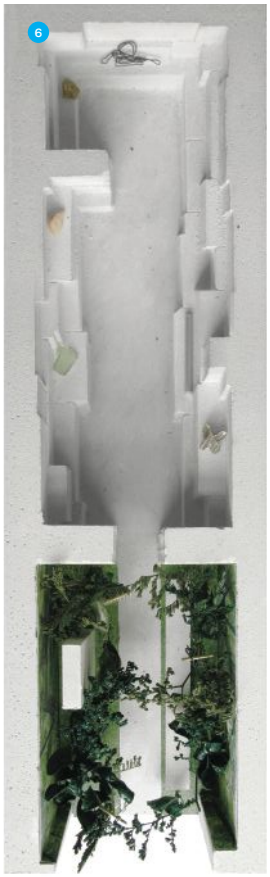

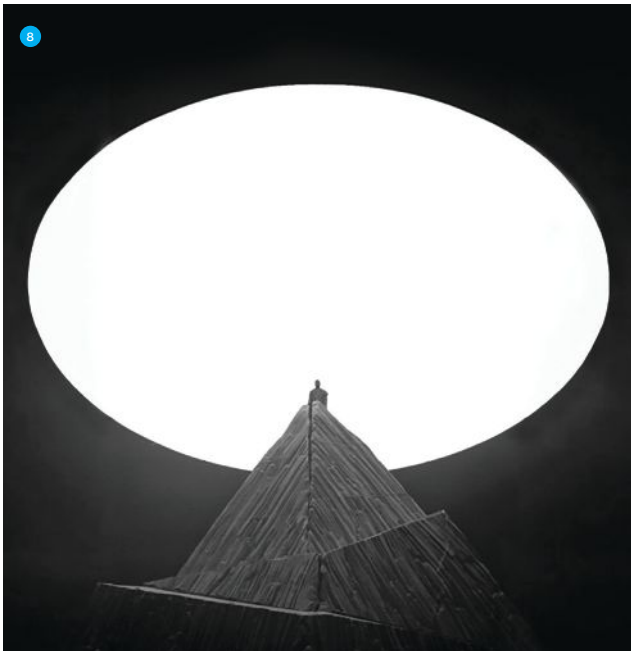

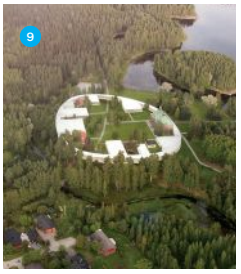

1,3. *Worms*, an installation for the New Museum's inaugural Ideas City festival in 2011 in New York, rethought the typical street fair tent as a colorful, tube-shaped structure made of parachute fabric and bent steel frames to hold a variety of programs. **2,4.** Plus Pool's two successful crowd-funding efforts have pushed the idea toward fruition, allowing Family and collaborator PlayLab to build prototypes and develop its filtration systems. **5.** Dallas Peaks, a 2009 competition entry, imagined a 600-person, net-zero-energy residential block in downtown Dallas with stepped, triangular glass towers to maximize solar and wind exposure for integrated photovoltaics and wind turbines. **6,7.** The Off-White boutique in Hong Kong mimics the city's diametric nature with a lush, jungle-like garden in the front, and a layered accretion of concrete cubes in back. **8.** Family designed a 50-foot volcano stage set for Kanye West's 2013–14 Yeezus tour. **9.** The firm submitted Gösta's Ring, a series of single-story galleries wrapped by a glass-walled circulation corridor, to a 2011 competition to expand the Serlachius Museum in Mäntää, Finland. **10.** A circular Central Bridge in Maribor, Slovenia, was part of Family's 2010 proposal.

TOP: IT HONG KONG; BOTTOM: VIRGIL ABLOH

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Technology: Creating Comfort in a Supertall

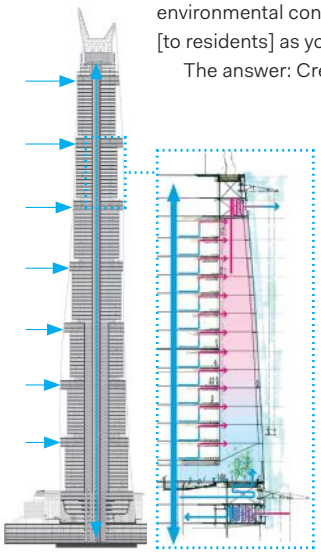
TEXT BY CLAY RISEN

Soaring more than 300 meters (984 feet) into the sky, supertall skyscrapers are monuments of engineering and construction prowess. Less well appreciated is the technology that makes them livable: How does one heat and cool a tower of such magnitude?

In a standard high-rise, a single system with large enough pumps and heat exchangers, and a cooling tower and chiller plant on the roof can suffice. But as a structure approaches supertall status, this approach becomes too expensive, too inefficient, and too bulky.

"Supertalls are like cities standing vertically," says Mehdi Jalayerian, an executive vice president for Chicago-based Environmental Systems Design, which consults on HVAC design. "The real challenge is how [do you] get environmental controls and amenities [to residents] as you get higher?"

The answer: Creatively.



Heating and cooling diagram, Shanghai Tower, by Gensler

Take the 121-story, 2,073-foot-tall Shanghai Tower, slated to become the tallest building in China. Rather than think of the building as a single unit, Gensler parceled the structure and installed a hybrid cooling system, says lead project architect Ben Tranel, AIA, a principal based in San Francisco. Gensler and engineering firm Cosentini Associates, in New York, divided the tower into nine zones, each 12 to 15 floors in height, and fitted it with two chiller plants, one in a sub-basement and the other in a mechanical space spanning the 82nd and 83rd floors.

Zones also allow the HVAC systems to operate with flexibility. Ambient air temperature changes with altitude; for supertalls, the change can be substantial. At the Shanghai Tower, the air surrounding the upper floors will be as much as 6 F colder than that at grade.

Gensler will also keep the tower cool by wrapping its cam-shaped exterior with a semi-fritted-glass curtainwall, inside of which rise 21 air-conditioned atria, ranging from 10 to 14 floors tall. The net effect is a blanket of chilled air that reduces the cooling load of the building core and does double duty as a passive cooling element. With help from this double skin, the building uses 21 percent less energy than if it had a conventional HVAC system.

Besides air temperature, air pressure can significantly affect comfort. Cold outside air entering through the front door gets heated by a building's HVAC system, rises through the interior via atria, elevator shafts, stairwells, and chases, and creates a pressure differential known as the stack effect. At 10 stories, the stack effect is minimal, but at 120 stories or more, it can be massive, creating uneven demand for heating and cooling and forcibly jamming elevator doors shut. The typical solution of using air pressure–preserving features, such as revolving doors, must be taken to an extreme: Some supertalls have vestibules at every stairwell and elevator lobby.

Beyond the specialized technology and equipment, the key to comfort in a supertall is a holistic design approach. "The coordination and organization of [HVAC] systems have to be hand in hand with the structure from the start," Jalayerian says. For example, Adrian Smith + Gordon Gill Architecture had only a general concept for the 167-story, 3,307-foot-tall Kingdom Tower, in Jeddah, Saudi Arabia, when they began talking with Jalayerian about cooling strategies. One result of those conversations is the orientation of the tower, which, with wings running to the northeast and northwest, will reduce solar heat gain in the building.

All of which means there's something deeply ironic about these mega-structures. Even as fast-growing economies in the Middle East and Asia commission supertall skyscrapers as markers of their newfound wealth, and even as these towers push the laws of physics, their iconic shapes are, to a great extent, defined by something as banal as air conditioning.

> *Check out our cover story, featuring an in-depth look at some of the world's coolest new skyscrapers, beginning on page 133.*

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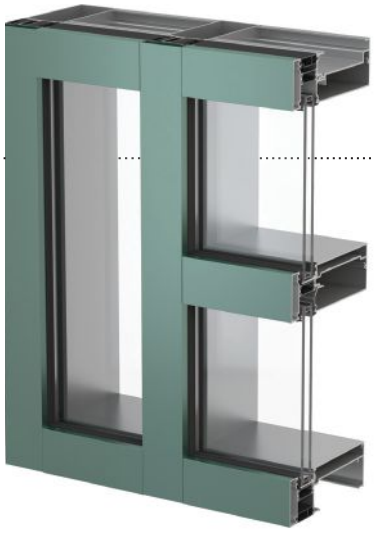
TEXT BY SELIN ASHABOGLU

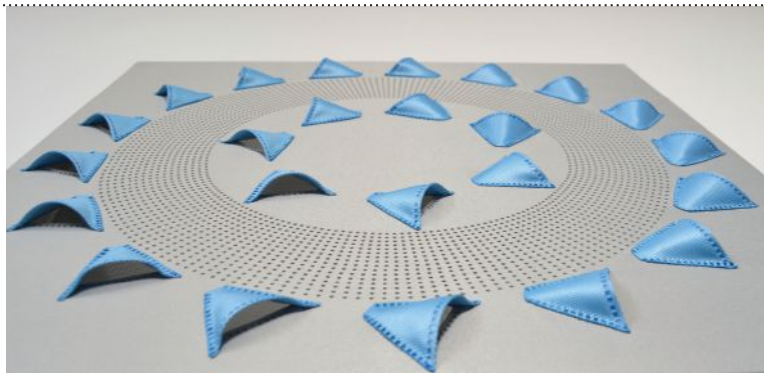
Equal Measure, Interface
Made of recycled type-6 nylon yarn from reclaimed fishing nets, these tufted and sheared or looped modular carpet tiles come in 10"-by-39" planks with three textural patterns. *interface.com*



YCW 750 XT IG, YKK AP
Integrated supports divert the load from standard 1"-thick insulated glass units in this thermally broken, inside-glazed curtainwall that has a system U-factor of 0.36 and an integral face cover. *ykkap.com*

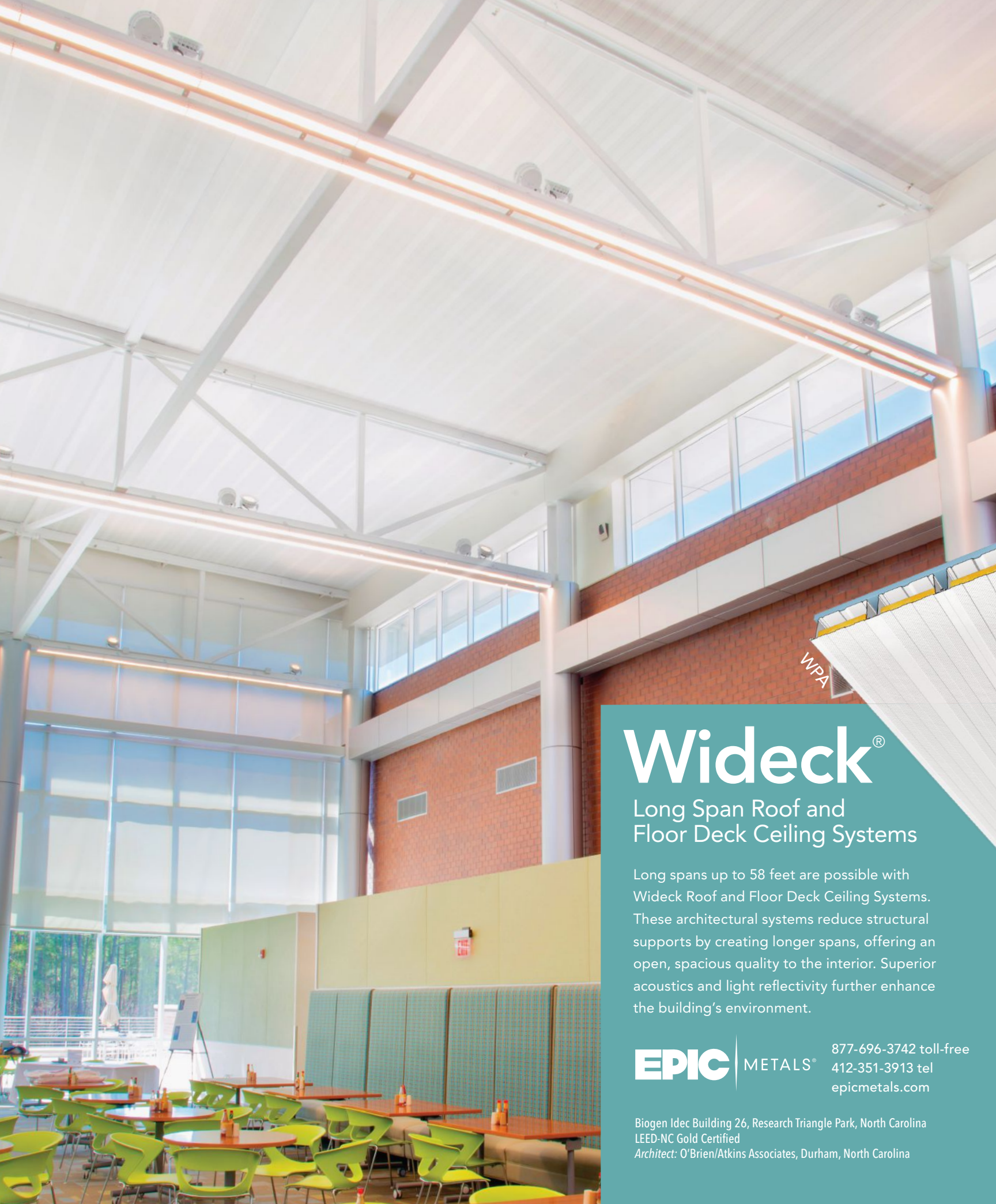
EchoPanel Paling, Kirei
PET bottles get a second life in partitions for corporate, hospitality, and education interiors with noise-reduction coefficients down to 0.65 at 24mm thicknesses. Low-VOC and Class-C fire-rated. *kireiusa.com*

Organic Blocks, Sustainable Materials
These recycled-cork panels muffle sound in offices and residences with five pre-finished reliefs (MiniChock, shown) in 10 colorways. *sustainablematerials.com*



SquAireTex Diffusers, Prihoda
For use in suspended ceiling grids, these tiles are fitted with fabric channels to direct airflow, replacing traditional swirl diffusers and anemostats. *prihoda.co.uk*

> *For more green building products from manufacturers at this year's Greenbuild show, in Washington, D.C., visit bit.ly/greenbuild2015.*



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Q+A: Mahesh Ramanujam

TEXT BY CAROLINE MASSIE

In September, the U.S. Green Building Council (USGBC) announced that its chief operating officer Mahesh Ramanujam, will replace Rick Fedrizzi, HON. AIA, as CEO when Fedrizzi steps down from the position at the end of 2016. Ramanujam joined the USGBC in 2009 as senior vice president of technology and became COO in 2011. The following year, he was also named president of the Green Building Certification Institute (now Green Business Certification Inc.). ARCHITECT caught up with Ramanujam to learn more about the USGBC's long-term goals as well as its plans for this month's Greenbuild International Conference and Expo, in Washington, D.C.

How will your tech experience benefit you as the CEO of the USGBC?
As a technologist, I quickly moved into business transformation. I joined the USGBC to help adopt and improve technologies as a starting point. My first two and half years at the USGBC gave me a very unique perspective on how and what it would look like if I had to be in charge of this operation. I was constantly looking at what I would improve and the innovation opportunities I would push. The wild imagination prevailed.

What are some of the USGBC's top priorities for next year, and beyond?
Our goal is market transformation. While we are extremely pleased with what LEED has accomplished, our work has just gotten started. We still have not made the strongest case that human health should be the de facto consideration when you walk into a building. We're also looking at the global supply chain. With the introduction of LEED v4, our next job is to look at how to build the life cycle of the product to be green.

On one side, you're talking about the wonderful achievements of building net zero, but there's so much sheer equity and social justice consideration to bring into the framework. Today the world's population is daunting: 2.5 billion people live on less than $2 a day and about a billion live on less than $1 a day. The USGBC is not just about buildings, but about driving sustainability and being the next game-changer for a green mission, community transformation, and sustainability for all. What we have done so far is only the ground floor.

How will having Greenbuild in D.C. advance those goals?
Greenbuild has never been in D.C., which has more LEED-certified projects per capita than any state. So it's exciting that this is happening in our hometown.

A study published in September by Booz Allen Hamilton reports that LEED-certified buildings account for 40 percent of green construction's contribution to GDP in 2015. Green construction will account for more than 2.3 million U.S. jobs this year and 3.3 million jobs by 2018. These numbers are powerful by themselves, but being able to connect that to the Greenbuild floor—where local leadership, vendors, and global partners are projecting a variety of products and the supply chain created because of LEED—will be a clear demonstration of job creation, innovation, and the ability for community engagement to drive sustainability at the most basic level in the marketplace.

As we're doing this in the nation's capital, our local community leaders are able to pull in policymakers. When green building legislation is under the consideration of these policymakers, we hope that those connections will influence them to vote for it and demand that more green jobs and products be generated from the local commerce. We are trying to boil it all down to economics and social aspects. Educating the policymaker is going to be one of the most important outcomes to come from the pragmatic approach we will take to Greenbuild.

> *This interview was edited for clarity and length. To read our full interview with the new CEO of the USGBC, visit bit.ly/MaheshRamanujam.*

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Norman Kelley is an architecture and design firm comprised of Carrie Norman, formerly a senior design associate at SHoP Architects, and Thomas Kelley, a clinical assistant professor at the University of Illinois at Chicago School of Architecture. Their project for the Chicago Architecture Biennial, "Chicago, How Do You See?", centers on architecture's genesis in fine motor skills and representation. "The act of drawing, and the drawing itself, is the architecture for us," says Norman, "and drawing by hand is still vital to how we see ourselves and how we think."

We generally only draw in black and white, and that lends itself to the figure-ground diagram. It's a democratized style of drawing—one that has a long history in architecture but can also be easily understood through the eyes of a child. The iterative process is important to us, too—and the connection of our drawings to works like *The Manhattan Transcripts* (1976–81) by Bernard Tschumi or Daniel Libeskind's "Chamber Works" drawing set is important. When they are framed in a gallery they seem complete, but they represent a work in progress that appeals to us. We're appropriating those techniques and trying to match them to the questions we are asking about the city now.

Our project for the biennial is a continuation of a project we did in Rome—drawing on the interior of McKim, Mead & White's American Academy in Rome. In Chicago, we're drawing on the outside of Shepley, Rutan & Coolidge's Chicago Cultural Center, which is different from the other drawings in our portfolio because it isn't graphite or ink. Instead, it's a white vinyl application on each of the existing windows, moderating how one looks into the building and out onto the city, that we drew in advance. The graphic presents an oversized survey of historical and not-so-historical window dressings, sourced from Chicago. We know we come at this from an academic point of view—line weight or "sensibilities" or projection—but we want to make that accessible to everyone.

When we were at Princeton together, labored drawings and analog techniques were very popular, and we're still sympathetic. Our work is about the process of representation, independent of technique. That's something we want to pass along to others. —*As told to William Richards* AIA

→ Norman Kelley is one of 60+ official participants in the Chicago Architecture Biennial (Oct. 3, 2015–Jan. 3, 2016), sponsored in part by the AIA. Learn more at *chicagoarchitecturebiennial.org*.


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By William Richards
Art Direction by Jelena Schulz

ILLUSTRATION: LAUREN NASSEF

Adaptive Practices

The Gateway Arch in St. Louis opened 50 years ago as the centerpiece of the Jefferson National Expansion Memorial, designed by Eero Saarinen in 1947 for the west bank of the Mississippi River. It is the tallest memorial in the United States and, reportedly, the tallest stainless steel monument in the world. Below the ground plane, the arch's legs drill down 40 feet before going another 20 feet directly into bedrock. In the first 300 feet above ground, concrete fills the cavity between the carbon steel plates on the inside of the arch's legs and the stainless steel plates on the exterior. Topping off at 630 feet, and offering visitors a 30-mile vista on clear days, the final steel-plate segment was placed on Oct. 28, 1965—four years after the architect's death from a brain tumor.

The arch competition drew 172 entries, including one from Saarinen's father, Eliel, that called for dance halls, restaurants, bridges, and murals that keyed into words like "recreation," "adventure," and "enduring prophecy" (the last of which is a play on the Manifest Destiny doctrine behind westward expansion). In 1948, the jury selected the younger Saarinen's entry (number 144) for its simplicity and symbolism, which almost got him into legal hot water. As the University of Kentucky historian Tracy Campbell points out in *The Gateway Arch: A Biography* (Yale University Press, 2013), the Italian architect Adalberto Libera threatened to sue Saarinen because his St. Louis solution looked suspiciously like a Fascist arch that Libera had designed for the 1942 Esposizione Universale in Rome (canceled due to the war). The suit was never filed. It seems strange, though, that Saarinen could be accused of copying a catenary arch—a form born out of physics as much as it was born out of the architect's hand, on par with a square or a circle.

But symbols are fungible. The Etruscan fasces, a bundle of rods (sometimes with an axe), was a symbol of strength and unity in the Roman Republic, carried before magistrates to announce their rank. By adding a laurel wreath to the symbol, the Romans connoted victory. It's no surprise that fasces were borrowed by Nazi Germany and Fascist (ahem) Italy as iconographic elements in sculpture, buildings, illustrations, and regalia. It should also be no surprise that the fasces appear in other places—take a look at the U.S. Senate's seal some time, or almost any Neoclassical public building from the 1920s or 1930s in any American city, or the occasional headstone or burial plaque.

On this page, Chicago illustrator Lauren Nassef reinterprets everyday objects that have become symbolic and, rendered as speculative buildings, could be iconic. Please don't sue her.

AIAFeature

The Life Cycle of Practice

How pioneering firms are taking architecture to the edge.

Elizabeth Evitts Dickinson

ILLUSTRATIONS: VIKTOR KOEN

In 2007, Stephen Kieran, FAIA, and James Timberlake, FAIA, took their graduate students from the University of Pennsylvania on a trip. The partners of Philadelphia-based KieranTimberlake wanted their Design-Research studio to explore how the study of architecture, coupled with the study of the human condition, could advance more meaningful design. The group traveled to Dhaka, Bangladesh, a densely populated megacity with a growing population and myriad ecological and man-made challenges. Located in a large delta, 80 percent of Bangladesh is a flood zone. The overcrowded city of Dhaka is quite literally sinking.

"This is a very intense place with extreme problems," says Kieran. "We asked, 'How can we, as architects, contribute to this place and the betterment of lives?'"

Eight years later, the Dhaka Design-Research Laboratory continues to investigate climate change, development, housing, and health in Bangladesh. In their new book *Alluvium: Dhaka, Bangladesh, in the Crossroads of Water* (ORO Editions , 2015), Kieran and Timberlake write of their approach to understanding place, one where social science is as valued as urban planning and design interventions are rooted in empathy as well as research.

"Oftentimes, the answers students come up with aren't about architecture," Kieran says. "It could be about developing clean drinking water. They may wind up designing a filtration system. To us, that is still architecture. We do the same for our clients. If there are other ways to solve a problem [besides a building], we climb in and help."

At KieranTimberlake, the scope of the architect is elastic and expansive. It begins with questioning and researching the very way buildings are conceived, designed, constructed, and delivered, and continues through to material and product development and the ongoing study and management of buildings and places. The firm includes an affiliate business, KT Innovations, which now develops and brings to market software and products for the built environment.

Their business model raises a compelling question: What is the purview of the architect?

It is an inquiry that has preoccupied the profession for centuries, and one that has, of late, been answered with the steady shrinkage of the architect's sphere of influence. "Everything has become so specialized that architects hold a very small portion, something like the middle 6 percent of the process," says Robert Forest, FAIA, a founding partner of Adrian Smith + Gordon Gill Architecture (AS+GG) in Chicago. "Previously, architects were engaged as the master builder right from conception. We were approving sites."

Ask architects when and how the scope of their work diminished and you hear a litany of reasons, from a general aversion to risk among practitioners and the increased pressures of regulation and litigation, to the complex, often fractured org chart of the building industry today. Slowly, architects have ceded their power to subfields—including some that didn't previously exist, like owner's rep—and the architect got sidelined.

Tomas Rossant, AIA, founding partner and design principal at Ennead Architects, dates this deflection point back to the 15th century. In his role as the 2015 president of the AIA New York Chapter, Rossant dedicated the year to exploring firms that, like KieranTimberlake and new practices like Alloy, Plastarc, and Situ Studio, are all pushing the boundaries of design.

During one of his "Dialogues from the Edge of Practice" panel discussions, hosted in February, Rossant suggested the profession's shift began with the Italian architects Filippo Brunelleschi and Leon Battista Alberti.

"Alberti, I think, is the father of modern practice," Rossant told the audience. "With Alberti came a distancing from making. He

AIA Feature

CONTINUED

didn't hold the contract of the guilds; he didn't sit with the stoneworkers."

Brunelleschi was different. "He got his hands dirty. He was a maker," Rossant said. "I think at the close of the last century the voice of Brunelleschi grew faint. He disappeared for a while, as a spirit within us. But in the last 20 years, many of us have picked up the DNA of Brunelleschi again. In my practice, and at others working on the edge, we are moving out of the small box of basic services for fees to play a bigger role to both design and implement productive environmental solutions that respond to our culture's needs and problems."

With this expansion of purpose comes a broadening of business practices and opportunities. In fact, these "edge architects" (as Rossant calls them) have endeavored not only to regain lost ground but to enlarge the practice into new practice areas. These firms are bringing design acumen not just to buildings and urban plans, but to leveraging technology; to products and materials; to information systems, ecologies, and urbanism. These firms are expanding the life cycle of the architect, making the scope of practice more elastic.

