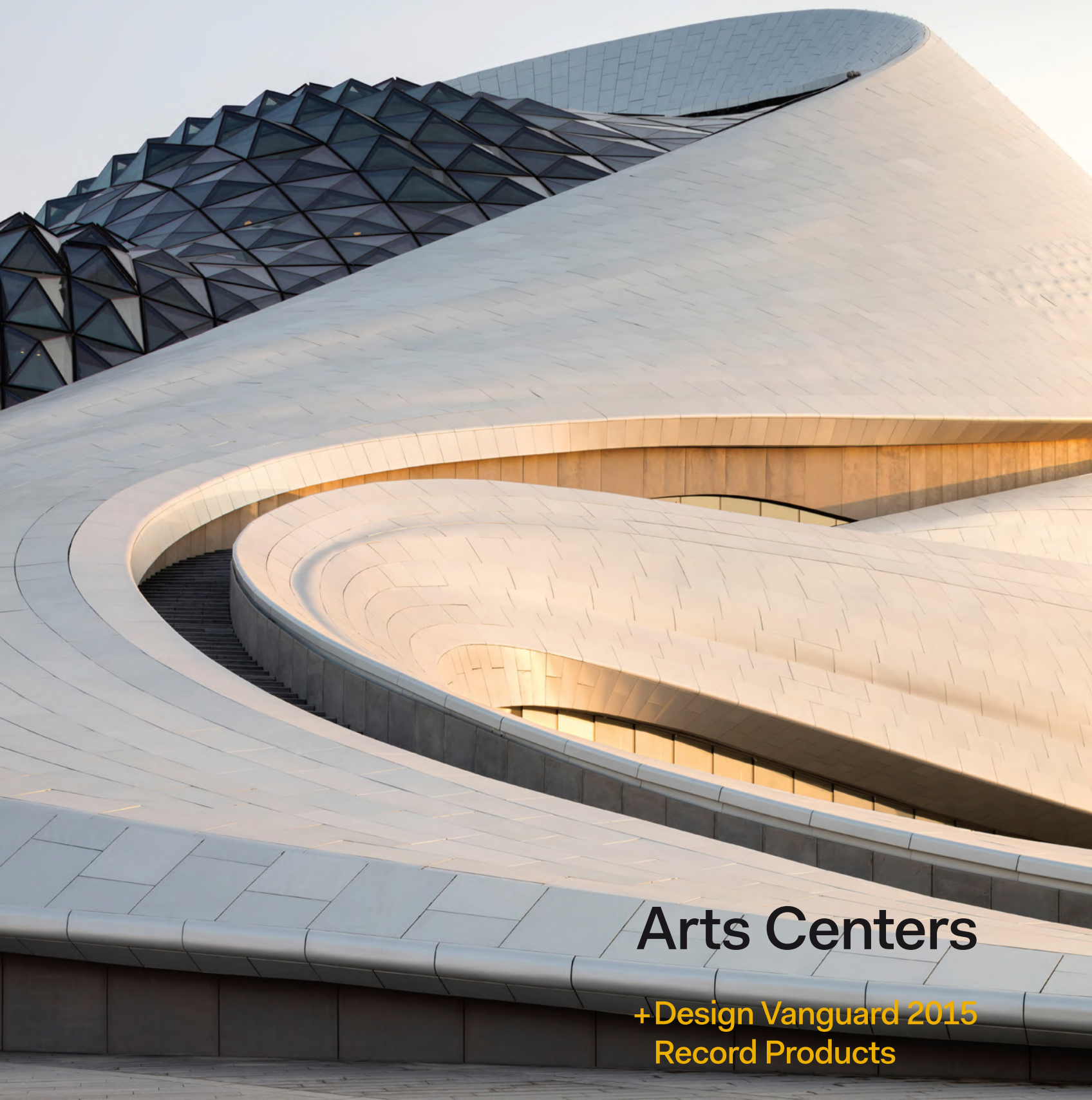


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