Before

Rather than waiting to respond to competitions, RFPs, or client phone calls, some firms are seeding projects in nascent stages. One way to achieve this is to become more politically savvy. Susannah Drake, AIA, principal of New York–based DLANDSTUDIO Architecture, an interdisciplinary architecture and landscape architecture firm, once told me that she hires staff capable of understanding policy papers and politics. With urban projects in particular, the layers of bureaucracy and the whims of elected officials often dictate which areas develop and which projects get greenlit. Being tapped into the politics and the policies gives her firm an upper hand by helping to understand the flow of funding and the possibilities for new ventures.

At AS+GG, the firm sometimes tasks staff with researching renewable energy and tax incentives. "We need to be proactive and aware of policy shifts, or of tax incentives for things like photovoltaics. We get requests from all over the country, so we should be able to talk about this," Forest says. "And since we work internationally, we're also looking at energy policies in places like China."

Another way to have a larger role in projects is to propose ideas. "In Chicago, there are lots of potential sites for projects," Forest says. "If we think there should be a project, we ask how we might spur that on. We do research, put together a business case, and see if there are clients that could latch on to that." The firm, for instance, completed a pro bono master plan for a neighborhood in transition, which led to other projects in the community.

In Baltimore, the firm of Ziger/Snead Architects earned the planning and design of a new film center and cinema after advancing ideas for an abandoned historic theater building. "Long before that project was officially offered to developers, we put teams together to try and make things happen with the owner," says partner Steve Ziger, AIA.

Questioning is another tool for expansion. Today, many fee-for-service firms work to a client's stated needs. The firm is presented with a project, and the architects respond. But what if you questioned the very proposal?

"You want to get involved sooner and contribute to the decision-making process, because if you don't you are constrained by the preconceptions of what comes to you, or you are marginalized and you have to fight your way out of that spot," says Gordon Gill, FAIA, design partner at AS+GG. "We got a call about putting a building on a lot. We said, 'You don't need a building, you need a park.' It's not about selling architecture, it's about solving problems. And we got that commission."

Questioning—and challenging—how architecture happens is the driving philosophy at KieranTimberlake. "Inquiry is the engine that motivates us," Kieran says. "We begin projects with 'RED Reports'—research and environmental design reports—which is a way to interrogate an opportunity. There's tremendous interest in questions that lead to insights and inventions that might then provide something of value to clients."

During

For the third year in a row, the Boston- and New York–based firm NADAAA won the top spot for design in the ARCHITECT 50 rankings, owing in large part to their ability to bridge the chasm between designing and building. At NADAAA, they've taken steps to regain a relationship with the trades. The architects reach out to the building industry early in order to better understand the logic of construction and how their designs might come to fruition. "With each project, we look at its innate qualities, not only in terms of their material behavior, but how each navigates the protocols of the construction industry,"

"We need to be proactive and aware of policy shifts, or of tax incentives for things like photovoltaics. We get requests from all over the country, so we should be able to talk about this."
—Robert Forest, FAIA

says partner Nader Tehrani. They also invent new materials and products when they bump up against the limits of existing off-the-shelf options. NADAAA tests and builds at their in-house fabrication lab. "This is where we make and research pieces for which there is no precedence, or that are speculative. Sometimes we hand the making of it off to the building industry, and other times we deliver it ourselves," Tehrani says.

KieranTimberlake, which has been a major player in redefining the way off-site buildings are fabricated and delivered through projects like their 2007 Loblolly House, now writes the construction relationship into some contracts. "We're no longer held at arm's length from the process of building," Kieran says. "We have common contracts with owners to build together and with incentives to earn more money depending on how well we work as a team. We are regularly drawn into contracts that allow us to affiliate with subcontractors, manufacturers of building products, and project development. That's a huge expansion."

Investing a measure of fiscal risk into a project is another way of regaining ground. SHoP Architects has famously championed the architect-as-developer model, trading simple fees for equity in some projects and challenging the notion of the architect as a hired draftsman. Investing in real estate will mean different things for different scales of practice, of course, but the notion that a firm can negotiate an equity claim in a project rather than merely a fee-based role means the architect is again part of the larger team.

After

Who says the relationship with a building, or a client, ends once occupants move in? Post-occupancy is becoming about more than mere data-gathering or change orders; it's now about fostering an ongoing relationship through new services. "Some of our contracts ask the client to provide us with data on the energy use of the building so that we can first go back and improve our design process and get a feedback loop, but also so that we can be involved as that building moves forward, even into the far future for things like restoration and renovation," Forest says.

KieranTimberlake wanted to better understand the interior climate of its buildings, but found existing monitors incapable of fine calculations. So the firm designed hypersensitive sensors capable of providing microclimatic data. "Most weather data, for instance, is regional. Climatic data in buildings is very 'regional.' We didn't find it to be sufficient to inform our work," Kieran says.

They put off-the-shelf thermocouple sensors and pendant sensors in the 2008 Cellophane House installation for the Museum of Modern Art's *Home Delivery: Fabricating the Modern Dwelling* exhibit. The practice of monitoring informed the development of their own sensors, which are being beta-tested by a number of firms this fall before being offered for sale in 2016. "Things that started with our projects have now become products," Kieran says.

And this is perhaps the most compelling area of expansion for architects: invention. When an architect bumps up against the limits of existing products or services, some are designing a solution themselves. And, increasingly, they are bringing those products and services to market. The Copenhagen- and New York–based architecture firm Bjarke Ingels Group (BIG) now has a division called BIG Ideas, where researchers develop everything from original building materials to smart locks for houses.

Technology and software platforms that harness data are another growth area. KT Innovations developed Tally, a plug-in for Autodesk and Revit that allows designers to assess the environmental impact of building materials early in the design process.

AS+GG has also pioneered a prototype platform that plugs building data into a parametric model, which clients can lease for the life of the building. "This model can transfer to the client for facilities management," Forest says.

Now imagine that technology applied to a master plan. "We're proposing for a Chinese client a master plan that's based on a parametric model that is flexible," Forest says. "When we finish our task, we give a model, and then we give them a platform capable adapting if something changes." In other words, the architects are selling not just a master plan but a lease on a program that can evolve as the place evolves and offer clients modifications. "With this platform, the client could in five years import the new reality—flooding, for instance—and the platform gives them a scenario of how to do planning," says Forest. "It's a dashboard for a city. You can see the present status, propose changes, and it will tell you what the outcomes are."

Inventions such as these open new and appealing business possibilities for firms: Moving away from a strictly fee-for-service model and gaining a measure of passive income. As a whole, those expanding the life cycle of architecture are exploring every aspect of the profession for possibility, while expanding into new realms.

After spending more than a year connecting with new entrepreneurial practices, Rossant sees commonalities among the firms. "Edge practitioners have a different brain structure, one in which all aspects of human endeavor are seen as design problems. They practice without ego and across disciplines," he says. "It's happening in these crazy firms started by Millennials, which have no respect for the boundaries of traditional practice. It's happening with renewed collaborations, often with disciplines that we haven't tapped before, like cultural anthropologists, social scientist, material scientists. It's such a cool time right now. Finally, many of us are taking risks again." AIA

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AIAPractice

Humanizing Architecture

On May 14, at the 2015 AIA National Convention in Atlanta, the Institute conferred its Gold Medal on Moshe Safdie, FAIA, whose comprehensive and compassionate approach to designing public and cultural spaces across the world has touched millions of people and influenced generations of younger architects. In his acceptance speech, reproduced below, the Israeli-born Safdie outlines how personal experience and a deep and abiding design ethic drive his approach to site, context, and the idea that the experience of architecture has to be a human one.

PHOTOGRAPHY: PETER ASH LEE / ART + COMMERCE

I am deeply honored to receive this award, particularly as it is bestowed by my peers. I do so with humility, combined with a sense of confidence, that it represents recognition of the ideals and principles that have guided my work as an architect for the past 50 years.

As for humility, I always tell my students that if every time they take a pencil in hand to design, if they can identify completely with those who will live, work, and be in their building, it is half the way to victory.

I was born into a state in the making. It was an idealistic moment in my people's history. It was not driven by fanaticism of religion, but by the ideology of the enlightenment. I grew up in the time of the kibbutz, the cooperatives, a society that believed in equity.

This experience had profound impact, forming my being as an architect in relationship to society. I do not say this as an abstraction, but rather from the perspective of where I—may I say "we"?—stood in relationship to those whom we served.

Ideals translate into an ethic, an ethic that must guide us as a profession. It is for each of us to personally figure out, but what more fitting moment today for me to declare my own?

I reflect on the words of my mentor, Louis Kahn: "Let a building be what it wants to be." What is a building's inherent and deep purpose? To me, it is discovering the life intended in a building, be it a school, hospital, performing arts center, airport, or mosque.

If you design a school, one question matters: Is it conducive to learning? This exploration for fitness to purpose must be at the center of architectural invention.

As a profession designing the physical environment, we draw heavily on society's resources. Our art is a material one. How we use materials—the building systems we evolve, the energy our buildings consume—is fundamental to a responsible building.

This is about designing buildings that are inherently buildable, which are conceived—to use Frank Lloyd Wright's words—"in the nature of materials." This is what differentiates us from the other arts, from sculpture, from music. Through generations, it has been a powerful component of architectural expression.

We were all here born into a globalizing world. My commissions have drawn me to every continent and many countries and cultures. I have had the good fortune to design places for the Inuits in the Arctic, the peasants of West Africa, places for Sikhs and Muslims, national institutions for Canada, U.S., Israel, and China.

I became an attentive student of culture. I discovered the satisfaction of creating buildings which truly belong, which feel as if they have always been there, yet responding and resonating to the needs of today.

I learned that architecture cannot be independent of place, and the notion that there are universal solutions that fit all must disappear as colonialism did. All-glass skyscrapers in the desert were not meant to be, any more than igloos in the tropics.

I've always believed that we must draw on our heritage, the lessons learned from those who built before us. In the words of Ecclesiastes, "There is nothing new under the sun." Without contradicting the scriptures, it is also true that there is always the challenge of the moment: a planet in which, now, the great majority live in cities.

In the countryside and towns, we had guaranteed open space, air, light, and contact with nature. Now, living in cities, whose size escapes our imagination—10, 20, 30 million and growing, and at densities that were not intended for a species which evolved roaming the savannahs.

The reality is of a world in which the dominant building type is the high-rise building. With it, life's sustaining elements are threatened: light, air, a sense of identity, contact with nature, privacy, as well as community. Neither the privacy of a house, nor the community of a village, are possible now without major new inventions which transcend individual buildings. They demand a new urban vision.

I have always felt that this should be the American Institute of Architects and Urbanists. In every age, and in every school of architectural thought, architectural concepts were derived from concepts of the city as a whole.

Architects always recognized that it is the aggregation of buildings that form places; and places form districts; and districts form cities. It is the urban environment that we experience

AIAPractice

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in our daily lives that really matters. At a time where our cities are both thriving and ailing, proliferating to accommodate the majority of humankind, yet increasingly depriving us of the fundamental qualities of life, not only light, air, and nature, but the deprivation of mobility—the erosion and privatization of the public realm—now is the time to declare, once again, that it is the cities we create that really matter.

And since we are in Atlanta, may I dare echo "I have a dream"? I have a dream of high high-rise cities transformed, penetrated by light and sun, with plant life and gardens on land and sky. Towers clustered into communities, served by innovative modes of transportation, mobility restored.

That the agora, souk, and city squares of bygone days are reinvented into new centers, integrating culture, commerce, and governance into places we can call an urban oasis; where privatized malls give way to vital and inclusive city centers worthy of our civilization.

Humanizing megascale is the single most urgent task that awaits us in the decades to come.

In accepting this award, I want to remind us that making architecture is a collective act. Like grand opera, it takes a composer, libretto writer, conductor, chorus master, soloists, and many others to achieve. I thank the devoted members of my firm, many there for decades. I thank the brilliant engineers and other specialists I have had the good fortune to collaborate with, and, last but not least, the committed clients who have made all this possible.

Thirty years ago, concluding my book *Form and Purpose*, I summed up my thoughts in a poem. What I wrote then seems relevant today:

He who seeks truth shall find beauty.
He who seeks beauty shall find vanity.
He who seeks order shall find gratification.
He who seeks gratification shall be disappointed.
He who considers himself the servant of his fellow beings shall find the joy of self-expression.
He who seeks self-expression shall fall into the pit of arrogance.
Arrogance is incompatible with nature.
Through nature, the nature of the universe and the nature of man, we shall seek truth.
If we seek truth, we shall find beauty.

—Moshe Safdie, Atlanta, Georgia AIA

AIAPerspective

PHOTOGRAPHY: CARL BOWER

A Crisis of Conscience

The architect's responsibility in the face of strife.

One of the most striking disasters of our time is not an act of nature. It's a result of political upheaval—hundreds of thousands of people fleeing war in Africa, the Middle East, and Afghanistan. The images are haunting—entire families adrift in flimsy boats, parents protecting their children from the rain and the police baton, all desperate to save themselves and their children.

As architects, our training and design thinking equip us to propose creative responses to natural disasters. This talent has been put to great purpose through the AIA's Disaster Assistance and Response teams. But what about disasters caused by civil strife? What role can we play in helping those agencies and countries struggling to house those displaced? How can we help to repair the communities and the very land that has been damaged by revolution and war?

For one, architects can continue to create prototype shelters, in cooperation with governments, relief organizations, and the private sector, to house those who have been displaced. We can design transitional education facilities and community gathering places to normalize life quickly. The goal is to avoid creating refugee ghettos imbued with hopelessness and infected by criminal activities and disease, and aim, instead, to integrate refugees into the communities that have accepted them.

The AIA's growing network of overseas chapters can also work alongside professional organizations in their home nations to find a way to act swiftly and locally to restore hope for the displaced.

At home, the Architects Foundation has created the National Resilience Initiative, which is made up of a network of regional design studios—an outcome of the partnership between the Architects Foundation and the Rockefeller Foundation's "100 Resilient Cities" program. While the initiative was inspired by climate change's global impact and the housing issues at the center of increased urbanization, it has great potential to address displacement caused by civil unrest through research conducted at its regional studios. It's work that needs to be done urgently, but it is also work that needs to be done thoughtfully. Human lives, after all, are at stake.

My challenge to architects: Be agents of compassion and healing wherever there is a need. In a world torn by strife, design thinking is a powerful balm. AIA

Elizabeth Chu Richter, FAIA, 2015 AIA President

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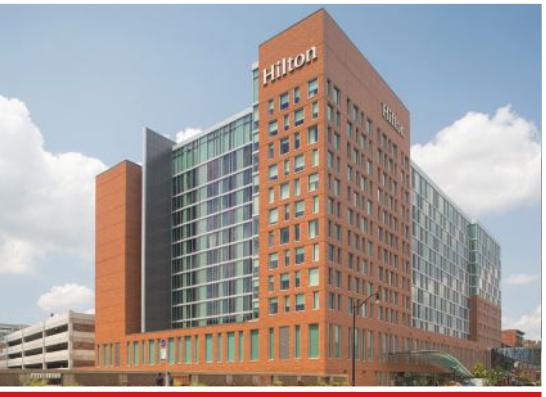

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“The show is an inclusive mélange, promoting the idea that architecture, like religion, is a construct that can be expressed, interpreted, and instrumentalized in myriad ways.”

The Big Ideas Behind the Chicago Biennial by Cathy Lang Ho

With more than 300 art and architecture biennials and triennials and counting, does the world need another? From the 19th-century Venetian original to the mid-20th-century copycat in São Paulo to the hip 21st-century incarnations in Shenzhen, China; Rotterdam, Netherlands; and Oslo, Norway, the format of the alternating-year global art and architecture extravaganza has exploded, reflecting the rapid global expansion of creative and financial markets and their inextricable entanglement with local economies and civic ambitions.

It's useful to rephrase the same question: Are the burning questions about architecture's importance and possibilities not already sufficiently considered on what's now essentially a perennial schedule? Are architects really lacking exhibitionist opportunities in alluring locales—chances to unleash their impulses by creating follies, sculptures, agitprop, manifestos, and so on? And should cities and funders expend precious resources on such temporary spectacles when there are so many other urgent urban and social problems that require investment?

The organizers of the Chicago Architecture Biennial (which is open until Jan. 3) have clearly considered all this and more. Intellectual powerhouses Sarah Herda, director of the Chicago-based Graham Foundation for Advanced Studies in the Fine Arts, and Joseph Grima, former *Domus* editor and accomplished curator, responded to Chicago's Department of Cultural Affairs and Special Events (DCASE) commissioner Michelle Boone's invitation with a conscientious effort to create not simply another tourism-motivated architecture mega-event, but a sturdy foundation for a new institution that will benefit the city in the long term while spotlighting some of the world's leading talents and new directions for the field.

Titled "The State of the Art of Architecture," the show is an inclusive mélange, purposefully avoiding any overarching proclamations or themes. At risk of being criticized for a lack of focus, the exhibition—which meanders throughout the magnificent five-story Beaux-Arts Chicago Cultural Center (CCC), formerly the city's main library and the nation's first free municipal cultural center—promotes the idea that architecture, like religion, is a construct that can be expressed, interpreted, and instrumentalized in myriad ways.

But can architecture be defined in individual, personal terms? Those in the field have been saying *Yes, definitely*, for some time now. But it doesn't mean that the general public won't be mystified by a dark room with glowing ethereal spiderwebs (by Berlin-based Argentine Tomás Saraceno), or a confounding

Tomás Saraceno's ethereal spiderwebs

series of ramps and bridges in a inaccessible courtyard (by Tokyo firm Atelier Bow-Wow), or petri dishes filled with detritus from the streets of Johannesburg (by South Africa–based Counterspace). Those with a traditional view of architecture might have a hard time accepting the new gospel. But this biennial—with its straightforward aims, situated in a beloved, well-used, public building, accompanied by dozens of programs and collateral events in partnership with nearly every cultural and educational institution in the city—works hard at spreading the message.

Big Ideas, Not Big Names

Co-artistic directors Herda and Grima borrowed the biennial's title from a 1977 Chicago conference organized by Stanley Tigerman, FAIA, which convened that generation's influential practitioners, including Peter Eisenman, FAIA, Frank Gehry, FAIA, and John Hejdik, to discuss their various "positions." "In a similar spirit but with an expanded, global scope," write Herda and Grima in the catalog introduction, "the Biennial summons to Chicago a group of architects … whose work tests the limits of the field, with the expectation that the resulting diversity of projects and ideas will cast into doubt our certainties about what architecture is." Rather than give space to select projects, the curators entrusted thoughtful designers to convey their personal concerns and passions in ways that will ideally bridge a general understanding of architecture's complicity in issues ranging from sustainability to housing, resilience to social justice. The show isn't about big names or big projects, but it's about big ideas.

Respect for individual agency is the thread that connects the hodgepodge. Displaying insight, sincerity, and optimism, as well as humor and poetry, the installations—contributed by 100 participants from more than 30 countries on six continents—make delightful use of the building's sidewalk, façade,

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light- and stairwells, passageways, banquet rooms, Millennium Park across the street, and sites in the city beyond. This is the first time the CCC has been given over to a single exhibition, and it has never looked better.

The first thing one sees (and smells!) when entering the CCC's foyer is an oversized table/bench composed of young stacked timbers, sliced and sanded smooth on its edges. Using locally sourced wood, *Place for Gathering*, as it's called, is the handiwork of Berlin-based, Burkino Faso–born architect Francis Kéré, whose previous projects have won widespread acclaim for making the most of available resources and centering communities. "It's all about people," he said simply, when he was asked during the biennial's marathon press conference (as all participants were) to articulate in 15 seconds or less, "What is urgent about architecture?"

This is just one of several projects that underscores the importance of collectivity, the need for architecture and cities to be designed to bring people together and foster communication and mutual benefit. Of his own village, Gando, Kéré writes, "Community members depend on one another for the survival and prosperity of the group as a whole." A second gathering space takes over the next room, *Randolph*, by Pedro&Juana, a German-Mexican partnership. They've transformed an old drab, multipurpose intermediary space into a cheery "living room" with globe lamps suspended from a web of bright yellow rope, swaying and dancing above custom-made metal mesh sofas and chairs. The removal of gray industrial carpeting revealed an intricate turn-of-the-century mosaic floor—one of the many lasting improvements that the biennial has brought to the CCC.

Kéré Architecture's *Place for Gathering*

The notion that architects can not only design and build buildings but also push agendas, manage crises, and improve society is not new, but the strategies presented in this biennial are.

Urban Speculation

Community action is very much a part of contemporary practice, particularly among the younger generation of architects who've grown up able to communicate, share, crowdsource, mobilize, socialize, publish, and more, at a tap or a swipe. Santiago, Chile–based research collective Toma has set up a workshop of sorts, *Especulopolis*, inviting visitors to participate in acts of "urban speculation." The live collaborative residency/workshop has become something of a fixture at recent international biennials—understandably, given the duration of these events (the Chicago biennial spans 100 days). After the opening festivities, it's nice that some architects want to stick around to engage with the locals.

London-based Assemble, a self-described "cooperative structure" known for its DIY urban

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interventions, exemplifies this new type of idealistic-slash-pragmatic practice. Although their installation wasn't complete at press time, the group was recently nominated for the Turner Prize—the first time a design studio has been shortlisted for this prestigious artistic honor. That a bunch of 20-something-year-olds who pledge to "democratize design and activate overlooked spaces through architecture and community-focused programs" can, in a short amount of time, create a thriving practice that's now being retained by communities, municipalities, and public art commissions, is inspirational.

A quick browse through the participant list reveals many practices that self-identify as collectives, boast multinational principals and bi- or tri-city operations, and work across art, architecture, publication, research, and so on. URBZ is a collective with team members in Mumbai and Goa in India; São Paulo; and Santiago, Chile. It organizes community workshops and actions, like the *Homegrown Cities* project, which facilitates self-built housing in slums. Fake Industries Architectural Agonism, which produced *Indo-Pacific Atlas*, a beautiful pop-up collage that explores the geopolitical consequences of media misinformation, is helmed by Columbia University–educated Spaniards Urtzi Grau and Cristina Goberna Pesudo and lists offices in New York; Barcelona, Spain; and Sydney. WAI Architecture Think Tank, which exhibited a new take on old-school paper architecture, is led by a Puerto Rican–French duo, Cruz Garcia and Nathalie Frankowski, who run a gallery along with a design practice in Beijing.

Gen Xers

Diversity—geographic, ethnic, disciplinary—is a defining feature of an emerging generation of architects, and permeates this biennial. The majority of the participants are under 45, like Herda and Grima themselves, Gen Xers comfortably sandwiched between Boomers and Millennials. Without investing too much in the sociological term, Gen Xers are purportedly activist, engaged, and, no longer guaranteed employment when armed with good degrees like previous generations, entrepreneurial by necessity.

The notion that architects can not only design and build buildings but also push agendas, manage crises, and improve society is not new, but the strategies presented in this biennial are. In the context of Chicago, a city like so many others worldwide struggling to deal with violent crime, divided neighborhoods, racial tension, and endless other urban and social problems, creative alternatives take on a new urgency. In the biennial, housing comes up repeatedly as an area of concern. Mexican architect Tatiana Bilbao designed a $8,000 house with a simple solid core that that residents may extend in phases using lightweight materials. Her full-scale prototype allows visitors to experience its spatial efficiency and possibilities for variation. French architects Lacaton & Vassal and Frederic Druot Architecture's remarkable upgrade of a dilapidated public housing estate in Bordeaux, France—which involved recladding the façade, adding balconies, remodeling interiors—shows an intelligent alternative to costly demolition and new construction. The project is portrayed through a touching film that captures the everyday lives of the project's residents.

Two other projects—which are starkly different in appearance but respond to a shared concern—are Chicago-born, Los Angeles–based

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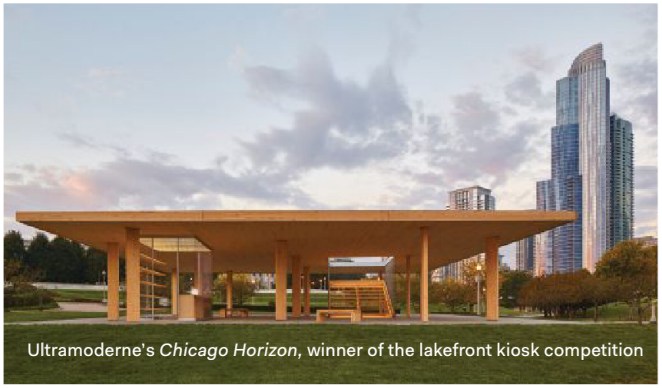
architect Erin Besler's *The Entire Situation*, which takes everyday standard construction materials (metal studs, sheetrock) to create interesting forms, and Milan-based Studio Albori, which improvised an installation on-site using materials donated from local salvage centers. Besler's installation is tidy, referencing the huge supply chains that drive the industry, and uses computational design to break boxy formulas. Meanwhile, Studio Albori's messy

Sou Fujimoto's *Architecture Is Everywhere*



Ultramoderne's *Chicago Horizon*, winner of the lakefront kiosk competition

collage, aptly called *Makeshift*, recycles discarded building elements, commenting on the wasteful nature of buildings, not to mention architecture biennials. Both critique the dominant architecture culture, building production, materials supply loops, and accessibility to the art of building.

The South Side

The felicitously timed opening of the Stony Island Arts Bank extends the biennial to Chicago's South Side. The bank project was spearheaded by Theaster Gates, who started gaining attention with the Dorchester Projects, the "recycling" of an abandoned home and vacant lot, also on the South Side, into a gallery, artist-in-residency program,

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and neighborhood resource. He has since grown his Chicago-based nonprofit, the Rebuild Foundation, into a full-fledged arts organization that oversees a community garden, Black Cinema House, a mixed-income housing collaborative, performance venues, artist studios, arts education programs for neighbors of all ages, and more. The Arts Bank is the most ambitious, however: The city sold the 17,000-square-foot neoclassical bank, which has sat vacant for more than 30 years, to Gates for $1, who in turn raised hundreds of thousands of dollars to finance its refurbishment. Gates describes the Arts Bank as "a new kind of cultural amenity, a new kind of institution—a hybrid gallery, media archive, and library and community center."

Gates is a new kind of hybrid professional himself—an artist, trained as a planner, as inspiring as a preacher, an accidental developer, property manager, and arts administrator—who in restoring pieces of architecture has restored whole neighborhoods. Acknowledging Chicago's proud architecture tradition, he also has highlighted the city's "history of segregation, of redlining and housing covenants that work against the poor, systems that leave people out so that they never get to experience the beauty of architecture." His point—that architecture's "highs" also have "lows," and vice-versa—offers a way to appreciate this biennial.

"Architecture is first found and then made," according to Japanese architect Sou Fujimoto, who illustrates his belief with an installation called *Architecture is Everywhere*, of everyday items, like staples, ping pong balls, bath puffs, and microchips, set on small pedestals with miniscule plastic humans. It's one of the show's most captivating installations. It opens different ways of looking at mundane things, celebrating serendipity in the everyday—and the minisculptures are striking primarily due to the relationships between the objects and the figures.

As South African architect Mokena Makeka said during his 15-second manifesto at the biennial's press conference, "Architects must be leaders. We must find relationships between design, politics, and power." "The State of the Art of Architecture" has essentially built an entirely new network of relationships and ideas which, one hopes, will gain more power as this generation grows.

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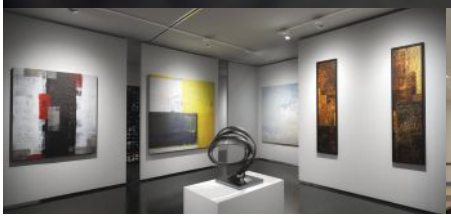

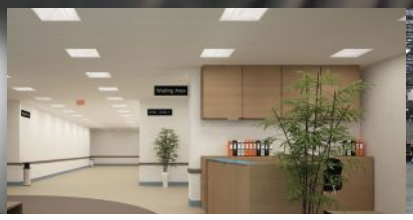

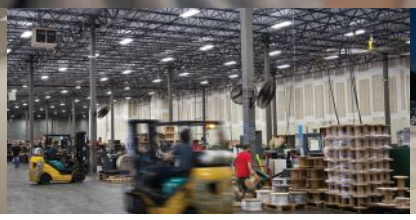

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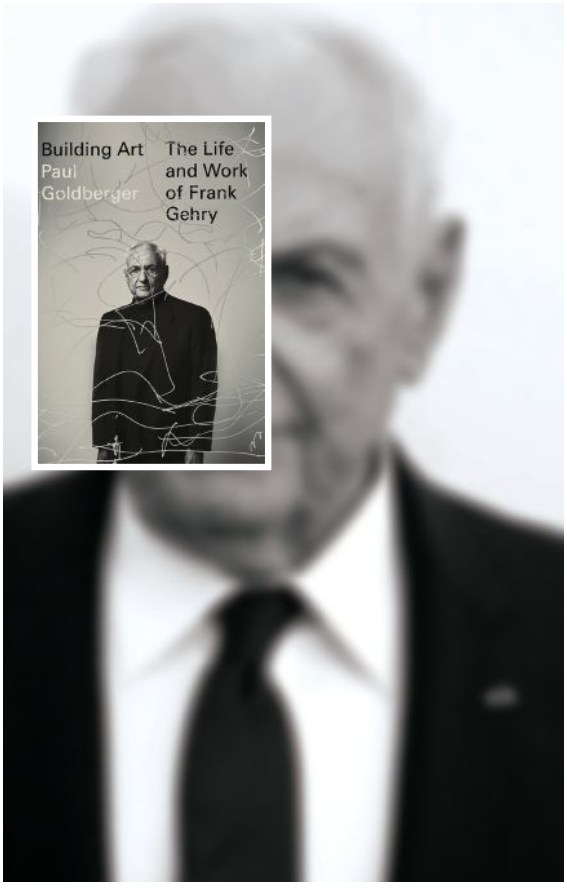
“What is it about architects—or architecture—that resists the biographer’s pen? What would a seasoned biographer like Isaacson or Caro do with an architect’s life?”

The Biographer’s Elusive Quest by Witold Rybczynski, HON. FAIA

Paul Goldberger's new biography of Frank Gehry, *Building Art*, published by Knopf in September, is currently No. 1 in Amazon's "Books on Individual Architects and Firms" category. But it's unlikely that it will equal the success of Walter Isaacson's *Steve Jobs* (Simon & Schuster), which was Amazon's top overall seller in 2011. This is no reflection on Goldberger's writing; architectural biographies are rarely bestsellers. It's true that the general reading public is not knowledgeable about architecture, but that could hardly be the reason; one of the most acclaimed biographies of modern times, Robert A. Caro's Pulitzer Prize–winning *The Power Broker* (Knopf, 1974), a life of Robert Moses, dealt with the arcane minutiae of municipal politics and public works.

The only architectural biography to win a Pulitzer Prize—back in 1956—was Talbot Hamlin's *Benjamin Henry Latrobe* (Oxford University Press). "Latrobe, the man, is never for an instant lost sight of," wrote Wayne Andrews in an admiring *New York Times* review, "no matter how rich the detail with which his career is sketched against the history of his times." Since then there have been biographies of H.H. Richardson, Louis Sullivan, and Daniel Burnham, although these scholarly studies have not received the same acclaim. Franz Schulze's *Mies van der Rohe* (University of Chicago Press, 1985) is good on the work but it does not plumb the depths of the taciturn master builder—it would take an Ibsen to do that. Neither Meryle Secrest, Brendan Gill, nor Ada Louise Huxtable's popular biographies of Frank Lloyd Wright managed to pin down that elusive genius. Nicholas Fox Weber's *Le Corbusier* (Knopf, 2008) is lively, although we are never quite sure what to make of its subject—driven idealist or unprincipled opportunist?



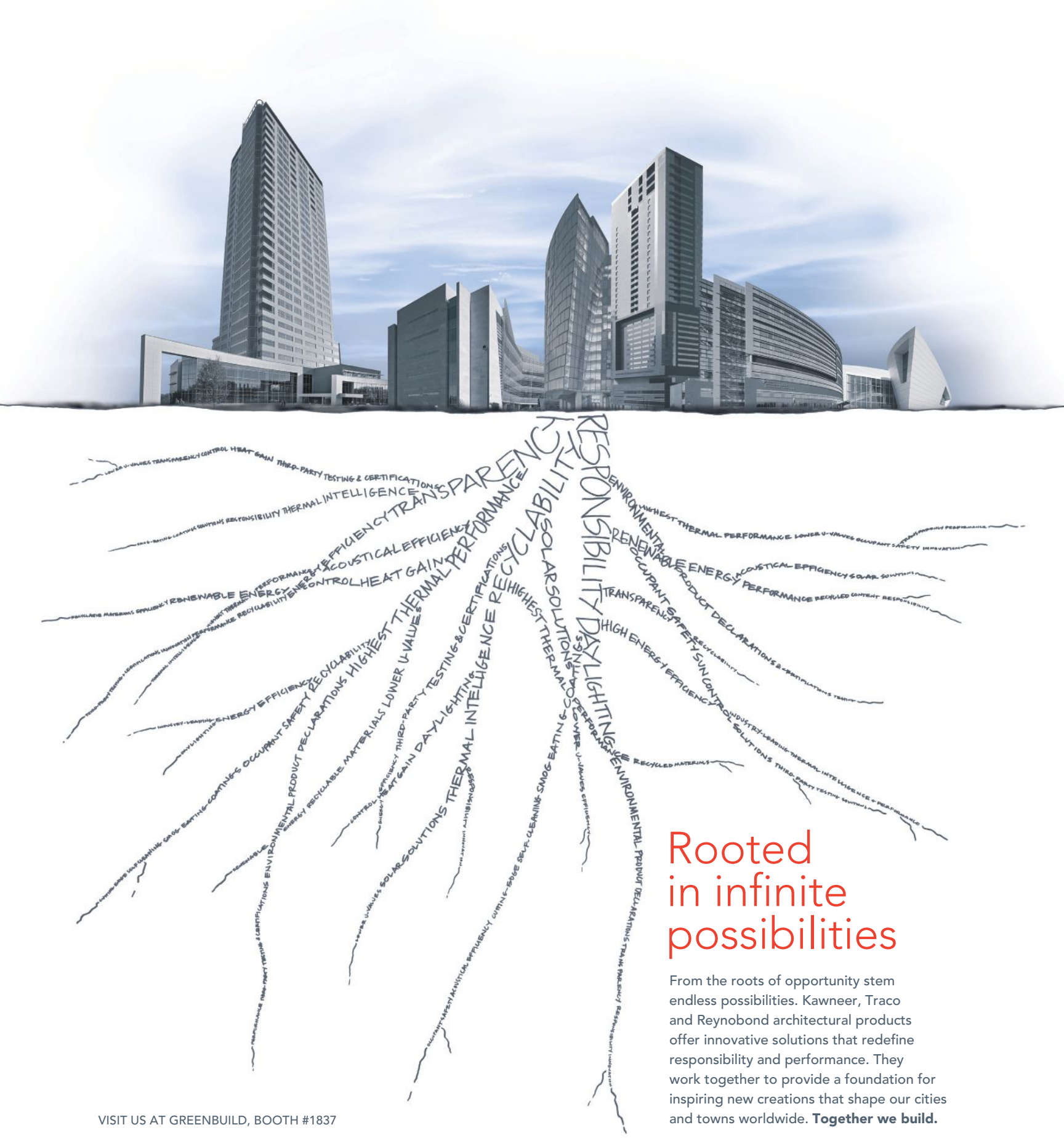
Living architects have not fared much better. Schulze's *Philip Johnson* (Knopf, 1994) did not fully capture that mercurial gadfly; Michael Cannell's *I. M. Pei* (Clarkson Potter, 1995) was hobbled by its author's lack of access—Pei did not speak to him; while Deyan Sudjic's authorized biography, *Norman Foster* (Overlook Press, 2010), had the opposite problem.

For *Building Art*, Goldberger, HON. AIA, spent many hours interviewing Gehry, FAIA, and he preserved his editorial independence, although his friendship with his subject is apparent. Nevertheless, the Toronto *Globe and Mail* reviewer, Alex Bozikovic, was left wondering, "So how does the personality explain the work? And how did this iconoclastic, stubborn Canadian-Californian become the world's most famous architect? This, the first full-length biography of Gehry, implies some answers but never really delivers them."

Eliciting Drama from Routine

What is it about architects—or architecture—that resists the biographer's pen? What would a seasoned biographer like Isaacson or Caro do with an architect's life? Perhaps people are just not that interested in what architects do. It takes years to write a good biography, and if the readership is not there, publishers and writers will pick other subjects. Or is it the nature of the profession? Like many artists, architects work for others, but unlike novelists and painters, they are not entirely free to follow their muse. Their creative imaginations are constrained by mundane practicalities—program, site, budget, construction techniques, building regulations. Perhaps that's why the film version of Irving Stone's bestselling biographical novel about Michelangelo, *The Agony and the Ecstasy* (Doubleday, 1961), focused on painting the ceiling of the Sistine Chapel rather than on building the Campidoglio, the Laurentian Library, or St. Peter's.

Despite the occasional dramatic setback—the lost competition, a building failure, the lawyered-up client—an architect leads the life of a settled



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professional. Commissions follow one another: architect meets client, architect develops a design, design is built—or not. It's difficult to tease drama out of such established routine. The modern architectural biographer faces several additional obstacles. The lives of architects were more interesting to write about—and to read about—when architecture was an avocation rather than a profession. In the past, before the education of architects was formalized, becoming an architect might include accomplishments in other fields, or apprenticeship with a master—both grist to the biographer's mill, and more compelling than simply "going to college." An architect might start out as a painter (Raphael), a sculptor (Bernini), or even a dramatist (Vanbrugh). The story of how a goldsmith invented the solutions to unprecedented building problems is one of the things that makes Ross King's *Brunelleschi's Dome* (Bloomsbury, 2013) so fascinating. The subject of Lisa Jardine's biography of Christopher Wren, *On a Grander Scale* (HarperCollins, 2003), is a polymath, equally capable of writing a mathematical treatise and building a telescope, as of laying out the plan of a cathedral. Hamlin's biography gains richness from Latrobe's achievements in painting, waterworks engineering, and canal-building.

Another obstacle is the nature of contemporary architectural practice. At his busiest, Latrobe employed a handful of assistants. Today's architect is part of a large team that includes not only partners and assistants, but dozens of specialist consultants. In addition, contractors and fabricators play an important role in what is now a highly industrialized process. Was the architect responsible for that striking exterior detail or was it an assistant? Or does credit belong to the so-called executive architect, the façade consultant, or the curtainwall fabricator? For the biographer, unravelling "who did what" is a challenging task.

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The Howard Roark Trap

There are books that have attempted to disentangle such questions by focusing on individual projects, interviewing the principals (especially the client), examining correspondence, analyzing sketches and drawings. Patricia C. Loud's excellent *The Art Museums of Louis I. Kahn* (Duke University Press, 1989) demonstrates how the design for the Yale Center for British Art changed dramatically when Kahn's first version went wildly over budget. "What does a building want to be?" the architect famously asked. Apparently, sometimes it just wanted to be less expensive. In *Fallingwater Rising* (Knopf, 2003), Franklin Toker documents the tug of war that took place over the building's unusual structure between Frank Lloyd Wright, his client Edgar Kaufmann, and their respective engineers. But a biography doesn't have space for such lengthy digressions. The temptation is to either simplify or omit. Too often, the architect is presented as the sole creative force—a heroic Howard Roark–like figure. Colorful but inaccurate.

Diaries, private journals, intimate letters, and memoirs are the foundation of any good biography. Here, the architectural biographer encounters yet another obstacle. A leading architect once said to me of a prominent project, "It just got away from us"—something he would never have admitted in public. Kiss-and-tell is (understandably) rare in a service profession; ever since Palladio, practitioners have praised good clients, and maintained a discreet silence about bad ones. And, like doctors, architects are loathe to criticize their professional colleagues in public.

One of the things that attracted me to write about Frederick Law Olmsted, the biographical subject of my book *A Clearing in the Distance* (Scribner, 1999), was that he was a journalist, editor, and author, before he became a landscape architect. Thus, his beautifully written park and planning reports provide a window into his design thinking. Most architects' explanations of their own work are notoriously unreliable. Le Corbusier treated the written word as a propaganda tool; except in rare interviews, Mies was close-mouthed about his work. Although Louis Kahn strove for an honest expression of materials and construction in his buildings, his spoken and written


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expressions were often obfuscatory and self-indulgent—Carter Wiseman, who wrote a biography of the architect, called them "word clouds."

Even architects who steer clear of poetry can't seem to help being upbeat. The French have a term for it: *déformation professionnelle*, that is, the way that one's occupation conditions one's behavior. The architectural profession involves not only design but also persuasion—persuading clients, builders, review boards, community groups. A successful architect must be a good salesman, as a result architects generally put on a good face and are hesitant to reveal their inner doubts. Projects are inevitably cast in a positive light.

Whence Came the Magic?

We read the lives of famous artists to discover the secret of their creativity: What made them tick? What was the source of their talent? What did they know that others didn't? Whence came the magic? It's difficult for a modern architectural biography to provide satisfactory answers to these questions. Even if there were not so many people involved in the building process, and even if architects were more forthcoming, the connection between personality and professional accomplishment is tenuous. It may be titillating—in a *People* magazine sort of way—to read about a famous practitioner's foibles, but an architect's private travails have little to do with his work. Wright's life was a veritable soap opera, but eloping with a client's wife, or experiencing personal tragedy, don't explain his organic designs. Kahn's polygamy is no more evident in his chaste architecture than Johnson's flirtation with Nazism was in his. Gehry may have a fragile ego—what architect doesn't?—but that hardly explains his flamboyant buildings.

Architecture is a public art. It exists in the public realm, and it expresses public virtues such as order, probity, and stability, which makes it a poor medium for personal expression. Perhaps the reason that it's so hard to write compelling architectural biography is because unlike the lives of politicians—or corporate tycoons—the lives of architects are both more private and less revealing. The architectural historians may have it right. Perhaps it's better to just examine the sketchbooks and focus on the buildings.


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"I did feel that I was walking on sacred territory to interrogate this perfect and most beloved work of art of Whistler's. I even thought, 'Oh, my God, this could just be such a car crash.'"

Darren Waterston's *Filthy Lucre* Interview by Amanda Kolson Hurley

In his paintings, the artist Darren Waterston often returns to the complex relationship between beauty and decay—the moment when a flower fades or a tantalizing piece of fruit starts to go rotten. He has now explored the theme on a much larger scale, with a dark homage to one of the most famous interiors in art history. *Filthy Lucre*, on display until January 2017 at the Freer and Sackler Galleries of the Smithsonian Institution in Washington, D.C., is a full-scale, detailed replica of James Abbott McNeill Whistler's Peacock Room (1876–77), a richly decorated dining room crammed with porcelain that Whistler called his "harmony in blue and gold."

Chock-full of Asian ceramics, with peacock feathers swirling over almost every surface and a moody Whistler portrait on one wall, the Peacock Room is the ultimate Gesamtkunstwerk. It was originally designed as the dining room in the London home of Frederick R. Leyland. In 1904, a Detroit industrialist and art patron named Charles Lang Freer acquired the artwork—which can be taken apart and reassembled—and bequeathed it to the Smithsonian. It's now on permanent display at the Freer Gallery, which means that visitors to *Filthy Lucre* can also see the inspration behind it.

Waterston was fascinated by the human story behind the Peacock Room's creation: Whistler and Leyland argued over his fee, and their years-long friendship ended in rancor. In Waterston's decadent copy of the room, signs of conflict and incipient rot emerge from the architecture. Paint puddles and drips; stalactites hang from the ceiling; vases lie in shards. *Filthy Lucre* is also an allegory for the vicissitudes of the art market, which Waterston sees as little changed from Whistler's era. Waterston talked with ARCHITECT about his ambitions for the project, which took a year-and-a-half to research and create.

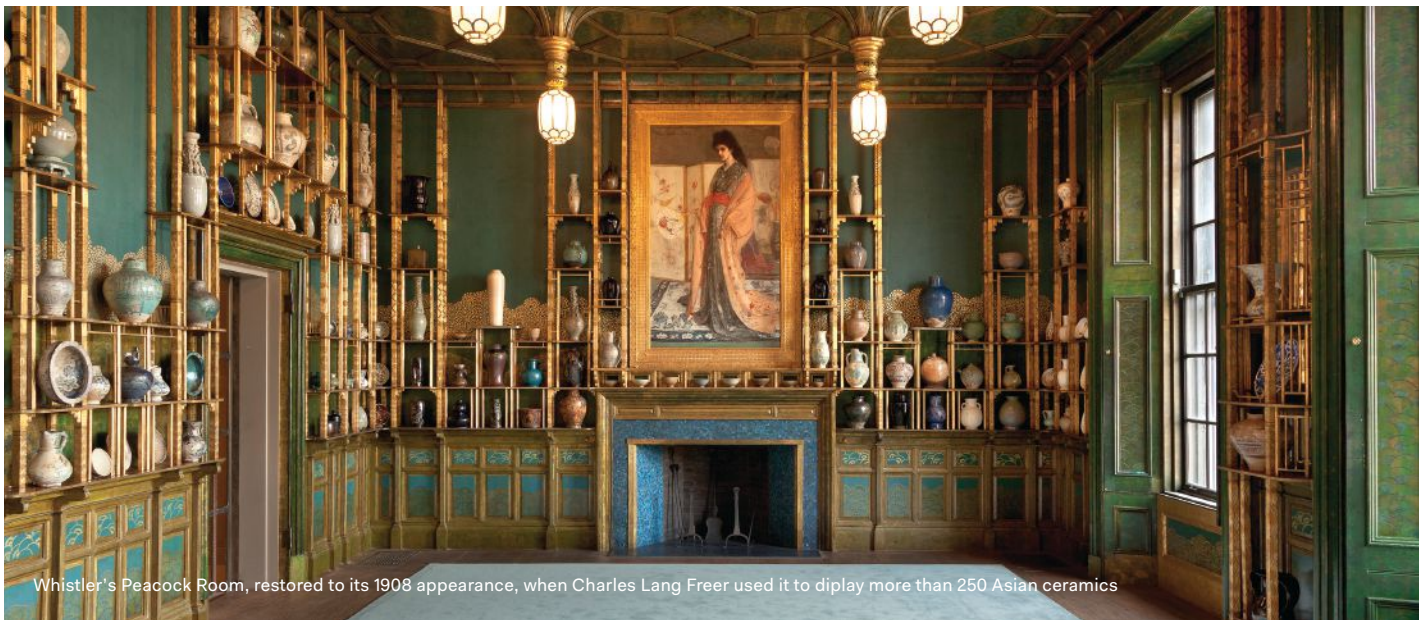
How did this project come about?

I did feel that I was walking on sort of sacred territory to interrogate this perfect and most beloved work of art of Whistler's. I even thought, "Oh, my God, this could just be such a car crash." I mean, I needed to think about how to do this. But also I had to have autonomy. I had to claim this as my own. I'm making a contemporary work of art. I'm not wanting this to be a parody or pastiche.

I had this open invitation from the Massachusetts Museum of Contemporary Art (MASS MoCA) from curator Susan Cross, who has been sort of the guardian angel, the gatekeeper of *Filthy Lucre* from the very beginning. She said, "All right, this is crazy. And yes, we're going to figure this out."

I had been thinking of all the great painted rooms in art history. As a painter, how can I create a work of art that feels like a painting, that you are walking into a painted space? I thought, "Oh, there's the Peacock Room." I had never seen it in person. And I just started to gather all I could about it. I just became so immersed in its history and in these complex relationships that played out in the making of it.

The more I was studying about the particular time in which the room was made, as well as the advent of



Whistler's Peacock Room, restored to its 1908 appearance, when Charles Lang Freer used it to diplay more than 250 Asian ceramics

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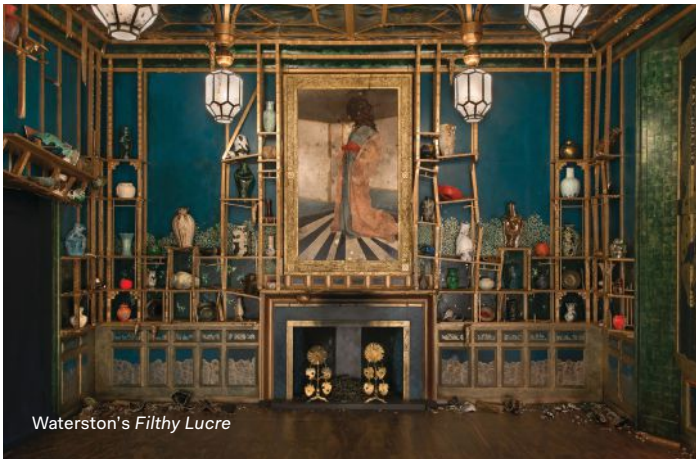
the art market and the dance between the artist and the patron, I thought, "This is my world." I mean, this is the contemporary art world. This is not 1860s, 1870s, 1880s London—it's now. It's the global art economy in all of its machinations and monstrosities, all of it.

Once you got MASS MoCA on board, how did the project unfold?

I'd worked collaboratively before on serious projects, but never at this scale. This is so particular. I had to be accountable for making sure that it was being done responsibly and that we were staying on track with budget, timeline, and resources. I was given a residency at MASS MoCA, so it was built there, and the whole project was managed there by the museum. Many of the key people involved in the making of it—the



Waterston's *Filthy Lucre*

builders, the welders, the craftspeople—were there in the community, and the main people were on the staff of the museum.

What I'm left with in the making of *Filthy Lucre* is really about those relationships. It's funny, it's like the reverse of Whistler's narrative for his Peacock Room, which ended up with a lot of heartbreak and all of these relationships deteriorating. In so many different ways, *Filthy Lucre* did the opposite. There was so much intimacy, closeness, friendship, and devotion to what we were doing.

What was the most challenging thing about the process?

I had this incredible advantage, to be given this breathtakingly beautiful studio space at MASS MoCA; I will never have a studio so gorgeous again, I'm sure. It was a huge, Civil War–era stone building on a river.

Then winter kicked in. The northern Berkshires is just bone chillingly cold. We could not keep the space

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Whistler's Peacock Room (top) as interpreted by Waterston (bottom)

TOP: NEIL GREENTREE, COURTESY FREER GALLERY OF ART, SMITHSONIAN; BOTTOM: JOHN TSANTES

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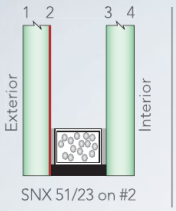

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warm enough. We had a lot of challenges around paint coagulating—not exactly freezing—let alone our cold fingertips.

Then there came another point in the making of it. It was Susan Cross who said to me, "Darren, we're not making a set here, this is not going to be seen from a distance. Every inch of this, not unlike the Peacock Room, is to be contemplated, and we really have to amp up the level of detail and finish and materials."

What were you trying to represent in terms of the different forces at work or the different ideas at play?

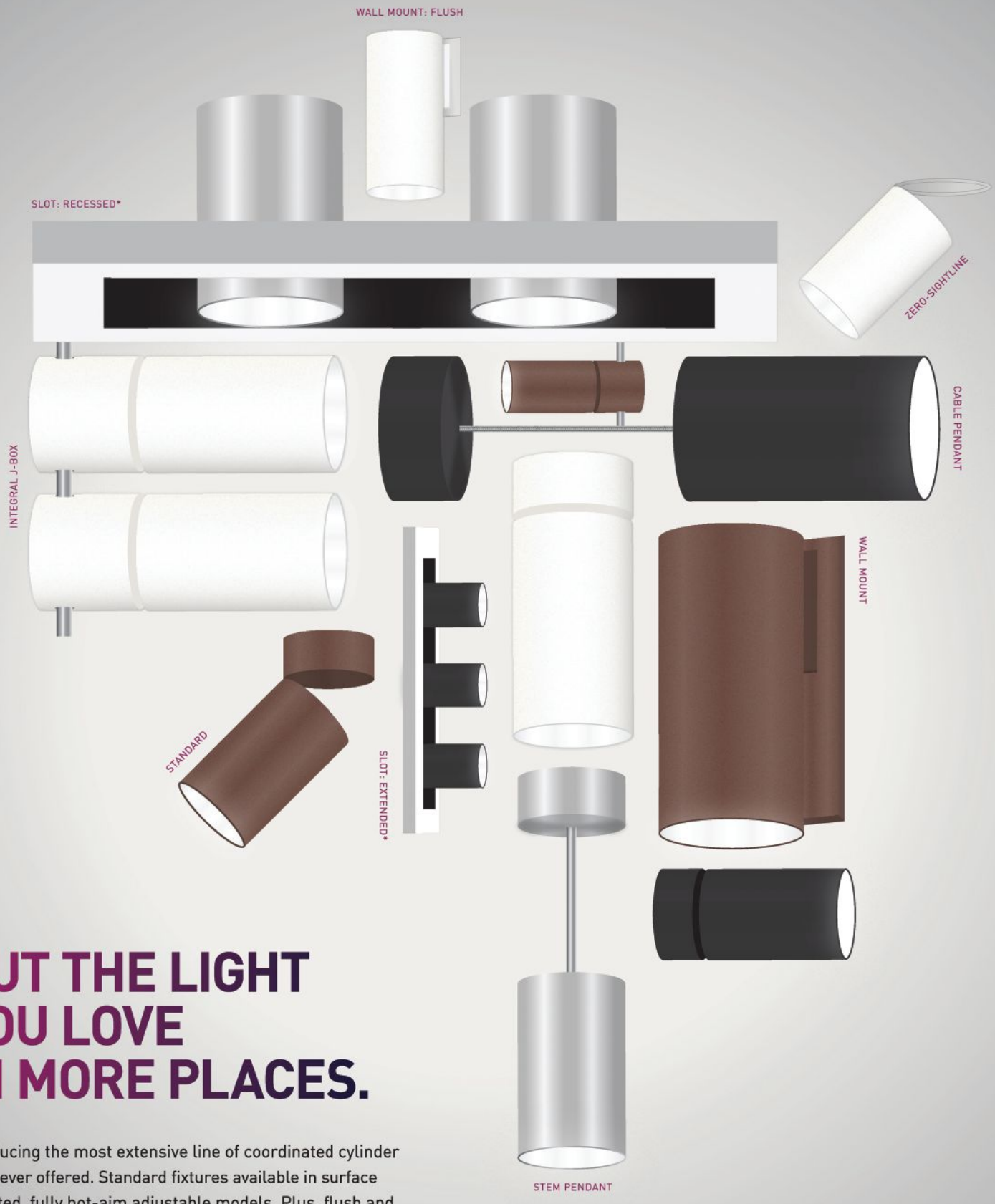
I think I wanted to have it be disorienting in some ways so that it doesn't feel like there's one very specific cataclysmic event that caused all of this, but that it's much more of a surrealist, dreamy mix of natural phenomena. It's trying to evoke a psychological state more than anything else. I feel like that was going to require things seeming as if they're mutating and volatile.

The materiality of it is unstable. The porcelain princess, her head is sort of ballooned into this big bouquet of spores or some sort of lichen, or she's mutating into something else. The representation of the peacocks is they're dismembering each other. The peacocks are literally ripping out each other's guts, but it's all done in this way that's very sumptuous and still under this decorative realm. I didn't want to just paint something that felt in-your-face grotesque; I wanted it to be still incredibly seductive and beautiful, but then as you sort of settle in, you see that there's all these other forces at play.

When did you first get in touch with Smithsonian curator Lee Glazer?

Early on, when I knew I was going to take this project on, I did a total cold call to Glazer. She's so open, so generous. She said, "All right, we've got to talk." In January 2013, I got to meet Lee in the Peacock Room. I walked in there and I thought, "Yes, this is absolutely the right decision to take this on." It was very, very moving to be in there the first time, and it was much more beautiful and much more grotesque than imagined, actually. It's so wrought, so overabundant.

THIS INTERVIEW WAS EDITED FOR CLARITY AND LENGTH.



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EVALUATING THE CARBON FOOTPRINT OF WOOD BUILDINGS

REDUCING GREENHOUSE GASES WITH HIGH-PERFORMANCE STRUCTURES

Presented by: reTHINK WOOD

Architecture 2030 objectives are making many designers pay greater attention to the materials used to construct buildings and the benefits, carbon and otherwise, of using wood from sustainably managed forests instead of products that are fossil fuel-intensive.

LEARNING OBJECTIVES

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

1. Examine the natural cycle of carbon absorption and storage, and the role of forests and wood products in mitigating carbon emissions.
2. Discuss the role of wood products sourced from sustainably managed forests in the design of sustainable, environmentally positive buildings.
3. Explain the low embodied energy of wood products, and how this translates into avoided carbon emissions throughout their life cycles.
4. Compare the carbon benefits of example buildings based on the results of two calculators.

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Worldwide, there has been increasing focus on the carbon footprint of buildings and recognition that design professionals are uniquely positioned to reduce greenhouse gases in the atmosphere by creating high-performance structures.

According to Architecture 2030, which was established more than a decade ago in response to the climate change crisis, buildings are "the problem." The building sector consumes nearly half of all energy produced in the United States, 75 percent of the electricity produced is used to operate buildings, and, in 2010, the building sector was responsible for nearly half of U.S. carbon dioxide (CO_2) emissions. However, buildings also offer a solution. By 2035, approximately 75 percent of the nation's building stock will be either new or renovated (from a 2010 baseline). This transformation offers a significant opportunity to reduce the carbon footprint of the built environment.

Today, energy efficiency—once the new frontier for environmentally conscious designers—is a commonplace objective and net zero energy is well within reach. As a result, greater attention is now being focused on the materials used to construct buildings—and the benefits, carbon and otherwise, of using wood from sustainably managed forests instead of products that are fossil fuel-intensive.

Extensive research, some of it developed in countries where ambitious government policies promoting carbon efficiency are being implemented, and sophisticated new calculation tools are making it possible for architects to evaluate and compare the impacts of different materials on the carbon footprint of buildings. Similarly, there is an increasing number of life cycle assessment (LCA) tools that allow designers to evaluate and compare buildings based on a range of indicators such as air pollution, water pollution, and waste.

CASE STUDY

Photo by Lawrence Anderson, www.lawrenceanderson.net

Volume of wood used:
2.3 million board feet (equivalent)

Carbon stored in the wood:
4,495 metric tons of CO_2

U.S. and Canadian forests grow this much wood in:
16 minutes

Avoided greenhouse gas emissions:
9,554 metric tons of CO_2

Total potential carbon benefit:
14,049 metric tons of CO_2

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Energy to operate a home for 1,194 years

Project: Stella

Location: Marina del Rey, California

Architect: DesignARC

Completed: 2013

Two factors made construction of the four- and five-story Stella unique: the fact that it includes Type IIIA and VA construction on one podium and the use of prefabrication to speed the building process.[1]

Sources: Wood Carbon Calculator for Buildings; *U.S. EPA

This course examines the environmental impacts of wood products—from the global scale of the world's forests to the individual scale of efficient, adaptable, and innovative buildings—using real-world examples from two U.S. carbon calculators as well as the latest research on LCA.

CALCULATING CARBON FOOTPRINT

Much of the information available about the effectiveness of wood products in reducing a building's carbon footprint has been driven by an increasing focus on carbon elsewhere in the world. The European Union, for example, is seeking to reduce carbon emissions by having all new buildings achieve 'nearly net-zero energy' by 2020—i.e., very high energy efficiency where the low amount of energy that is required comes from renewable sources.

In The Netherlands, the 2012 building code requires LCA data to be submitted for each new building, and a total 'environmental shadow cost' must be calculated per square meter of building area in order to get a building permit.

The UK government will require new homes to be 'zero carbon' beginning in 2016, and is considering extending this to all buildings as of 2019.

Other policies go further, explicitly recognizing the benefits of forestry and wood use:

- In the UK, climate change policy includes carbon sequestration via tree planting and forest management, the production of wood fuel as a renewable energy source and the promotion of wood products as a substitute for more carbon intensive materials.
- In France, the government requires that new public buildings have at least 0.2 cubic meters of wood for every 1 square meter of floor area.
- In New Zealand, wood or wood-based products must be considered as the main structural material for new government-funded buildings up to four floors.
- The Japanese government introduced a law requiring wood to be considered as the primary building material for any government-funded project up to three stories, and for any privately funded building used in a public manner such as elderly care facilities.
- In Canada, the governments of British Columbia, Ontario, and Quebec have policies that encourage the use of wood in public buildings.

In the U.S., increasing emphasis on the effects of carbon in the atmosphere has motivated the development of many calculators for various products and activities. Two in particular are commonly used by U.S. architects to understand and compare the carbon impacts of their building designs.

Developed by the U.S. Environmental Protection Agency, the Greenhouse Gas Equivalencies Calculator[2] translates emissions data into recognizable equivalents such as annual greenhouse gas emissions from passenger vehicles or CO_2 emissions from the energy used to operate a home for a year. The second tool, the Wood Carbon Calculator for Buildings,[3] was developed to allow users to calculate the carbon benefits of their wood building projects, including the amount of carbon stored in the wood products, emissions avoided by not using fossil fuel-intensive materials, and amount of time it takes North American forests to grow that volume of wood. It does this in one of two ways:

- If the volume of wood products is known (including lumber, panels, engineered wood, decking, siding, and roofing), the carbon calculator will provide a detailed estimate for that specific building. The more detailed the information, the better the results.

On many public lands, years of fire suppression combined with a 'hands off' approach to management has created overly dense forests with a heightened risk of wildfire—and the resulting massive CO_2 emissions. Active forest management, which includes thinning these forests to reduce the severity of fire when it occurs, protects values such as habitat and recreation while helping to ensure that forests store more carbon than they release. Photo by Weyerhaeuser Company

BY THE NUMBERS

- Every minute, on average, new growth adds more than 50,000 cubic feet of wood to U.S. forests, sequestering approximately 800 million metric tons of CO_2
- In that same average minute, more than 24,000 cubic feet of wood are removed from U.S. forests to build homes, make furniture, and create other products
- 100 cubic feet of wood (absolutely dry) contains: 0.65 metric tons of carbon
- Each year, 10–45 million tons of CO_2 are stored in new wood products

- If volume information is unknown, users can select from a list of common building types and receive an estimate based on typical wood use.

For the more detailed calculation, users enter the nominal volume of wood in a building, and the calculator then performs necessary volume conversions, makes corrections for moisture content, and arrives at a total mass figure of wood contained in the building. The tool then uses that information to estimate the building's carbon benefits.

Both the Greenhouse Gas Equivalencies Calculator and the Wood Carbon Calculator for Buildings were used to generate the equivalencies in this course.

FORESTS ABSORB, STORE, AND RELEASE CARBON

Responsibly managing forests in a way that balances harvesting and replanting, and provides a sustainable source of wood products that continue to store carbon and offset the use of fossil fuels, can significantly reduce the amount of carbon in the atmosphere over the long term.

As trees grow, they clean the air we breathe by absorbing CO_2 from the atmosphere. They release the oxygen (O_2) and incorporate the carbon (C) into their twigs, stems, roots, leaves or needles, and surrounding soil. Young, vigorously growing trees take up carbon dioxide quickly, with the rate slowing as they reach maturity (typically 60–100 years, depending on species and environmental factors). A single tree can absorb as much as 48 pounds of CO_2 per year and sequester up to 1 ton of CO_2 by the time it reaches 40 years old.[4]

As trees mature and then die, they start to decay and slowly release the stored carbon back into the atmosphere. Carbon is also released, but more quickly, when forests succumb to natural hazards such as wildfire, insects or disease.

Growing forests absorb, store, and release carbon over extended periods of time. According to a new report by the Dovetail Partners consulting group, U.S. forests add more than twice as much wood through new growth annually than is removed or lost through natural mortality. As a result, wood volumes contained within the nation's forests have been increasing. Citing research from the U.S. Forest Service, the report states: "The amount of forestland area in the U.S. has been essentially constant since 1900. This reality and a long history of positive net growth (growth in excess of mortality and removals), coupled with improvements in forest management and supported by strong markets for forest products, have resulted in U.S. forests storing more carbon than they release into the atmosphere (i.e., they are a net carbon sink). In fact, scientists estimate that U.S. forests have been a net carbon sink since the early 1900s." The Forest Service estimates that U.S. forests store approximately 67 metric tons of carbon per acre.[6]

These conclusions are echoed in the *National Report on Sustainable Forests–2010*,[7] which states, "Total U.S. forest area, as defined for the purposes of this report, currently amounts to 751 million acres, or about one-third of the nation's total land area. Since the beginning of the past century, the size of this inventory has been relatively stable, and the forests it represents remain largely intact..." In the U.S., forests and forest products store enough carbon each year to offset approximately 10 percent of the nation's total CO_2 emissions.[8]

That said, changing environmental conditions have made the active management of forests critical. For example, wildfire is a natural and inherent part of the forest cycle. Today, however, wildfires must be prevented from burning unchecked because of danger to human life and property. As a result, many forests have become over-mature and overly dense with excess debris, which, combined with more extreme weather, has caused an increase in both the number and severity of wildfires. The combination of older forests and changing climate is also having an impact on insects and disease, causing unprecedented outbreaks such as the mountain pine beetle—which further add to the fire risk.

Active forest management, which includes thinning overly dense forests to reduce the severity of wildfires, helps to ensure that forests store more carbon than they release. Forest management activities aimed at accelerating forest growth also have the potential to increase the amount of carbon absorbed from the atmosphere. The International Panel on Climate Change (IPCC) has stated: "In the long term, a sustainable forest management strategy aimed at maintaining or increasing forest carbon stocks, while producing an annual sustained yield of timber, fibre or energy from the forest, will generate the largest sustained mitigation benefit."[9]

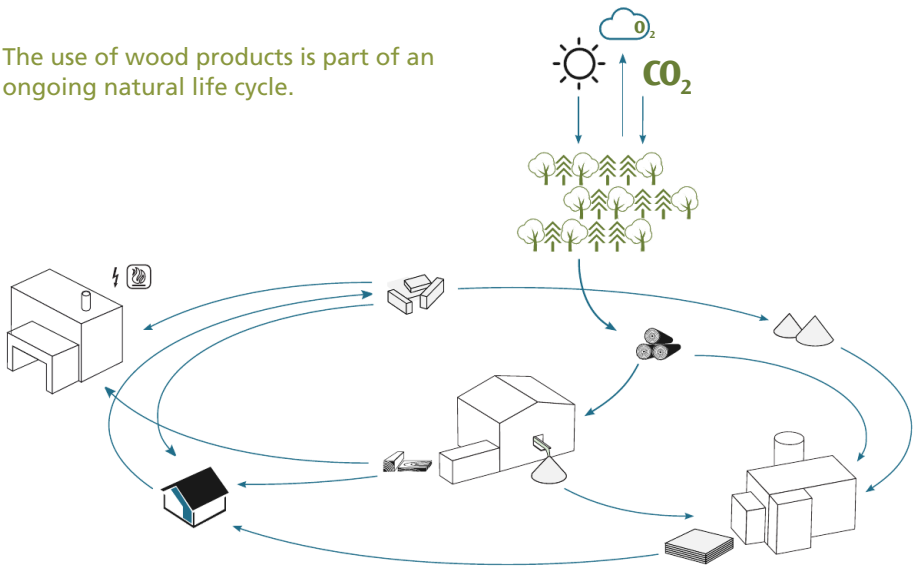
Whether trees are harvested and used for products or decay naturally, the cycle is ongoing, as forests regenerate and young trees once again begin absorbing carbon. But when trees are manufactured into products and used in buildings, a new phase of carbon mitigation begins.

WOOD BUILDINGS STORE CARBON

Wood is comprised of about 50 percent carbon by dry weight.[10] So the wood in a building is

SUSTAINABLE FORESTRY CARBON CYCLE

The use of wood products is part of an ongoing natural life cycle.



Source: Building with Wood—Proactive Climate Protection, Dovetail Partners Inc.

providing physical storage of carbon that would otherwise be emitted back into the atmosphere. For example, according to the Dovetail Partners report, the structure of an average U.S. single-family home stores about 9.3 metric tons of carbon, which is equivalent to 34 tons of CO_2.

In a wood building, the carbon is kept out of the atmosphere for the lifetime of the structure—or longer if the wood is reclaimed and reused or manufactured into other products. Wood stores more carbon than is emitted during its harvest, production, transport, and installation—even when transported over great distances.

As part of its report, Dovetail posits that increasing the use of wood in construction could significantly enhance carbon storage in the nation's building stock. According to the Forest Climate Working Group, a coalition that collaborates on forest carbon strategy and policy recommendations, the current inventory of wood structures in the U.S. is estimated to store 1.5 billion metric tons of carbon, which is equivalent to 5.4 billion tons of CO_2. Most of this resides in the nation's housing stock, about 80 percent of which is wood-frame construction. Increasing wood use to the maximum extent feasible in multi-family housing, low-rise non-residential construction, and remodeling could result in a carbon benefit equal to about 21 million metric tons of CO_2 annually—the equivalent of taking 4.4 million cars off the road indefinitely.

This article continues on http://go.hw.net/AR1115Course1. Go online to read the rest of the article and complete the corresponding quiz for credit.

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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/CEU

QUIZ

1. According to Architecture 2030, buildings offer a climate change solution because:
   - a. Passive house technology is becoming more advanced in North America.
   - b. Architects and engineers are designing more mid-rise, multi-family buildings instead of single-family homes.
   - c. By 2035, approximately 75 percent of the nation's building stock will be new or renovated and this transformation offers a significant opportunity to reduce the carbon footprint of the built environment.
   - d. Buildings are now being designed to last 100 years or more.

2. The calculations in the example buildings in the course estimated which carbon benefits?
   - a. The amount of carbon permanently stored in the wood products.
   - b. Fossil fuel emissions avoided by not using steel or concrete.
   - c. The amount of time it takes North American forests to grow the volume of wood in the building.
   - d. All of the above

3. All of the following statements about the forest carbon cycle are true except:
   - a. Young, vigorously growing trees take up carbon dioxide quickly, with the rate slowing as they reach maturity.
   - b. As trees mature and then die, they start to decay and slowly release the stored carbon into the atmosphere.
   - c. Wildfires, insect infestations, and the presence of excess decaying debris in forests have all decreased in recent years, so less management of forests is necessary.
   - d. Carbon is released quickly when forests succumb to hazards such as wildfire, insects or disease.

4. True or False: Forests in the U.S. and Canada sequester high amounts of carbon. In the U.S., forests and forest products store enough carbon each year to offset approximately 10 percent of the nation's total CO_2 emissions.

5. A product's embodied energy refers to:
   - a. the percentage of wood in a tree that is carbon.
   - b. the amount of energy that would be released if the product was burned.
   - c. the product's measured carbon content as opposed to its estimated carbon content.
   - d. the energy required to harvest, manufacture, transport, install, maintain, and dispose or recycle a material.

6. On average, North American wood producers use what percentage of every tree brought to the mill for processing?
   - a. 10 percent
   - b. 25 percent
   - c. 50 percent
   - d. 99 percent

7. Which of these statements best characterizes the energy used for manufacturing of wood?
   - a. Wood is manufactured using very high temperatures requiring large amounts of fossil fuel.
   - b. Most of the energy used to manufacture wood comes from converting residual bark and sawdust to electrical and thermal energy, requiring minimal additional fossil fuel energy.
   - c. Manufacturing wood products requires about the same fossil fuel energy as steel, concrete, or glass products.
   - d. Manufacturing wood products requires more fossil fuel energy than plastic products.

8. Wood buildings keep carbon out of the atmosphere in what way?
   - a. The wood in a building is providing physical storage of carbon that would otherwise be emitted back into the atmosphere.
   - b. Life cycle assessment (LCA) studies show that wood performs better than other materials in terms of embodied energy.
   - c. The use of wood offsets the need for other energy-intensive materials and fossil fuels.
   - d. All of the above

9. The embodied energy implications of material disposal are important considerations in sustainable design because studies show that North American buildings often have a service life of:
   - a. less than 50 years, regardless of material, because of changing needs or increasing land values.
   - b. over 200 years.
   - c. less than 25 years, if poorly insulated.
   - d. 25 to 100 years, precisely correlated to material and type of construction.

10. Which of the following statements best describe the role of wood materials in energy-efficient buildings such as Passive House and net-zero-energy designs?
    - a. Wood is an attractive material for these designs because it combines thermal mass, water resistance, structural integrity, and finish quality.
    - b. New prefabricated wood building systems for low energy designs have been developed offering greater air tightness, less conductivity and more thermal mass.
    - c. Wood materials are only used in low-energy designs for trim and finishes to add to the occupant satisfaction; they are not considered relevant to the energy use of the building.
    - d. Both a and b are true, but not c.
    - e. Both b and c are true, but not a.

USING CONCRETE AS A SUSTAINABLE SOLUTION FOR BUILDINGS

Presented by:
PCA
America's Cement Manufacturers™

LEARNING OBJECTIVES

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

1. List the five main components in concrete mix design and understand their relative impacts on performance and the environment.
2. Calculate the mix design options to achieve optimal carbon footprint reductions and performance criteria.
3. Discuss concrete's inherent attributes of strength and durability in the face of natural disaster.
4. Learn how concrete contributes to thermal and acoustic comfort for building occupants.

CONTINUING EDUCATION

CREDIT: 1 LU

COURSE NUMBER: ARnov2015.2

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

Visit http://go.hw.net/AR1115Course2 to read more and complete the quiz for credit.

By David Shepherd, AIA, LEED AP

The sustainable-design movement is evolving from checking boxes in credit templates to holistic design. And in the search for holistic sustainable solutions, designers are seeking new insight through life cycle analysis and building modeling to evaluate a project's impacts over its entire life. Certain attributes of sustainable buildings become increasingly important, such as:

- Energy
- Durability and resilience
- Reduced material manufacturing impacts
- Operational impact improvements
- Comfort—HVAC, noise, emissions

This article will update readers on steps the cement and concrete industries are taking to evaluate and reduce their environmental impact. It will also offer designers insight on how to increase sustainable performance on their projects through optimization of concrete applications in sustainable building. And to support this, the cement and concrete industry is developing detailed information to inform designers about the environmental impacts of their product choices.

EMBRACING TRANSPARENCY

The cement and concrete industry has embraced environmental transparency for some time, publishing its first industry-average LCA in 2000. Since then, the concrete industry has advanced its self-evaluation of environmental hot spots in its processes, and graduated to developing product category rules (PCR) and environmental product declarations (EPDs).

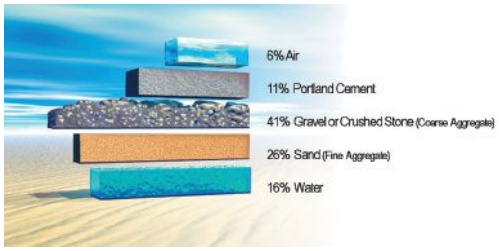
The Carbon Leadership Forum (CLF) at the University of Washington released a U.S.-specific PCR for ready mixed concrete in November 2012, which was revised in December 2013.[1] In February 2013, the World Business Council for Sustainable Development (WBCSD) also announced the development of a PCR for unreinforced concrete.[2]

Other concrete-related industry PCRs that have been published recently include:

- Slag Cement, published in August 2014[3],
- Portland, blended hydraulic, masonry, mortar, and plastic (stucco) cements, published in September 2014[4], and
- Manufactured Concrete and Concrete Masonry Products, published by ASTM in December 2014[5].

An industry-average environmental product declaration for ready mixed concrete was published by the National Ready-Mixed Concrete Association (NRMCA) in October 2014. NRMCA's *Industry-Wide Environmental Product Declaration (EPD) and Benchmark Report*[6] discloses average environmental impacts for concrete. These data are for concretes of varying strengths, uses, and mixture proportions. Several companies have also published EPDs for individual concrete-related products. Similarly, the U.S. cement industry expects to publish an industry average EPD for the most commonly used kinds of cement at the start of 2016.

FUNDAMENTAL CONCRETE COMPONENTS



To understand how the cement and concrete industries can reduce their collective environmental footprint, it is important to understand the components of concrete-related products. A unique attribute of concrete as a construction material is the ability to modify the proportion of ingredients in the mix design through specifications to achieve specific goals for the intended application. Concrete is primarily a mixture of two main components: aggregates and a binding paste. The paste is comprised of portland cement and water, which can be modified with supplementary cementitious materials and admixtures for achieving specific construction, structural and environmental characteristics. (See Sidebar—Mix Design Optimization) The paste can also contain entrapped or purposely entrained air. The aggregates are typically locally sourced sand, gravel and/or crushed stone.

PORTLAND CEMENT

Cement, which is typically 7 to 15% of the volume of concrete, provides the primary engineering and durability properties of concrete.

Portland cement is produced in a rotary kiln from a precise blend of constituents. The most common combination of ingredients is limestone (for calcium) along with much smaller quantities of clay, iron ore and sand (as sources of alumina, iron and silica, respectively). Increasingly, alternative sources from industry by-products (steel mill slag and scale, foundry sands, or bottom ash from coal fired power plants) can provide the essential elements for cement production.

The materials are heated to temperatures around 2700 degrees Fahrenheit (1500 degrees Celsius) to chemically transform the raw materials into clinker as it passes through the rotary kiln. After the clinker has cooled, it is very finely ground with gypsum, limestone, and minute amounts of other constituents to form portland cement.

Figure 1–Limestone, silica, alumina and iron chemically combine to form clinker in the rotary kiln of a cement plant.

Cement-plant carbon-dioxide emissions come from two sources: combustion and calcination. Combustion accounts for approximately 40% of the total CO_2 emissions from a cement manufacturing facility. The remaining 60% CO_2 emissions from calcining are formed when the raw material (limestone) is heated and CO_2 is stripped from the calcium carbonate molecules. This reaction enables the chemical formation with the other ingredients to achieve the hydraulic properties of portland cement. According to the U.S. EPA, 2013 U.S. greenhouse gas emissions totaled 6,673 million metric tons of carbon dioxide equivalents (CO_2e). Production of cement accounted for approximately 75.44 million metric tons of CO_2e or 1.1% of the U.S. national total.

The kiln's combustion-generated CO_2 emissions are directly related to fuel use. Some of this energy comes from traditional sources, but over 73% of U.S. plants reporting in the 2013 PCA Labor-Energy Survey reported utilizing alternative fuels. Many plants use between 20 to 70% of alternative fuels for their energy requirement. Alternative fuels include waste oil, solvents, resins, scrap tires, refinery wastes, and other wastes that have high energy content. Cement kilns are one of the few options where these wastes can be safely and efficiently disposed, because of the high temperature in the kiln and the length of time exposed to this level of heat. The EPA has designated thermal destruction by energy recovery in cement kilns as the Best Demonstrated Available Technology (BDAT) for treatment of these wastes.

ENERGY RECOVERY FROM WASTE

Figure 2–Whole steel belted tires feed into a cement kiln for energy recovery and solid waste reduction.

The EPA recognizes tire derived fuel as a Best Management Practice and encourages industries to recover the energy from this waste stream while offering the added benefit of reducing the landfill for scrap tires. Tire derived fuel (TDF) has approximately 20% more BTUs than a comparable weight of coal, and since tires are manufactured in part with natural latex which literally grows in trees, TDF has a lower greenhouse gas impact than coal. The steel reinforcing belts in a tire are a recycled material source for some of the iron needed in cement production. The use of tires as fuel can actually reduce certain emissions in cement production.[7] The Rubber Manufacturers Association reports in 2013 an estimated 44,300,000 scrap tires were diverted from landfills for energy recovery in cement kilns.[8]

SUPPLEMENTARY CEMENTITIOUS MATERIALS

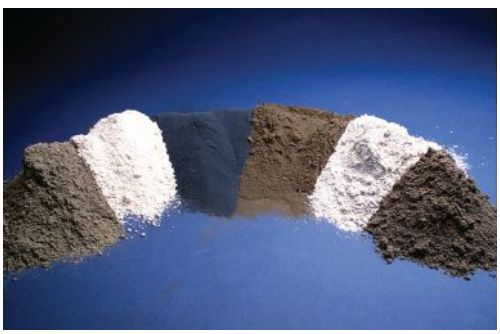


Figure 3–Fly-ash, slag and silica fume offer environmental and performance benefits when optimally combined with portland cement in concrete mix designs.

Supplementary cementitious materials (SCMs) such as fly ash, slag, and silica fume are industrial by-products which offer both environmental and performance benefits for concrete production. Fly ash is a residual from the combustion of pulverized coal in electric power generating plants. Slag cement is created from iron blast-furnace slag, a by-product of the steel-making industry. Silica fume is a waste created from the electric arc furnace used in the production of silicon or ferrosilicon alloy. In their 2014 Industry Wide EPD for Concrete, the ready mixed concrete industry reported that 95% of their plants use SCMs in their concrete products.

The intelligent use of SCMs can reduce the environmental footprint and contribute beneficially to the fresh and hardened properties of concrete. It is important to consider the impact on the properties of the concrete when determining the optimum amount of SCMs in a concrete mixture, which can affect water demand, curing times, durability, aesthetics, and other factors. Typical SCM proportions range from 15 to 40% of a mix design (by mass) and their use is also influenced by the local availability of these materials.

Aggregate

Aggregates, constituting 60 to 75% of concrete by volume, are customarily sand, gravel, or crushed stone which are typically locally sourced, naturally occurring, with low embodied energy. A typical sand or aggregate quarry is considered relatively shallow and small in scale, closely contained and monitored compared to most mining operations. When closed, aggregate quarries are often converted to their natural state, or into recreational areas, or agricultural uses.

Figure 4–Part of the 6 million tons of recycled concrete generated from runways, taxiways and structures at Denver's Stapleton Airport—image courtesy of RMCI

Recycled concrete from demolished buildings and pavements and reclaimed aggregate from concrete production and can be used to replace a portion of new aggregate in concrete, particularly the coarse portion. In a 2008 report, Federal Highway Administration noted that eleven states currently use recycled concrete aggregate in new concrete.[9] These states report that concrete containing recycled aggregate can perform equal to concrete containing natural aggregates. Applications such as foundation slabs and insulated concrete form walls are also well suited for recycled aggregate incorporation.

To conserve natural resources, the use of marginal aggregates in concrete is becoming more common. Some natural aggregates may react to the alkalinity of the cement paste, contain organic impurities or other chemicals which can be detrimental to durable concrete. Judicious mix design can accommodate some reactive aggregates with careful selection of cementitious materials (cements and SCMs) and appropriate testing.

Alternative aggregates are also available from industrial by-products, such as blast furnace slag aggregate, simultaneously reducing use of virgin resources and land-filled waste materials. Blast furnace slag is a lightweight aggregate derived from industrial waste with a century long history of beneficial use in the concrete industry.

Water

Water is essential to the hydration of cement in concrete. Almost any water suitable for drinking is acceptable for use in concrete. To improve water conservation, recently approved practices in concrete production include replacing of some of the potable water with water reclaimed from previous concrete production, industrial processes and other water sources typically not used for human consumption.

Admixtures

Chemical admixtures enhance the plastic and hardened properties of the concrete. Admixtures typically do not significantly affect the environment impact because they are used in such small quantities. Dosage rates are typically in the range of 0.005 to 0.2% of the concrete mass. They are primarily used to provide air entrainment, control set times, and improve workability in fresh concrete. When used in concrete for improved hardened properties, they can increase compressive strength, reduce shrinkage, and lower permeability. This can result in greater durability and longevity with a corresponding conservation of material resources and related environmental impacts.

MIX DESIGN OPTIMIZATION

With cement contributing a significant portion of concrete's environmental impact, a common specification strategy is to reduce the cement content of a mix design to the lowest possible level. This is often done in conjunction with increased percentages of supplemental cementitious materials, with the caveat that this can result in positive or negative performance consequences with the recognition that cement provides the primary engineering and durability properties of concrete.

Contrary to the strategy above, high percentage cement mix designs can be a solution for a lower carbon footprint in some applications. The use of high strength concrete for certain design elements can result in a significant reduction of cross section, may eliminate the need for multiple elements or may provide significantly longer service life.

Consider this simplified example of a forty story building with a floor plate supported by with sixteen columns (15' floor to floor height) per floor. Utilizing a 4,000 psi mix design (with 440 lbs of cement /cu. yard) requires columns with a cross sectional dimension of 36" x 36". Raising the cement content to 856 lbs /cu. yard yields a compressive strength of 9,000 psi. The column cross sectional area is reduced to 24" x 24".

	4,000 psi Concrete	9,000 psi Concrete
Total Cementitious Materials in lbs per cu. yd.	550	865
Supplementary Cementitious in lbs. per cu. yd.	110 (flyash)	40 (silica fume)
Portland cement in lb per cu. yd.	440	825
Column cross section in inches.	36 by 36.	24 by 24
Concrete per column (15 ft) in yd.	5.00	2.22
Portland cement per column in lbs.	2200 lbs	1833 lbs
Volume of cement reduction		**16%**
Volume aggregate reduction		**55%**

This results in a 16% net reduction for cement and a 55% reduction for aggregates, lowering the greenhouse gas footprint for these elements as well as providing an increase in net rentable floor area of 3120 s.f.

CHARACTERISTICS OF SUSTAINABLE BUILDINGS

As we've become more knowledgeable and experienced in sustainability, we've come to expect more from our buildings and the products from which they are constructed. Concrete has certain inherent properties that aid in creating more-sustainable buildings such as:

- Durability and resiliency
- Heat island mitigation

- Stormwater management
- Thermal mass
- Low or no volatile organic compounds
- Recyclable
- Local availability
- Sound attenuation

Durability

In determining the real value of a building, one must consider both the impacts over the entire life cycle of the project. Extracting optimal value from any material invested in a building demands durable products, design details and construction practices. Determining the impacts of material production is becoming more common as manufacturers publish data through EPDs. A key factor in building reuse and adaptability is the durability of the original structure and components. Structures require different types of durability depending on the intended use, environmental exposure and desired engineering properties.

Concrete components provide a long service life due to their durable and low-maintenance surfaces. Concrete can resist weathering action, chemical attack, moisture and abrasion while maintaining desired engineering properties. These characteristics of concrete make it sustainable in multiple ways: it avoids contributing solid waste to landfills, it reduces the depletion of natural resources, and the generation of air, water and solid waste from replacement materials. When properly designed, concrete structures can be reused or repurposed several times in the future.

Figure 5–Built in 1933, the Rainbow Bridge spanning the Payette River in Idaho remains in service today and is listed in the national historic register. Photo from Idaho Dept. of Transportation

Visit http://go.hw.net/AR1115Course2 to read more and complete the quiz for credit.

QUIZ

1. Where does the CO_2 originate in the cement manufacturing process?
   a. Fuel combustion in the kiln
   b. Calcination
   c. Both a and b
   d. None of the above

2. What volume of concrete is cement?
   a. 7 to 15%
   b. 15 to 30%
   c. 30 to 60%
   d. 60 to 80%

3. According to the EPA, 2013 cement plant greenhouse gas emissions were what percentage of the nation's total emissions?
   a. .36%
   b. 1.1%
   c. 5%
   d. 10%

4. What percentage of alternative fuels do cement plants use for their energy?
   a. 5 to 10%
   b. 10 to 20%
   c. 20 to 70%
   d. 70 to 100%

5. True or false: Fly ash is a by-product of steel manufacturing.
   a. True
   b. False

6. What federal agency recognizes the durability of concrete by promoting concrete safe rooms for providing occupant protection from natural disasters?
   a. Public Health Service
   b. Federal Emergency Management Agency (FEMA)
   c. U.S. Fire Administration
   d. Transportation Security Administration

7. What is the solar reflectance value (SRI) of new concrete without added pigments?
   a. >19
   b. >29
   c. >32
   d. >78

8. How does one take into account the thermal mass benefits when modeling energy performance of a building?
   a. Account for hourly heat transfer on an annual basis
   b. Account for hourly heat transfer on an hourly basis
   c. Account for annual heat transfer on an annual basis
   d. Account for annual heat transfer on an hourly basis

9. What component of concrete is the greatest by mass?
   a. Aggregate
   b. Cement
   c. Water
   d. Admixtures

10. Increased outdoor temperatures due to the urban heat island effect, have been linked to what?
    a. Greater air-conditioning loads
    b. Reduced outdoor air quality
    c. Increased cases of asthma
    d. All of the above

SPONSOR INFORMATION

PCA
America's Cement Manufacturers™

PCA represents America's cement manufacturers and has been a widely-recognized authority on the technology, economics, and applications of cement and concrete for nearly 100 years. PCA is a vocal advocate for sustainability, economic growth, sound infrastructure investment, and overall innovation and excellence in construction. More information on PCA is available at www.cement.org.

CONSERVING WATER

THROUGH THE LATEST UPDATES TO HIGH-EFFICIENCY PLUMBING FIXTURES IN COMMERCIAL RESTROOMS

Presented by:

SLOAN
Water Connects Us®

Photo courtesy of Sloan Global Holdings, LLC

LEARNING OBJECTIVES

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

1. Discuss the importance of water conservation and how very low-flow/high-efficiency toilet systems can aid in these efforts.
2. Review the technology behind hybrid urinals and how this product can contribute to water conservation.
3. Examine a study that explored how a reduction in water consumption impacts drain lines and the plumbing system as a whole.
4. Identify changes in LEED v4 related to water efficiency.

CONTINUING EDUCATION

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

COURSE NUMBER: ARnov2015.3

Use the learning objectives above to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit http://go.hw.net/AR1115Course3 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 IMPORTANCE OF WATER CONSERVATION

All the water that is currently on the Earth is all the water that we will ever have. The Earth's water is used and reused constantly in a never-ending cycle. As our population grows, and increasing water demands tax the limited supply of this precious resource, it is clear that conservation is an essential part of our existing and future water needs.

Water scarcity is a pressing issue for communities, urban planners, developers and others, particularly in arid regions and metropolitan areas across the U.S. In the years to come, even those who currently reside in areas with more abundant water resources will find that they, too, cannot afford to ignore their responsibilities in using water more wisely.

Plumbing Fixtures and Water Consumption

From product standards to model plumbing codes, plumbing fixtures are generally assumed to need water to function. For years, water closets and urinals were designed without a lot of forethought about the amount of water that was needed to remove both solid and liquid waste. They were designed to use as much water as needed to get the job done. These plumbing fixtures were always considered water-consuming fixtures by both the product standards and the plumbing codes. This water consumption was represented in a gallons per flush (gpf) or liters per flush (Lpf) consumption rate.

EPAct Leads the Way in Water Conservation

Recently the growing demand for water conservation has been driving flush volumes ever lower. The Federal Policy Act of 1992 (EPAct), scarce water supply, environmental awareness, social awareness of the value of water, LEED and other green building programs, and various state and local initiatives have all led to substantial reductions in water use for various plumbing fittings and fixtures. Plumbing

High-efficiency toilets moved from 1.6 gpf to 1.28 gpf, then dual-flush fixtures with 1.6/1.1 gpf were created. Photo courtesy of Sloan Global Holdings, LLC

Over the past 24 years, due to the EPAct, the consumption rates of various plumbing fixtures and fittings have reduced significantly, sometimes by as much as 80%. Image courtesy of Sloan Global Holdings, LLC

A 1.1 gpf flushometer is only recommended in new construction installations or those where sufficient drain line carry can be assured. Alternatives include 1.28 gpf or 1.6 gpf flushometers. Photo courtesy of Sloan Global Holdings, LLC

manufacturers have responded with a wide array of products that perform equal to or better than inefficient older products.

The flush volume of toilets has improved steadily from the 1950s when it took 7 gallons per flush! Over the past 24 years, due to the EPAct, the consumption rates of various plumbing fixtures and fittings have reduced significantly, sometimes by as much as 80%. These fixtures are now referred to as High-Efficiency Toilets (HETs) and High-Efficiency Urinals (HEUs). During this time period there have been many water saving innovations that are still widely used, despite even newer technologies and stricter standards. High-efficiency toilets moved from 1.6 gpf to 1.28 gpf, then dual-flush fixtures with 1.6/1.1 gpf were created. Flush volume for urinals has steadily decreased from 3 gpf to 1.5, 1.0, 0.5, 0.25, and then 0.125.

All of these flush volumes are still viable options, but the latest in the evolution of water savings technology are 1.1 gpf toilet systems, hybrid urinals with water-free technology, and reclaimed water flushometers.

1.1 GPF TOILETS

In 1992, the EPAct reduced the water use in plumbing fixtures at the national level to 1.6 gpf for toilets, which sparked a debate regarding drain line transport efficacy. This debate continues today as the plumbing market transitions towards 1.28 gpf toilets, and continues to push the envelope by reducing consumption levels to a new threshold of 1.1 gpf. 1.1 gpf toilet systems combine a vitreous china toilet fixture with either a manual or sensor-operated high-efficiency 1.1 gpf flushometer.

The new combinations provide consistent, reliable performance designed to help architects, engineers, contractors, and building owners achieve their goals of reducing water consumption while maintaining performance expectations. These new toilet systems are an extremely water efficient product, using 14% less water than the 1.28 gpf, and 31% less than the 1.6 gpf, which is the current EPA standard. Furthermore, these max-efficiency plumbing products can contribute to LEED® credits for water use reduction.

At 1.1 gpf, it is more important than ever that the flushometer and the fixture work in harmony to deliver the evacuation performance and drain line carry that is necessary. That being said, while 1.1 gpf can be met, 1.28 gpf is becoming the norm and is still the fastest growing flush volume. But, the pressure to go lower is real due to the need for water savings, especially in certain regions of the country such as California's executive mandate of 25% water reduction.

1.1 gpf Fixture Options

With 1.1 gpf toilet systems there are typically three mounting options and three water efficient flushometer options. The mounting options include floor mount, floor mount ADA, and wall hung. The flushometer options are solar/battery combination, battery only, and manual. Solar powered HET flushometers and HET water closets utilize solar panels with battery backup to help power the flushometer, which effectively doubles the battery life, making it the most energy efficient solution. These flushometers include an override button for manual use. Electronic HET flushometers and HET water closets deliver battery-powered, sensor-activated, hands-free operation for optimal hygiene and reliable performance while delivering significant water savings. These flushometers also include an override button for manual use. Finally, there are manual HET flushometers and HET water closets.

Using 1.1 gpf Fixtures in New Construction

Regardless of which HET is chosen however, the best case scenario is achieved when the flushometer and fixture are optimized to work together in order to guarantee the maximum performance in a wide variety of building environments. For that reason, flushometers and vitreous china fixtures are often sold as packaged products from many manufacturers, and professionals need to choose which approach best suits their needs. It's not all about cost; performance is a key issue, especially in light of lower flush volumes.

In fact, a 1.1 gpf flushometer is only recommended in new construction installations or those where sufficient drain line carry can

Waterfree Urinal

Conventional Urinal

Hybrid Urinal

be assured. Alternatives include 1.28 gpf or 1.6 gpf flushometers. New construction has the advantage of starting with the latest flushing technologies and drain lines, and HETs are natural choices for both performance and water savings. Plumbing retrofit and renovation decisions are more difficult for existing buildings, however.

Existing facilities that want to reduce water consumption by moving to HETs, yet still have the older 3.5 gpf water closets, have little choice but to completely change out their fixtures and fittings. In that case, the decision comes down to: would a 1.28 gpf, 1.1 gpf or a 1.6/1.1 gpf dual-flush system work best? In many cases providing a dual-flush system using 1.6 for solid and 1.1 for liquid waste provides the best combination of performance and water savings. When making plumbing upgrades, it is important to factor in both the age of the building and the condition of the drains.

HYBRID URINALS CONTRIBUTE TO WATER CONSERVATION

A discussion about water closet fixtures wouldn't be complete without talking about urinals in commercial men's restrooms. Since their introduction, water-free and 0.125 gpf high-efficiency urinals have helped save thousands of gallons of fresh water every year with each installation. When properly maintained, these fixtures provide efficient removal of liquid waste with no odor or clogs.

0.125 gpf has become standard for saving water but some negative perceptions have been created that these fixtures create excessive odor, that trapway and drain lines continue to clog with calcite, and that there is not enough water to be hygienic. High levels of bacteria do cause foul odors, but bacteria require water to survive and reproduce. The primary root cause of these issues is marginal flush volume and flow.

The challenge is, however, that improper or infrequent maintenance can lead to the buildup of solids in the drain line, which leads to reduced flow and bad-smelling restrooms. As a result, many building owners are not satisfied and believe that these high-efficiency urinals don't live up to expectations.

Urinal Maintenance

Both conventional and water-free urinals form different types of biosolid buildup that cause backups and odor, resulting in an unpleasant experience for users and maintenance personnel alike. When urine is mixed with flush water in conventional urinals, a hard substance known as 'calcite' builds up in the trapway and pipe walls, causing blockages over time. Calcite is an extremely hard substance and is very difficult to remove, requiring a mechanical auger.

Without flush water, urine forms a soft, water-soluble biosolid substance known as 'struvite' that collects in pipes and can also cause blockages over time. Because struvite is water soluble it can be easily rinsed away with just water and a brush, but it is often overlooked by maintenance personnel and causes clogging.

The root causes of struvite build-up are:

- Lack of rinsing during cartridge change
  - Unaware of need to rinse
  - Unpleasant task
  - Inconvenient or lack of supply of water
- Improper installation/drainage
  - Poorly pitched drain nipple
- Downward slippage of bracket/urinal
- Inadequate supplemental flow
  - Lack of upstream water fixture such as lavatory or closet

HYBRID URINAL SUPPLEMENTAL WATER TECHNOLOGY

However, multiple studies have found that when urinals are connected to a main horizontal drain line shared by other fixtures such as sinks, toilets, and showers, the rate of solid buildup is dramatically reduced by the "supplemental water" that flows through the drain between uses. There is a new hybrid technology that harnesses these key findings to create the perfect blend of both conventional flushing urinals and efficient water-free urinals.

The technology creates a robust source of supplemental water and automatically injects it

Every 72 hours, the system automatically purges the housing and pipes, rinsing them thoroughly to prevent the buildup of sediment. Image courtesy of Sloan Global Holdings, LLC

into the drain line, right where buildup begins to cause the most trouble. The water injection is pre-programmed on a timer and eliminates the need to clean the line. The volume and location of the water injection prevent the formation of calcite and easily remove any small amounts of struvite forming in the drain line.

Hybrid urinals can be used for a wide range of applications, from healthcare facilities, schools, and universities to stadiums, transportation terminals, and office buildings.

Here are some additional benefits of hybrid urinals:

- Water-free operation that provides the maximum LEED credits available, saving tens of thousands of gallons of water every year.
- No more traditional "bucket dumps" of soapy water or unpleasant manual bottle brush drain cleaning during cartridge changes.
- Elimination of clogging due to struvite buildup.
- Odor-free operation.
- Maximum cartridge life from elimination of unnecessary changes.

Industry standards provide the necessary requirements and testing criteria to ensure that plumbing fixtures are safe, sanitary and adequate for use in any properly installed plumbing system. Photo courtesy of Sloan Global Holdings, LLC

QUIZ

1. Water consumption is represented in what unit of measurement?
   a. Gallons per flush (gpf)
   b. Volume per flush (vpf)

2. In 1992, the EPAct reduced the water use in plumbing fixtures at the national level to _____ gpf for toilets.
   a. 1.28
   b. 1.1
   c. 1.6

3. True or False: A 1.1 gpf flushometer is only recommended in new construction installations or those where sufficient drain line carry can be assured.

4. 1.1 gpf toilet systems are an extremely water efficient product, using _____ less water than the 1.28 gpf, and _____ less than the 1.6 gpf product.
   a. 14%, 31%
   b. 1%, 5%
   c. 10%, 50%

5. What is the latest technology in high-efficiency urinals?
   a. 1.1 gpf
   b. Water-free hybrid
   c. 0.125 gpf

6. Which of the following is a very hard substance that builds up in trapway and pipe walls, causing blockages over time?
   a. Struvite
   b. Calcite

7. True or False: In a hybrid urinal, the system automatically purges the housing and pipes every 72 hours, rinsing them thoroughly to prevent the buildup of sediment.

8. Which of the following plumbing fixture standards applies to vitreous china non-water urinals?
   a. ASME A112.19.2
   b. ANSI/ASME A112.19.19

9. Which of the following was studied by the Plumbing Efficiency Research Coalition?
   a. Slope
   b. Flush volume
   c. Toilet paper
   d. All of the above

10. True or False: In LEED v4, the prerequisite threshold for Indoor Water Use Reduction is 20%.

SPONSOR INFORMATION

SLOAN.
Water Connects Us®

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How the Cartridge Technology Works

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This article continues on http://go.hw.net/AR1115Course3. Go online to read the rest of the article and complete the corresponding quiz for credit.

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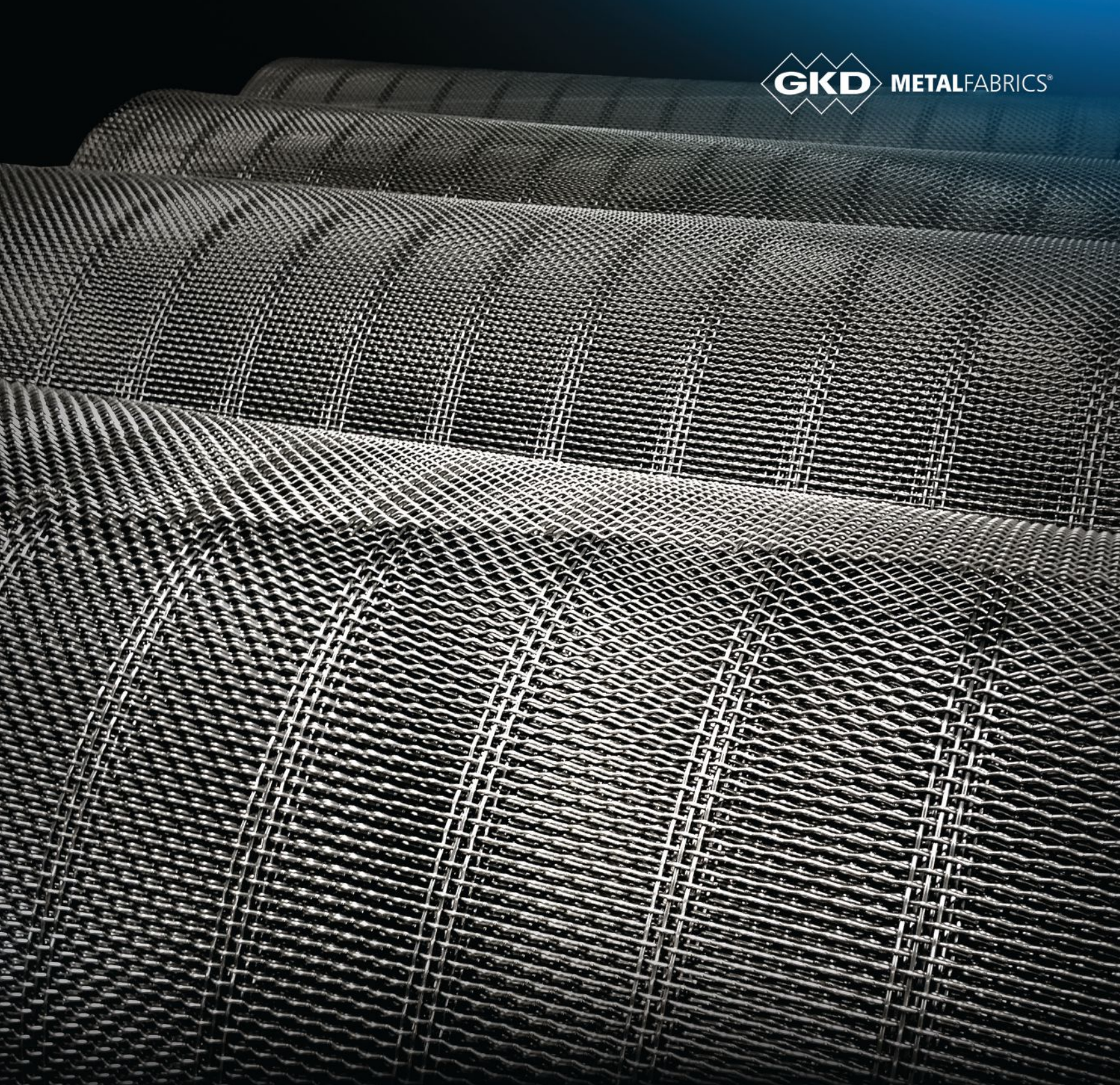

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Tall Buildings

The world's first skyscraper, architect William LeBaron Jenney's Home Insurance Building in Chicago, rose 10 stories and 138 feet at its completion in the mid-1880s. As of this summer, there are 90 completed supertall buildings (over 300 meters, or 984 feet) and two megatall buildings (over 600 meters, or 1,968 feet), according to the Council on Tall Buildings and Urban Habitat, which monitors high-rise construction across the globe. But height isn't everything. As the projects on the following pages demonstrate, there are many ways to measure a tall building: form and proportion, physical and cultural context, program and technology. A tower is what you make of it.

Hôtel de Police & Extension de Charleroi Danses
Charleroi, Belgium
Ateliers Jean Nouvel and MDW Architecture

246 feet / 75 meters

TEXT BY EDWARD KEEGAN, AIA

PHOTOS BY FILIP DUJARDIN

With a population of just over 200,000, Charleroi is the fifth largest city in Belgium, but not a place of memorable skylines. The UNESCO-listed belfry of the Charleroi City Hall punctuates the center of the low-slung town. The surrounding landscape, long dominated by industry, remains lush and speckled with small green hills. Into this relatively tranquil setting, Paris-based Ateliers Jean Nouvel, with Brussels-based MDW Architecture, set a 75-meter-tall (246-foot-tall) ovoid blue tower whose gently curved form seems to mimic the natural landscape—while its scale is a bit out of place, if not out of time.

The 19,392-square-meter (208,734-square-foot) tower forms the most obvious talisman for an unusual, three-part program that opened in November 2014. The project revitalizes five 19th-century buildings with a police headquarters, expanded facilities for the dance company Charleroi Danses, and a brasserie—all configured within a V-shaped public square.

The police headquarters spans the new tower and two old cavalry barracks, attached at the ground level. Certain functions receive specialized spaces—three levels of parking, a detention area, and storage are below grade; a public auditorium and debriefing room are on the ground level; and 24-hour staffed technical services is on the third level. But most of the tower's 20 floors are arranged to be flexible, so that departments can shift according to changing needs.

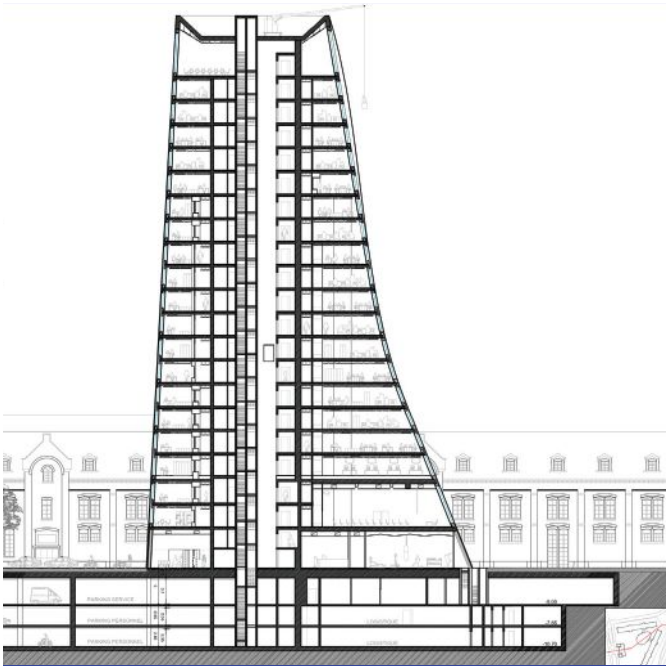
The tower's egg-shaped floors, rising around an almost circular core, evolve towards a more circular form as the building rises. Generally free spans allow the most flexible accommodations on each level. Jean Nouvel, HON. FAIA, employs a highly varied fenestration system—not unlike some of his previous studies in tall buildings—with a wider, double-height expression at the lower openings evolving into smaller ones above, and the top level is marked again by tall windows that express the floor's additional height.

The red brick plaza, accessed from the Boulevard Pierre Mayence on the west side of the site, mimics the materials of the existing buildings, while the area adjacent to the tower continues the tower's blue brick. The Charleroi Danses facilities are housed in existing buildings on the site's south side, with the new pavilion for the brasserie on the north end.

Nouvel finds inspiration in many places, from the camera-lens façade of the 1987 Arab World Institute in Paris to the geyser form of Barcelona's Torre Agbar. At Charleroi, dark blue symbolizes the police. "The idea was to create a city-scale landmark which is not too high, as a sort of dialogue with the City Hall belfry, and as a message stating that the police force services are open to all at all times," Nouvel says.

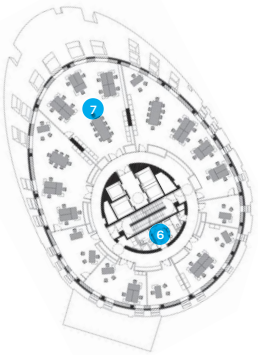
Previous Spread: Tower with single-story connections to adjacent historic barracks

Section A–A1

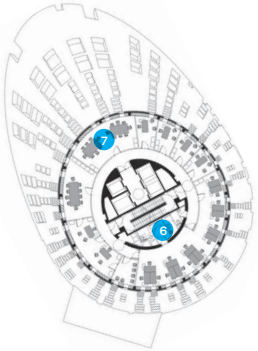


1. Public entrance
2. Police wings
3. Brasserie
4. Charleroi Danses studios
5. Artist housing
6. Restrooms
7. Office

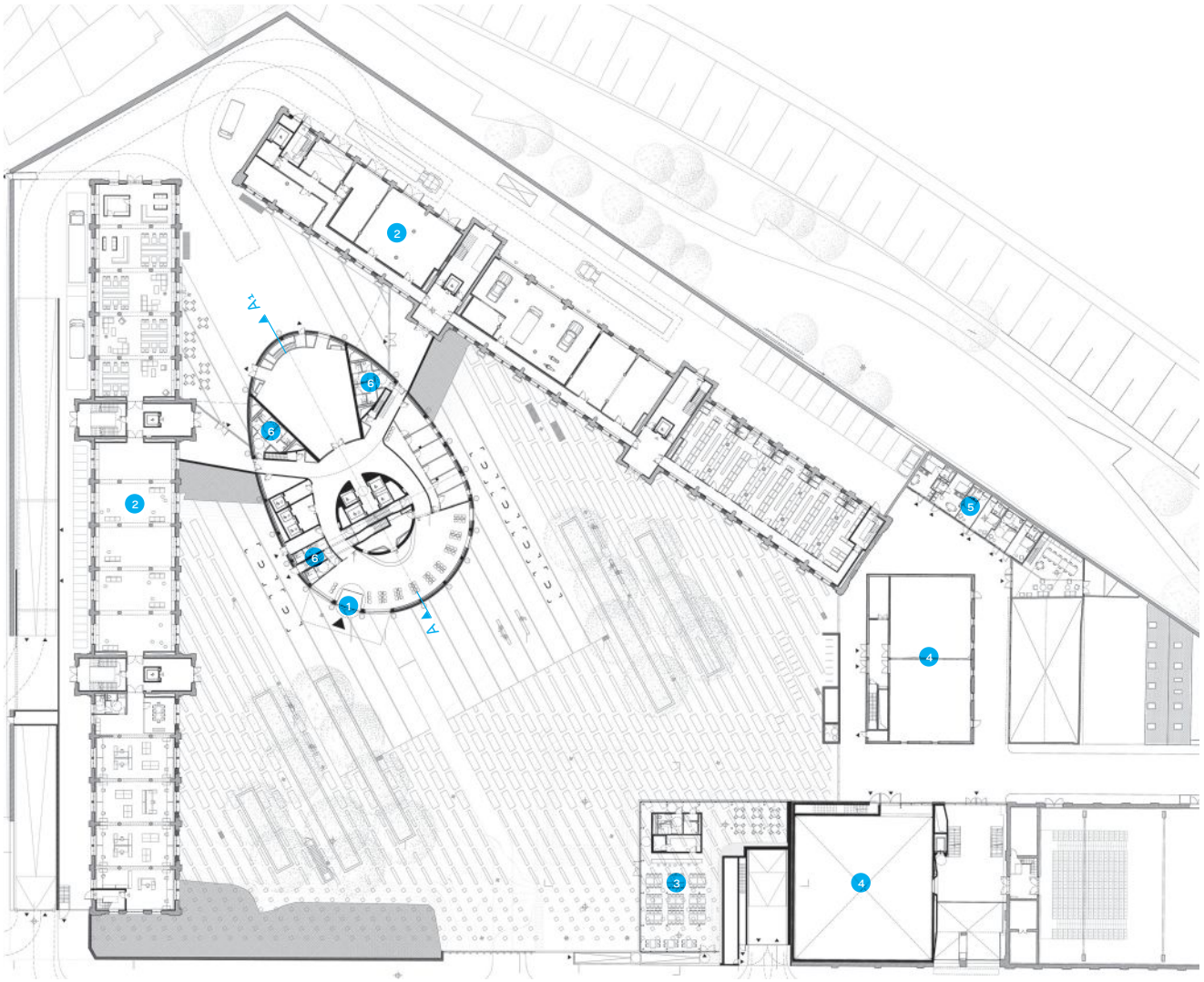
Fifth-Floor Plan



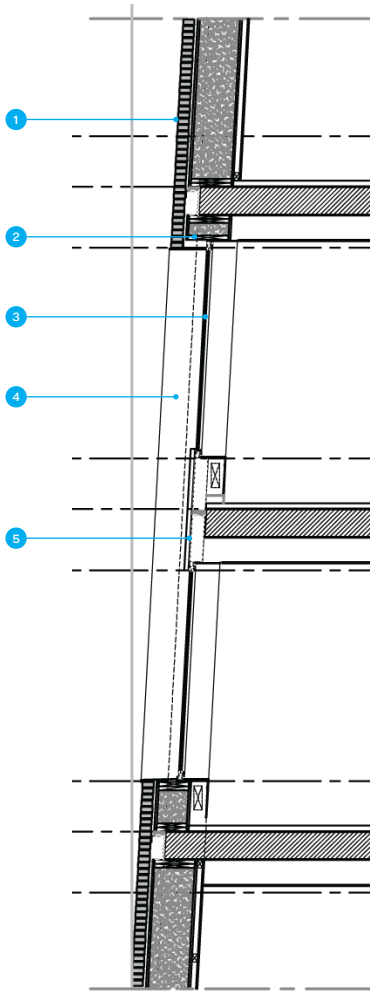
12th-Floor Plan



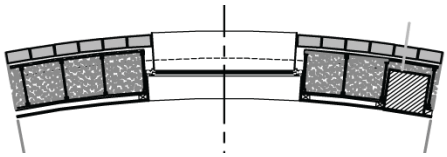
Ground-Floor Plan



Exterior Wall Section Detail

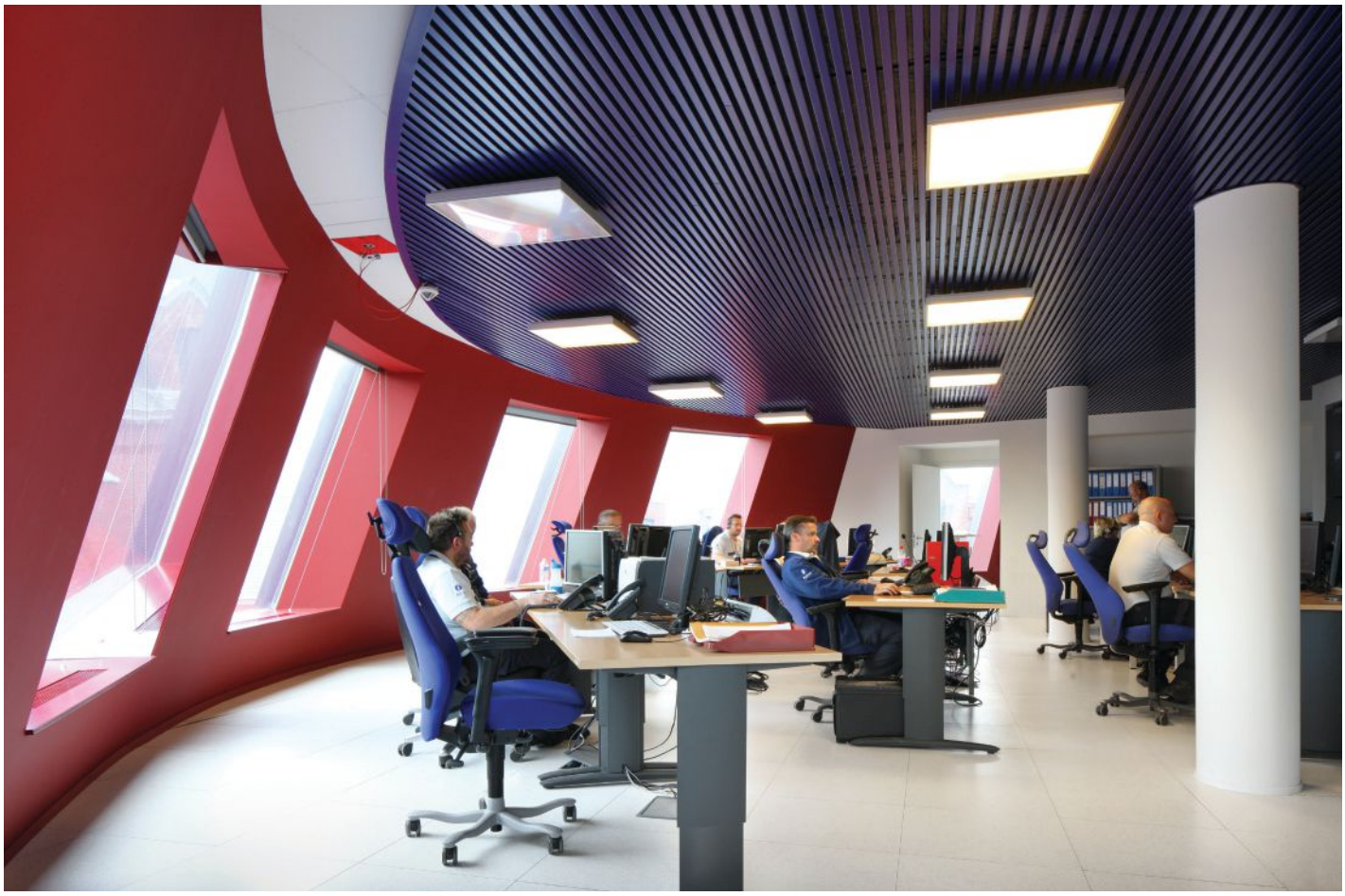


Exterior Wall Plan Detail



1. Enameled facing brick
2. Masonry support affixed to slab nose
3. Double-glazed window in anodized-aluminum tilt-glass frame
4. Window framing
5. Anodized-aluminum siding spandrel panel on frame

Tower public entrance



Above: Office space in tower

Opposite: Passage from tower to 19th-century wings

View of tower from southeast

Project Credits

Project: Hôtel de Police & Extension de Charleroi Danses, Charleroi, Belgium
Client/Owner: Ville de Charleroi
Architect: Ateliers Jean Nouvel, Paris · Jean Nouvel, HON. FAIA; Julie Parmentier (project leader); Gaston Tolila (project leader, competition); Mélanie Doremus, Bernard Duprat, Stacy Eisenberg, Sophie Laromiguiere, Ludovic Magnifico, Kirsi Marjamaki-Mas, Anne Traband (architects); Eugénie Robert (graphic design); Benjamin Alcover, Jugulta Le Clerre, Benoit Patterlini, Sebastien Rageul, Adelaida Verastegui (perspectives); MDW Architecture, Brussels · Marie Moignot (project leader); Yvan Breithof, Miguel Camba, Liz Poggioli, Vincent Sainlez, Stéphanie Seldeslachts, Daniele Wagner
Engineer: VK Architects and Engineers, DTS & Co, MATRIciel, Venac
General Contractor: CFE (BPC – CFE Brabant)
Cost Consultant: CFE
Size: 19,392 square meters (208,734 square feet) (tower); 34,039 square meters (366,393 square feet) (total)
Cost: €55 million ($61 million)

Intesa Sanpaolo
Turin, Italy
Renzo Piano Building Workshop

545 feet / 166 meters

TEXT BY CLAY RISEN
PHOTOS BY ENRICO CANO

Italy may be home to some of the world's most picturesque cities, but it's not exactly known for its skyscrapers. So when Renzo Piano, HON. FAIA, set out to design the high-rise headquarters in Turin of Italian megabank Intesa Sanpaolo, he had to respect the city's history with a tower that was iconic but not haughty, that made a statement without making a declaration. The result is the 38-story, 545-foot-tall Intesa Sanpaolo tower, beside a public park at the edge of town.

Piano calls the tower a "bioclimatic" building, and as with many of his recent structures, he packed it full of eco-friendly features. The top floors are given over not to C-level suites but a triple-height greenhouse, with views over Turin and toward the snow-capped mountains that frame the city. Photovoltaic cells cover the tower's southern façade, while the stairwell running up that side of the building doubles as a "vertical winter garden," with hanging plants beside the steps.

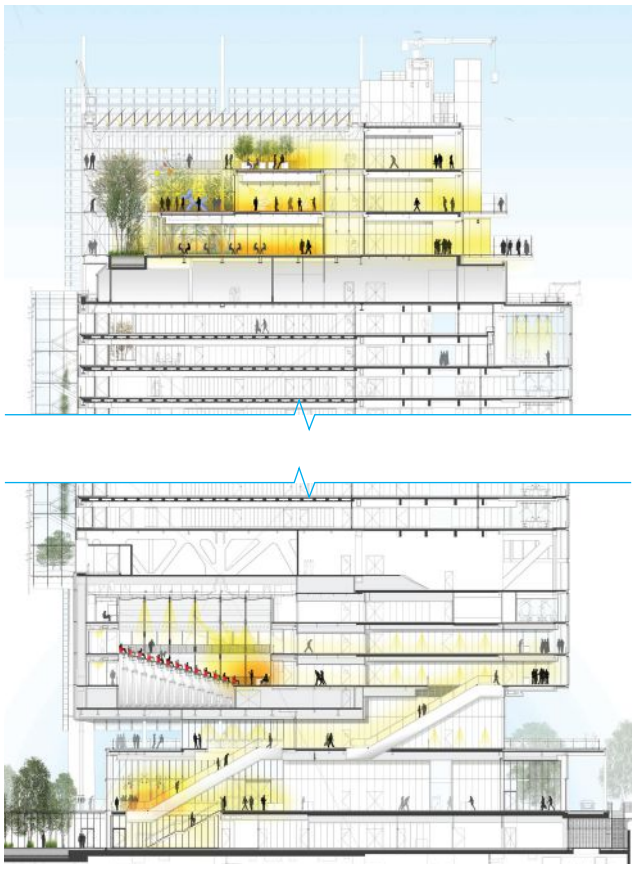
The tower, which cost approximately $565 million and took more than seven years to build, also boasts a number of passive heating and cooling elements. During the summer, apertures in the exterior wall draw cool air into plenum cavities between the concrete-slab floors, which radiantly cool the offices during the day. The ceilings are a generous 10 feet 6 inches high, allowing natural light to penetrate deep into the building's interior, while computer-controlled shades keep out the sun on the brightest days. These features, along with an energy-saving double-skin façade, LED lighting, and a geothermal heating and cooling system, helped the tower earn a LEED Platinum rating.

Intesa Sanpaolo likewise plays a valuable civic function. The penthouse-level garden, restaurant, and gallery are open to the public. The developers upgraded the next-door park, the Giardino Nicola Grosa; there is also a sunken garden on the building grounds that serves a company restaurant and daycare. Inside the tower, Piano included a 364-seat auditorium, which can be used for performances or lectures. The auditorium spans almost the entire width of the building with no internal columns, thanks to an innovative structural system anchored by six steel megacolumns at the building's flanks, paired with a slip-formed concrete core. At the seventh floor, just above the auditorium, four-story-deep horizontal trusses transfer internal loads to the megacolumns, opening up the space below.

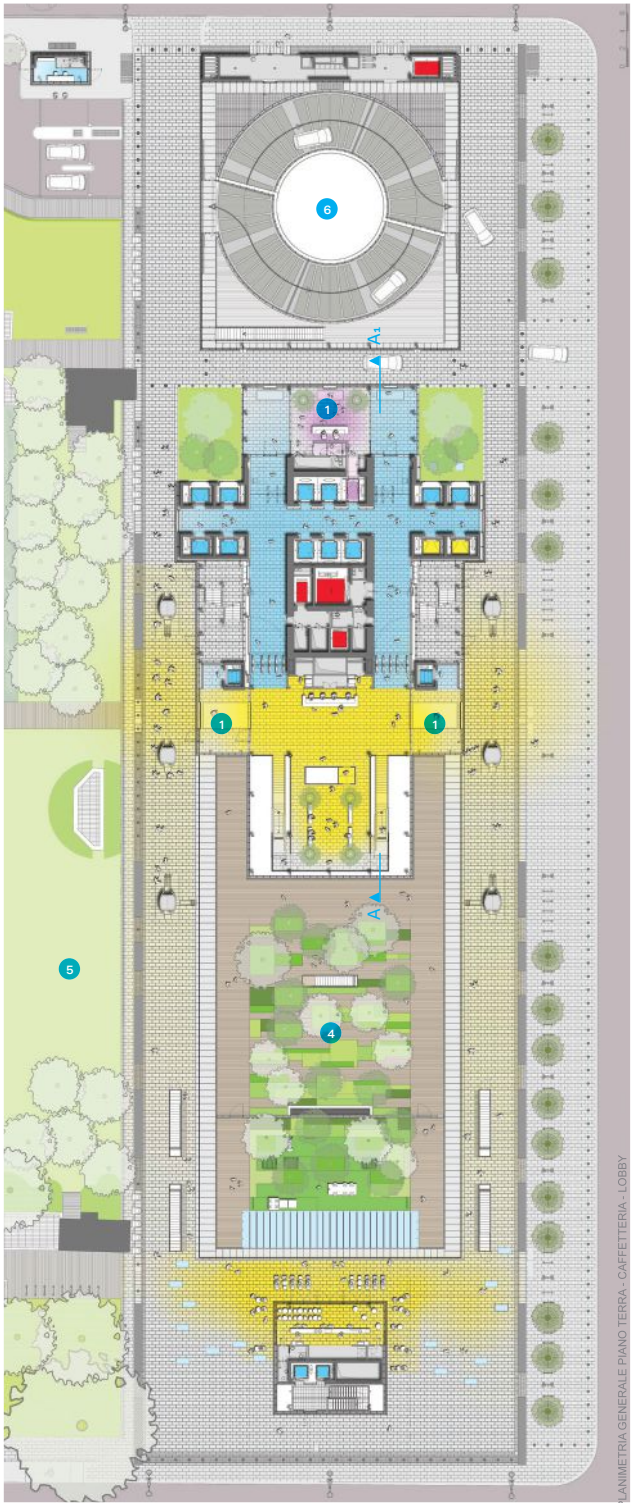
In an era when big banks have come under fire for valuing the interests of capital above those of everyday people, the Intesa Sanpaolo office building is a refreshing correction: A bank headquarters that puts the needs of the surrounding community on the same level as those of its own tenants.

Previous Spread: Western face of tower overlooks reinvigorated park

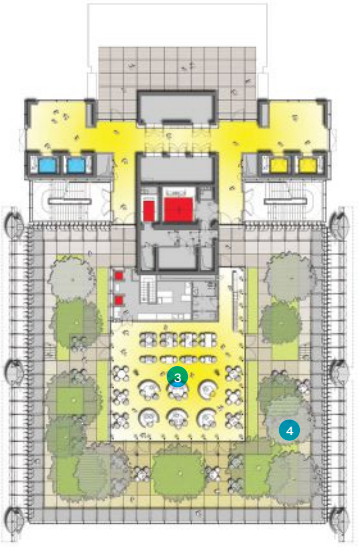
Section A–A₁



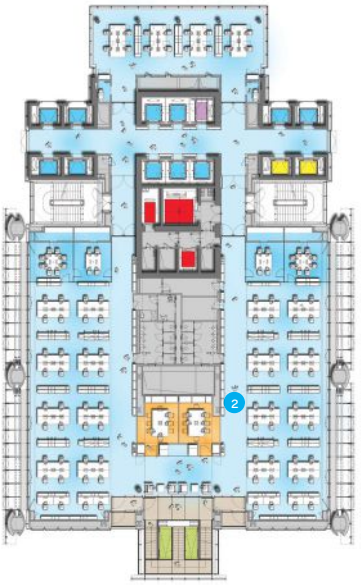
Ground-Level Plan



Restaurant-Level Plan (35th Floor)



Typical Office-Level Plan (Ninth Floor)

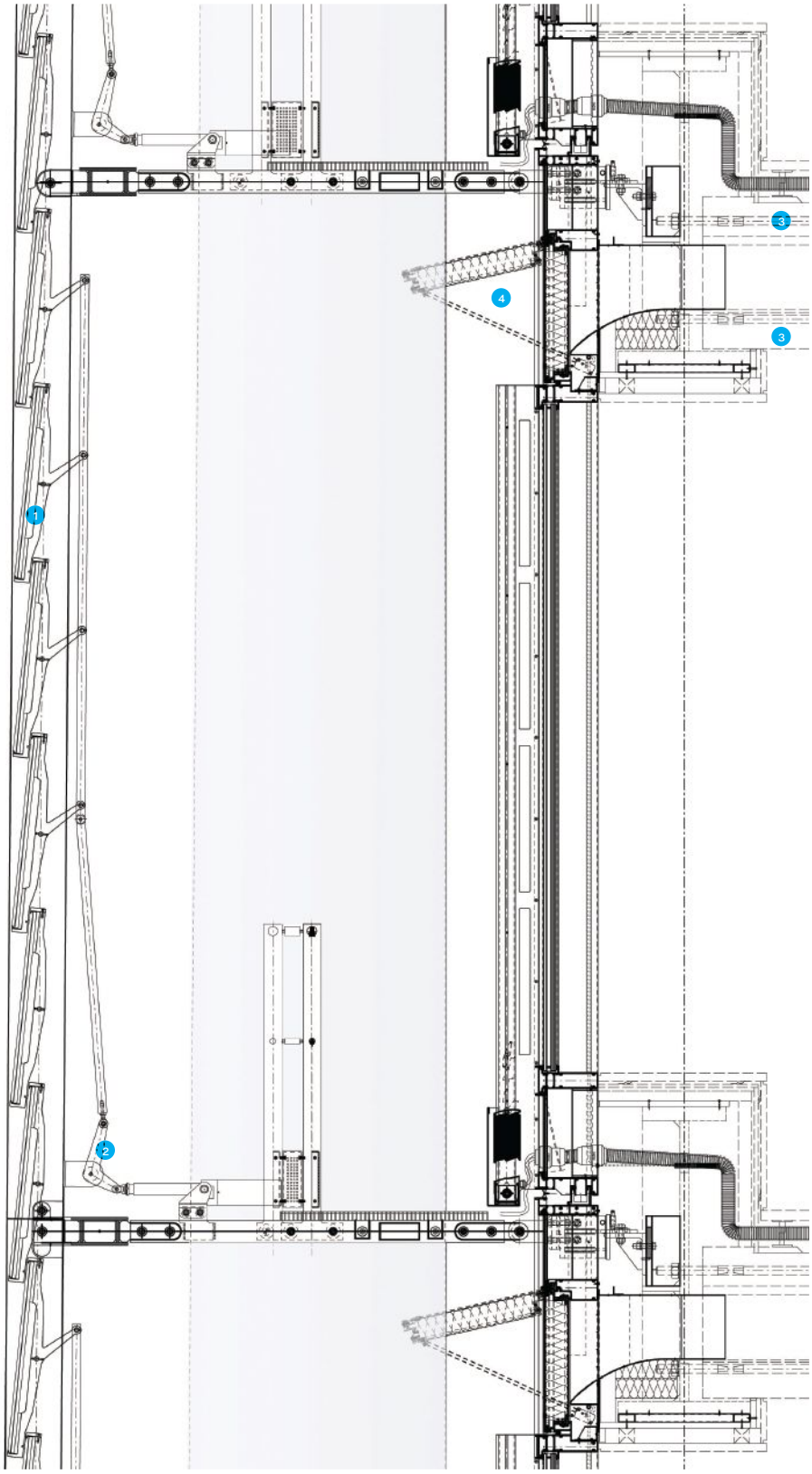


1. Entrance
2. Office
3. Restaurant
4. Garden
5. Giardino Nicola Grosa
6. Parking ramp

0 20 40

Opposite: South façade with photovoltaic panels and stair with internal hanging vegetation

Façade Section



1. Operable louvers
2. Louver mechanism
3. Concrete slab
4. Subfloor ventilation

Above: High ceilings allow daylight deep into office floor plates

Opposite: Penthouse-level public garden, restaurant, and gallery

Project Credits

Project: Intesa Sanpaolo, Turin, Italy
Client: Intesa Sanpaolo
Design Architect: Renzo Piano Building Workshop, Genoa, Italy · Renzo Piano, HON. FAIA; P. Vincent (partner-in-charge); A.-H. Temenides (associate-in-charge); W. Matthews, C. Pilara, J. Carter, V. Serafini, T. Nguyên, T. Sahlmann, V. Delfaud, A. Amakasu, A. Alborghetti, M. Arlunno, C. Devizzi, G. Marot, J. Pattinson, D. Phillips, L. Raimondi, D. Rat, M. Sirvin, M. Milanese, A. Olivier, J. Vargas, S. Moreau (team); O. Aubert, C. Colson, Y. Kyrkos, A. Pacé, O. & A. Doizy (models)
Consulting Architect: Inarco
Structural Engineer: Expedition Engineering, Studio Ossola, Studio Tecnico Majowiecki
Building Services: Manens-Tifs
Façade Engineer: RFR
Landscaping: Atelier Corajoud, Studio Giorgetta
Interior Design: Michele De Lucchi, Pierluigi Copat Architecture
Size: 85,000 square meters (914,932 square feet)
Cost: €500 million ($565 million)

Tower rises 38 stories above historic cityscape of Turin

Jiangxi Nanchang Greenland Central Plaza, Parcel A
Nanchang, China
Skidmore, Owings & Merrill

994 feet / 303 meters

TEXT BY NATE BERG

PHOTOS BY LV HENGZHONG


招商银行
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绿地集团
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The twin towers of Jiangxi Nanchang Greenland Central Plaza, Parcel A, were about halfway built when Skidmore, Owings & Merrill (SOM) received a somewhat inconvenient request from the developer. Instead of the designed height of 289 meters (948 feet), the towers were to be adjusted, mid-construction, to reach 300 meters (984 feet). "Adding 11 meters to a building that's already under construction is not necessarily an easy task," says lead designer Mark Nagis, AIA, who is based in SOM's Chicago office.

At that stage of construction, there weren't a lot of options that would pencil out with the building's existing engineering and load management design. Nagis and his team went back to the drawing board, then to the 3D printer, then to the wind tunnel. After testing the structural loads of their design alternatives, they found a solution in an elegant crown covered with gently angled glass panels. The panels add the desired height and open like vertical blinds to allow the prevailing east–west winds to blow through, load-free.

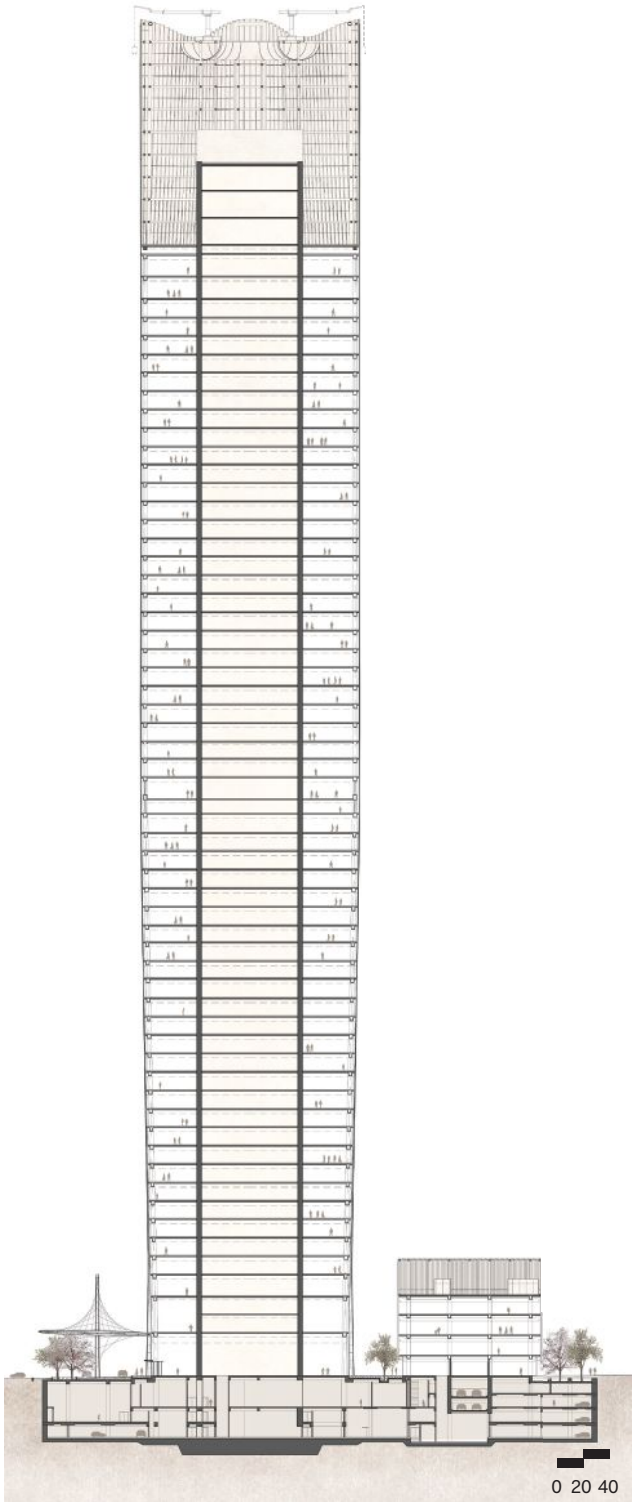
Completed in January at an official 303 meters (994 feet), the matching office towers are the tallest buildings in Nanchang, the capital of the Jiangxi province in southeastern China. The towers, developed by the Greenland Group, total 2.18 million square feet and anchor a brand new high- and mid-rise district just across the Gan River from Nanchang's old center.

The towers are conspicuous in the new skyline, and not just for their height. Each one transitions from a rounded square base to a more tubular form in the midsection to a squished cruciform in the crown. Both twist slightly to maximize views over the growing district, a new park, and the old city.

The towers are enclosed in smooth glass held in place by a structural sealant. "It's curving in two directions," Nagis says. "So it's a fairly complex surface." When the project was first sketched out in 2008, SOM's architects weren't even sure manufacturers could produce the glass. "The design concept demanded that it be parametrically analyzed from the early stages," says project manager Michael Pfeffer, AIA. "Our structural engineers were sitting side by side with us the whole time." The geometry made the prospect of a smooth curtainwall especially tricky.

But by the time they were drawing up construction documents in 2010, the technology had caught up to the dream. Using a process known as cold bending, the glass panels were warped in two directions to accommodate the buildings' curves. The result is a seemingly continuous surface wrapping the towers like a glass wave. "When you stand back and look at it, it's a fairly simple building," Nagis says. "But in terms of its enclosure, it's very complicated."

Section A–A1



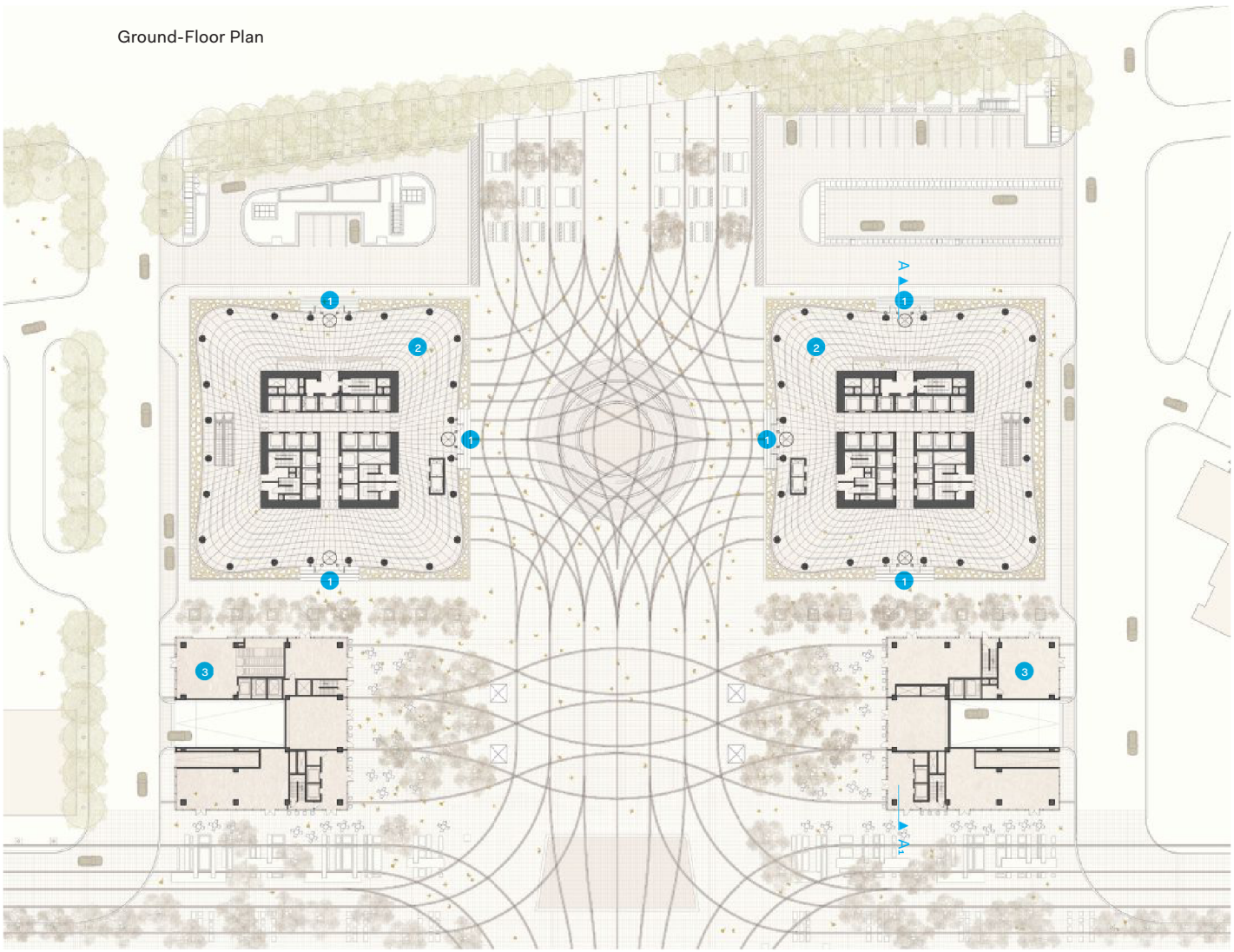
Typical Floor Plan

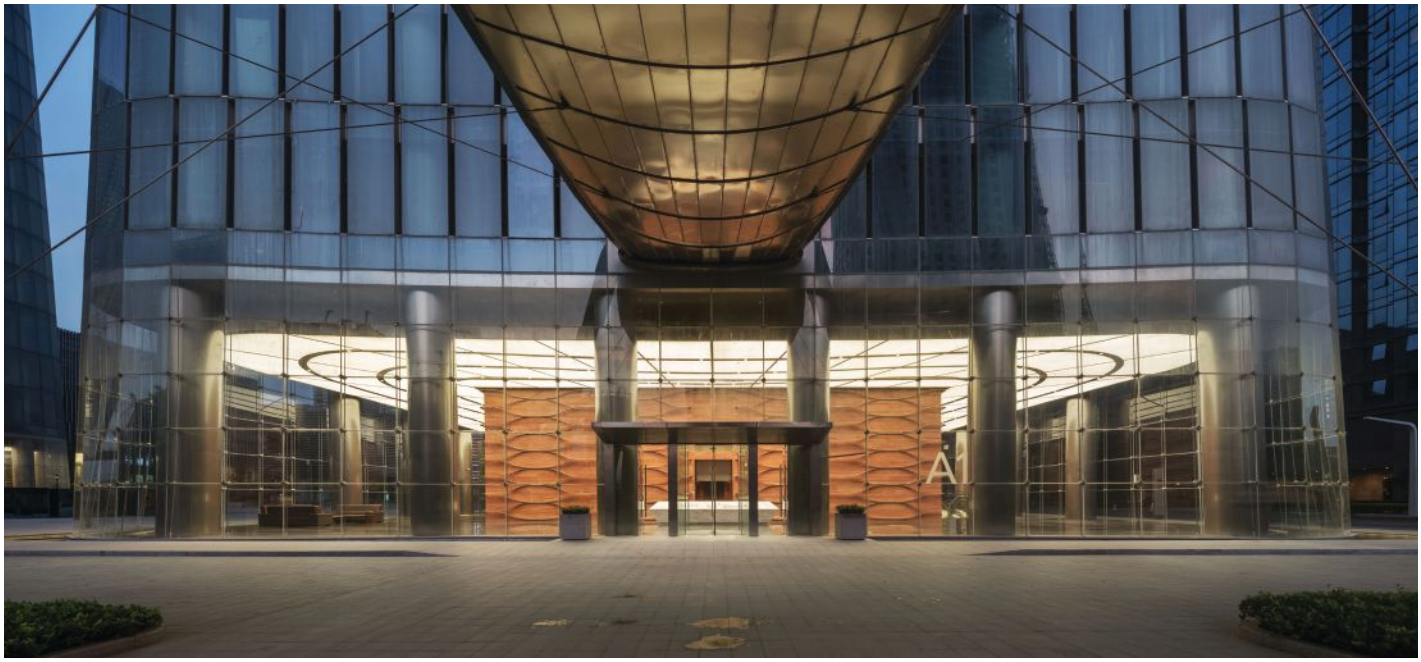
1. Entrances
2. Lobbies
3. Retail pavilions
4. Office
5. Restrooms

0 20 40

Previous Spread: View of towers from east

Ground-Floor Plan





Above: Ground-floor entrance

Opposite: Inside crown

Project Credits

Project: Jiangxi Nanchang Greenland Central Plaza, Parcel A, Nanchang, China
Client: Greenland Group
Project Team: Skidmore, Owings & Merrill, Chicago · Jeffrey McCarthy, FAIA (consulting managing partner); William F. Baker (structural engineering partner); Michael Pfeffer, AIA (managing director); Luke Leung (director of sustainable engineering); Ross Wimer, FAIA (former senior designer, Skidmore, Owings & Merrill); Mark Nagis, AIA (design architect); Yue Zhu, AIA (senior technical coordinator); Henry Chan, AIA (technical coordinator)
Landscape/Irrigation Consultant: SWA Group
Lighting Consultant: KGM Architectural Lighting
Life/Fire Safety Engineering: Aon Fire Protection Engineering (formerly Schirmer Engineering)
Acoustical Consultant: Shen Milsom & Wilke
Vertical Transportation Consultant: Edgett Williams Consulting Group
Size: 202,797 square meters (2.18 million square feet) (towers); 219,776 square meters (2.37 million square feet) (total)
Cost: Withheld

Maison du Savoir
Esch-sur-Alzette, Luxembourg
Baumschlager Eberle

293 feet / 89.3 meters

TEXT BY IAN VOLNER
PHOTOS BY EDUARD HUEBER + INES LEONG / ARCHPHOTO

The name "La Maison du Savoir"—the House of Knowledge—has a nice sort of 18th-century ring to it, like one of those communal buildings from the utopian imagination of French Revolutionary–era architect Claude Nicolas Ledoux. But where Ledoux might have made his into a temple of pure rationality, shaped as a sphere or pyramid, the Swiss office of Austrian firm Baumschlager Eberle has made an emblem of a very different age: a slab tower rising from a long vertical base, pierced by a ground-floor opening, and wrapped in a deep, double-gridded cladding.

It is, in other words, a concentrated image of modernity, with box-like façade patterning that evokes midcentury classics like I.M. Pei, FAIA's Kips Bay Towers and a Soviet Bloc–like shaft-and-base approach to form-making. Where those buildings are best known for their use of raw concrete, however, the Maison du Savoir is decked out entirely in steel, a nod to the former mill facility that occupied the site of what is now the University of Luxembourg. As firm principal Dietmar Eberle, HON. FAIA, puts it, "I always believe a building should relate to the site where it is placed."

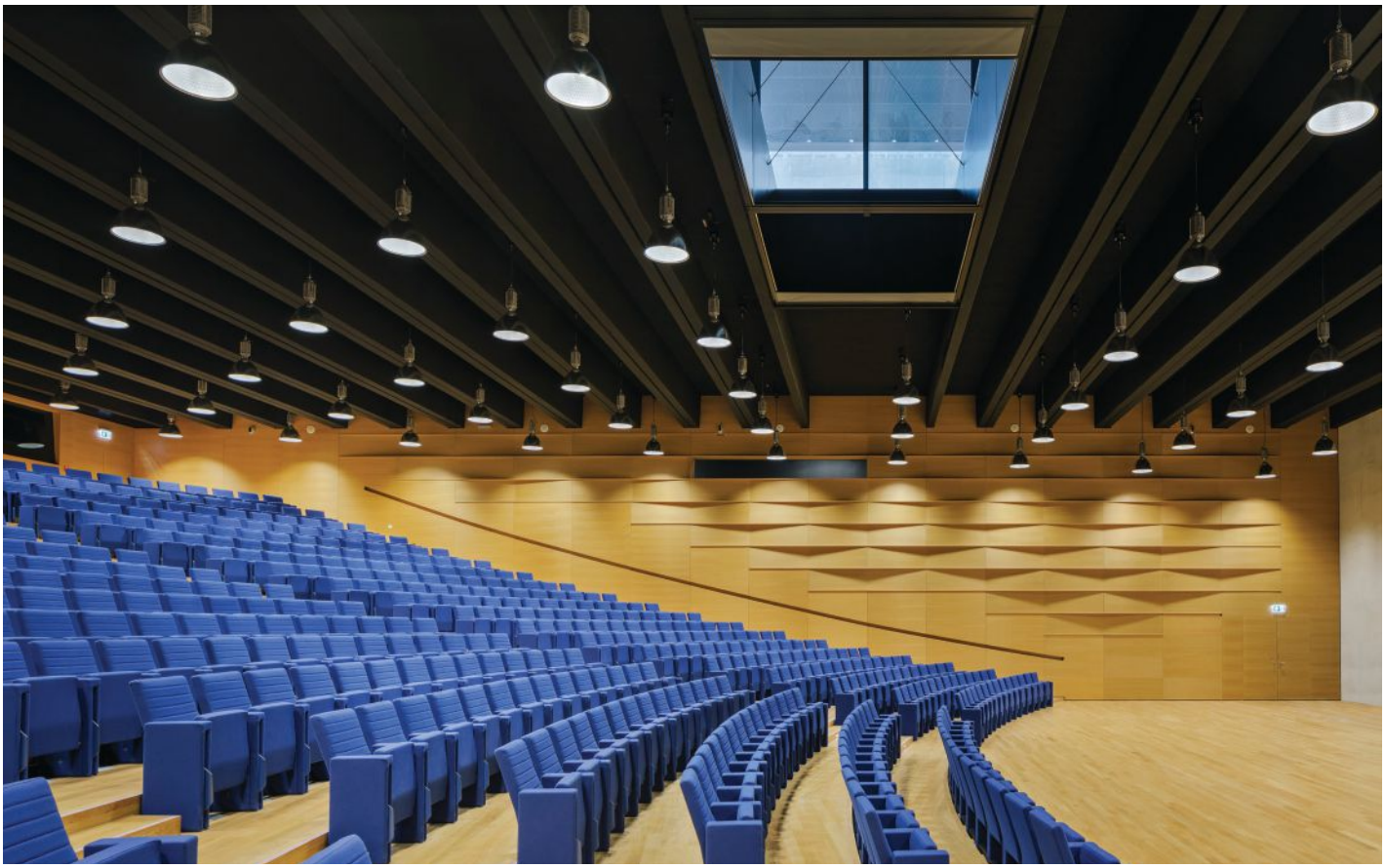
Billed as one of Europe's newest, the university was founded in 2003 to help stem the mass emigration of young Luxembourgers who typically leave the tiny country to finish their studies. With a comprehensive curriculum, the school has been operating from satellite facilities, and is now in the process of partially consolidating its operations onto a single campus in the town of Esch-sur-Alzette south of the capital.

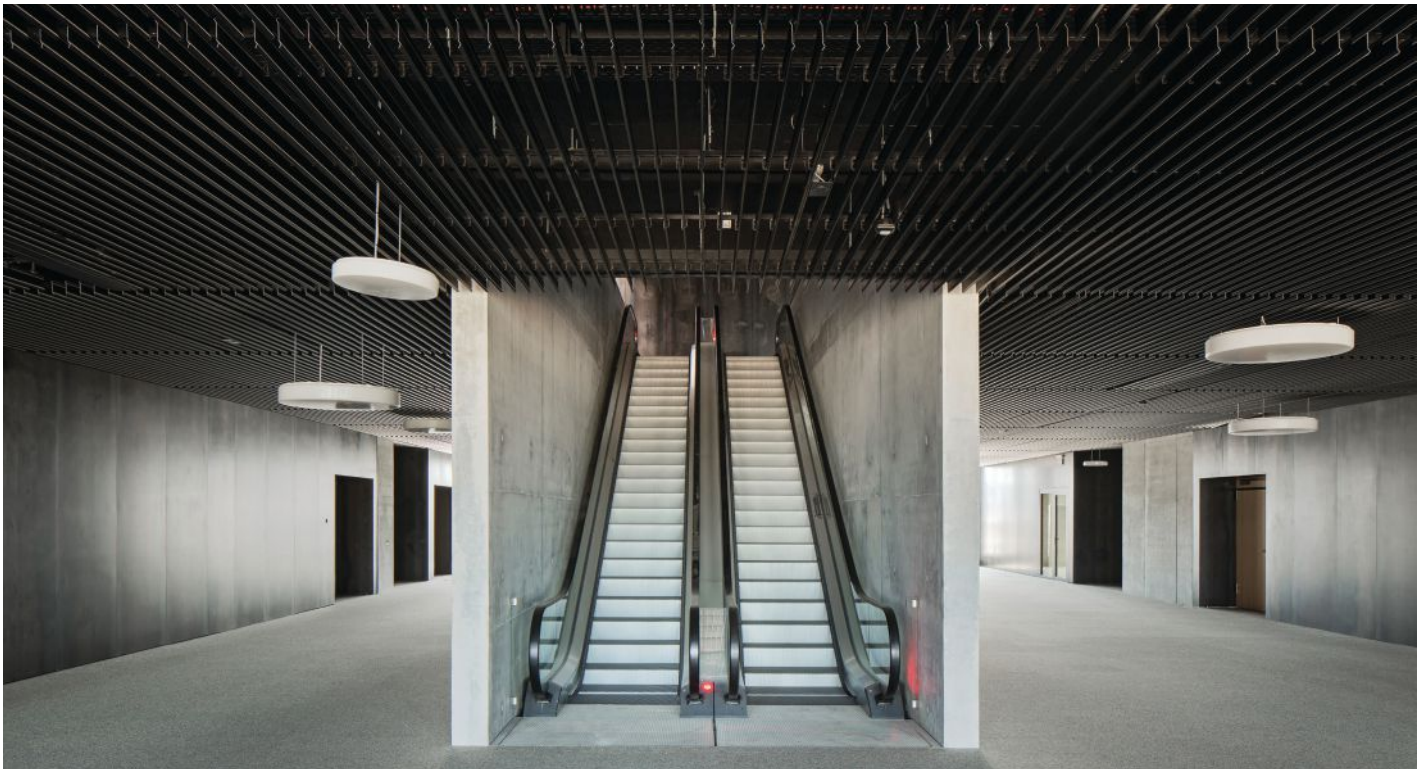
The Maison du Savoir is a key component in that scheme, drawing together a sequence of educational activities into a single integrated structure spread over some 576,000 square feet of floor space. With its powerful planar thrust in both the vertical and horizontal dimensions, the building's geometry suggests a fusing of the school's disparate parts—a "bridge," as its creators have called it—supporting a new educational infrastructure. The waffle-like sheath underscores its rational, scientific mission while providing shading "as determined by the movement of sun," explains Eberle, to reduce mechanical load.

The fact that the building communicates so powerfully in a modern and decidedly urban idiom seems an unusual choice for a campus building. But Luxembourg's master plan for Esch-sur-Alzette, converting it to a "*cité des sciences*," suggests that urban scale and density are precisely what the clients were after. Seen from that perspective, the designers' bold choice of envelope is an appropriate updating of a model academic community, one centered less around the platonic ideal than the technological structures of contemporary life.

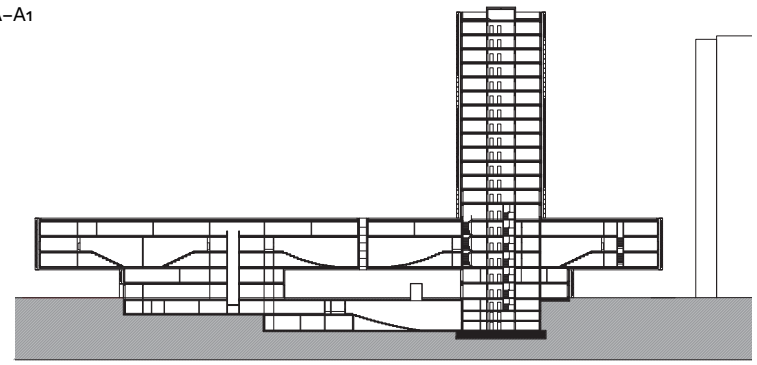
Previous Spread: View from northeast

This Page: South elevation





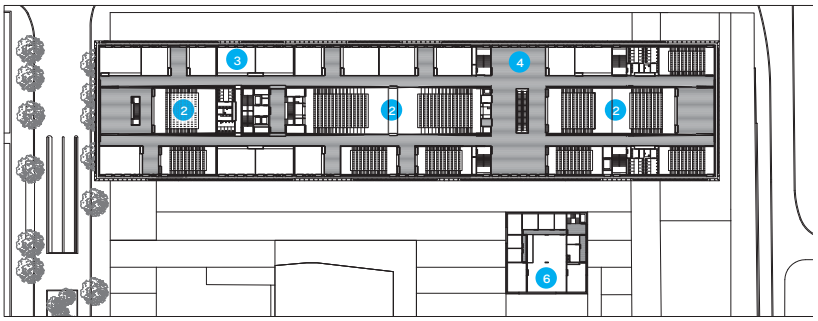
Section A–A1



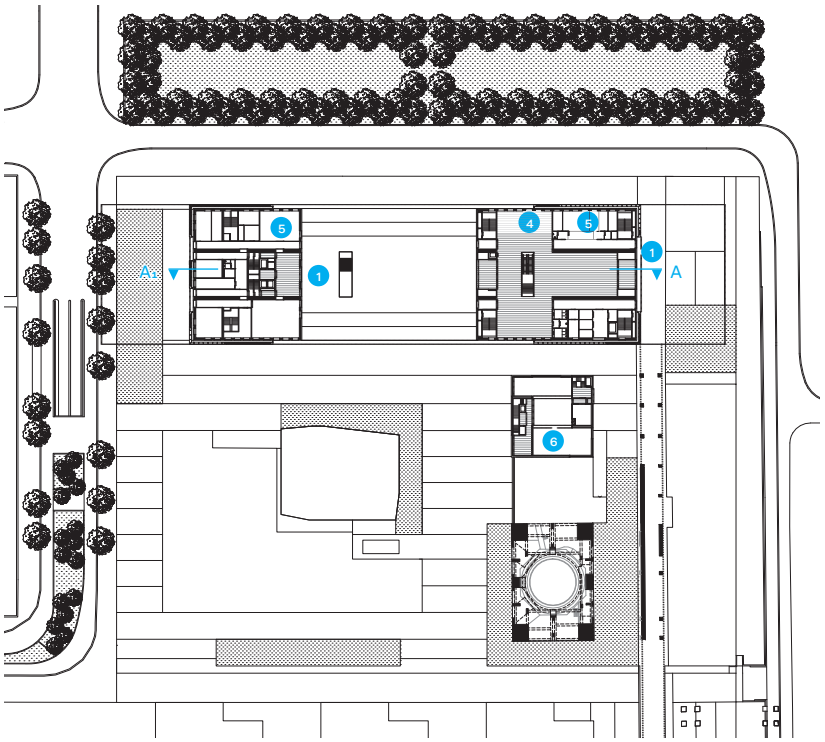
Opposite, Top: 750-seat, multipurpose auditorium

Opposite, Bottom: Escalators in foyer

Third-Floor Plan



Ground-Floor Plan



1. Entrance
2. Auditorium
3. Classroom
4. Circulation
5. Lounge
6. Restaurant

0 40 80

East entrance

Maison du Savoir with new campus restaurant in middle and remains of steel mill at left

Project Credits

Project: Maison du Savoir at University of Luxembourg, Esch-sur-Alzette, Luxembourg
Client: Le Fonds Belval
Design Architect: Baumschlager Eberle, St. Gallen, Switzerland · Elmar Hasler, Marco Franzmann (project leads); Christian Bieber, Robert Urbanek, Daniela Concin, Xiao Fen, Christopher Heinzelmann, Gu Sung Lim (team)
Partner Architects: Christian Bauer & Associés Architectes, Luxembourg
Static Engineer: Ingenieursbureau Jan Van Aelst
Building Technology: Jean Schmit Engineering
Size: 53,560 square meters (576,515 square feet)
Cost: €76.65 million ($84.7 million)

Residential:
Prism Tower/400 Park Avenue South
New York
Atelier Christian de Portzamparc

476 feet / 145 meters

TEXT BY JOSEPH GIOVANNINI

PHOTOS BY WADE ZIMMERMAN

In Manhattan, the classic way to satisfy setback rules intended to maximize daylight on the street is to step back the building profile as it rises. At the Prism Tower, Christian de Portzamparc's crystalline, 40-story building at 400 Park Avenue South, the architect says that he instead "fragmented and angled the façade." De Portzamparc, HON. FAIA, de-massed the building by breaking it into shards, and simply inclined the leading edges of the prisms to open a path for sunlight. Averaging the push and pull of the façade's fragments achieves the same degree of slope as terraced setbacks.

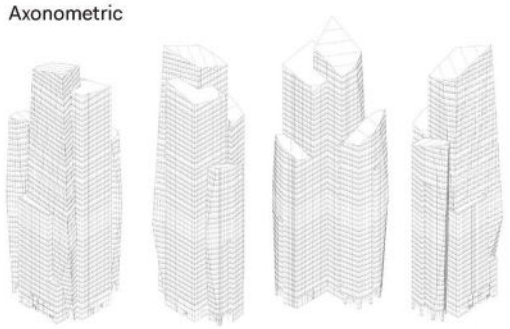
The result is not only light on the street, but a breath of fresh air. The crystalline forms establish a zone of their own, opening up the street wall of right-angled, brick-faced buildings with an exceptional—and exceptionally beautiful—surprise: a tall, sheer rock crystal of glass. The entire shaft of the elegant new landmark, not just the crown, is iconic. It contributes to the skyline and to the bodyline of buildings, Yosemite's West Face transposed to Manhattan.

For all the éclat on its corner, de Portzamparc says the $400 million building grew from the inside out. The architect configured an L-shaped building to match the shape of the site but kept the ends clear of the adjoining buildings, where he extruded pavilions with windows oblique to the street. The angled windows capture longer views and more light. De Portzamparc designed the two legs of the L as intersecting volumes, and he joined them and the adjacent pavilions with deep reveals whose shadows separate, and profile, the adjacent prisms. He detailed the tower so that its spandrels and awning windows form continuous surfaces whose visual unity supports the profile of each shard. The eye looks to the knife-like corners and finds that the blades are crisp and sharp.

In a feedback loop, the irregularity of the perimeter rebounded on the floor plans, where the multiplicity of privileged corners in the distinct volumes created opportunities for unique apartment configurations. New York–based Handel Architects, architect of record, designed the rental apartments on the lower 22 floors; Stephen Alton Architect, also a local firm, did the condominiums above.

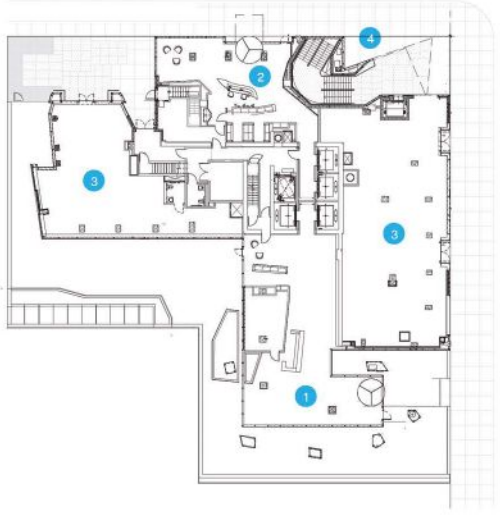
The tower was designed in 2003, and after a construction delay of a dozen years, de Portzamparc says, "I was gratified that the design remained valid and dynamic." His interpretation of a complex, angular language that started appearing internationally in the 1980s remains fresh because of the clarity of an idea and a form developed with such conviction. The Prism Tower is exceptional within its context, and as an uncompromised statement, exceptional within what has become a new tradition.

Axonometric



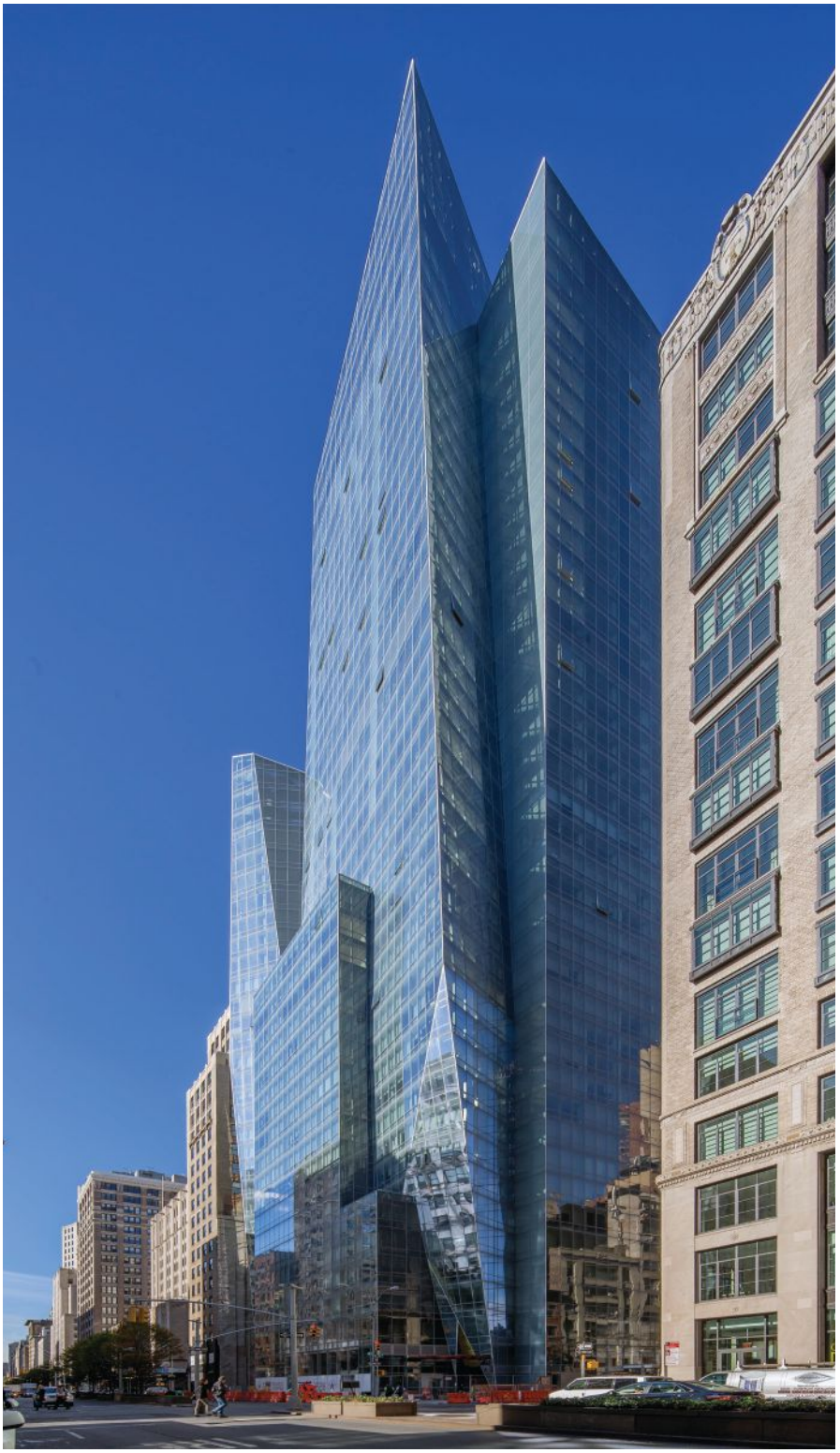
Seventh-Floor Plan

Ground-Floor Plan



Previous spread: View of tower from north, with Kohn Pedersen Fox's metal-clad Baruch College Academic Center at rear left

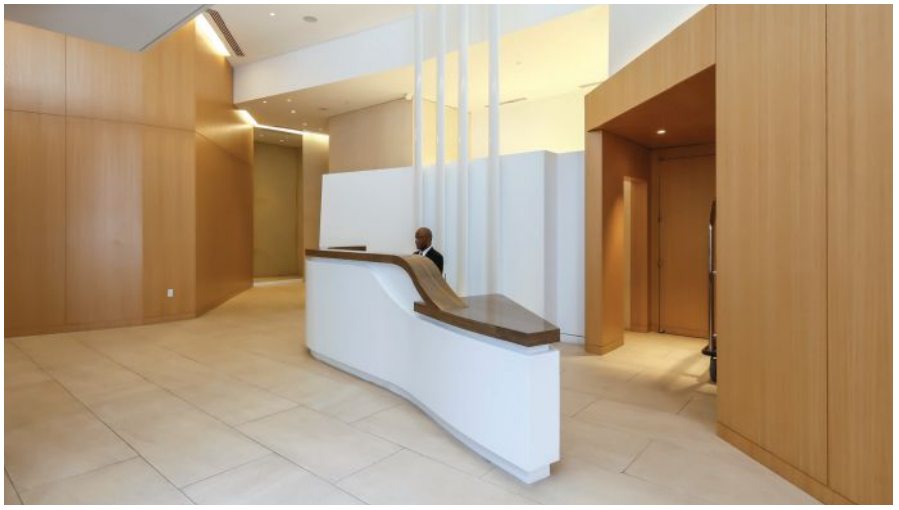
This Page: View of tower looking south along Park Avenue South

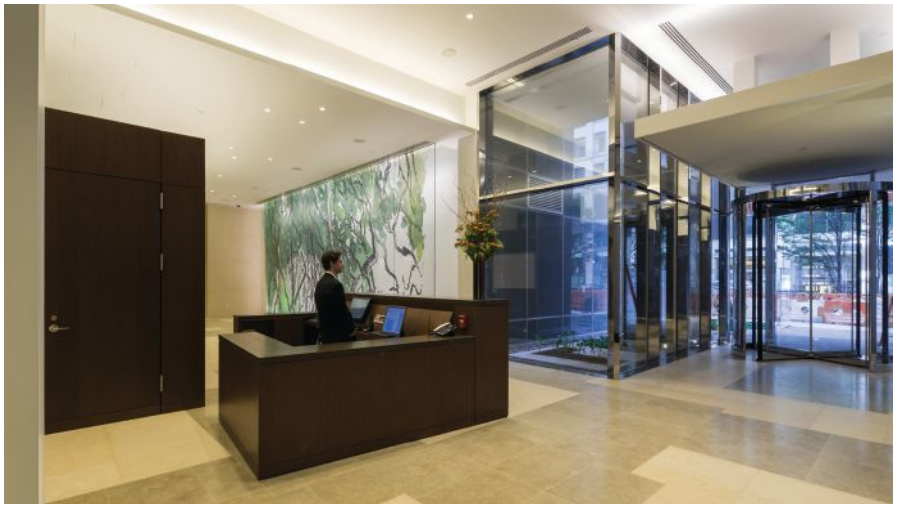


1. Condominium lobby
2. Apartment lobby
3. Retail
4. Subway entrance

View from south on Park Avenue South


E 25 ST
Bank





Top: Apartment lobby

Middle: Condominium lobby

Bottom: Typical condominium kitchen

Opposite: 20th-floor apartment terrace

Project Credits
Project: Prism Tower/400 Park Avenue South, New York
Client: Equity Residential and Toll Brothers City Living
Architect: Atelier Christian de Portzamparc, Paris · Christian de Portzamparc, HON. FAIA; Frederic Binet, Bruno Durbecq (architect assistants)
Executive Architect: Handel Architects, New York · Blake Middleton, FAIA (partner); Jessica Wetters, AIA, Emil Stojakovic, AIA (project architects)
Interior Designer: Handel Architects (apartments); Stephen Alton Architect, New York (condominiums)
Mechanical and Electrical Engineer: Cosentini Associates
Structural Engineer: Desimone Consulting Engineers
Civil and Geotechnical Engineer: Langan Engineering
Construction Manager: Lend Lease
Façades: Gordon H. Smith Corp.
Landscape Architect: W Architecture and Landscape Architecture
Lighting Designer: Bliss Fasman
Zoning Consultant: Development Consulting Services
Size: 430,556 square feet
Cost: $400 million

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Editorial: The Little Biennial That Could

The Chicago Architecture Biennial debuted in October, and the cognoscenti were watching. Closely. Beneath the widespread support ran a faint undercurrent of astonishment that any city, even the birthplace of the skyscraper, would challenge the discipline's reigning festival, the Venice Architecture Biennale. There was also concern whether the artistic directors, Sarah Herda and Joseph Grima, could pull it off—not due to any shortcoming on their part, but because they only had 12 months between the formal announcement of the biennial's existence and the scheduled opening. Yet open it did, and with justifiable fanfare.

Herda and Grima dubbed this first iteration "The State of the Art of Architecture," after a 1977 debate in Chicago organized by Stanley Tigerman, FAIA. The title is so broad that it might as well serve as a mission statement for the whole ongoing enterprise. But what does it actually mean? The phrase "The State of …" suggests an encyclopedic survey, and work by some 100 designers and artists from 30 countries does appear in the show, staged at the city's Beaux-Arts cultural center. But there's a point of view teasingly implicit in those three words, "… the Art of …"; I wish Herda and Grima had more forthrightly articulated it on site.

In keeping with the open-endedness of the title, the installation isn't organized according to overtly stated themes. But Herda and Grima, who are among the most astute design observers of my generation, obviously pursued a set of overarching ideas in choosing the remarkable roster of participants and took great care in grouping the projects for display.

Attentive visitors will detect patterns—common concerns and predispositions among an emerging generation of practitioners. There's social justice (Studio Gang's design strategies for urban police stations), economic opportunity (Tatiana Bilbao's adaptable, $8,000 house prototype), community-building (Studio [D] Tale's map of private minibus routes in Harare, Zimbabwe), technical innovation (Junya Ishigami + Associates' roof design, a sheet of steel a half-inch thick and 330 by 200 feet in area, supported on just four perimeter walls), and even—old-fashioned as it may seem—formal beauty (Andreas Angelidakis' classicizing, PoMo-ish ceramics). There's blessedly little blobmeistering or theoretical posturing (though an inscrutable video by François Roche does its best to fill the void). The wall texts accompanying each project are, for the most part, simply worded and to the point. That's a plus, because the biennial's ability to reach broad audiences will be a decisive measure of its success, both this year and in the future.

A good biennial champions the cutting edge—the state of the art—which this one certainly does. The cognoscenti should be satisfied. A truly great biennial helps architects comunicate meaningfully with the public, and demonstrates the real promise of those fresh ideas. By that standard, did Herda and Grima pull it off? The critics' reviews are rolling in (including Cathy Lang Ho's on page 83), but I'm eager to see final attendance numbers. The biennial's opening weekend drew a crowd of more than 31,000, which is an awesome start. By comparison, the summertime food fest, Taste of Chicago, attracted 1.5 million during its five-day run this year. Architecture should be so lucky.

STEPHEN VOSS

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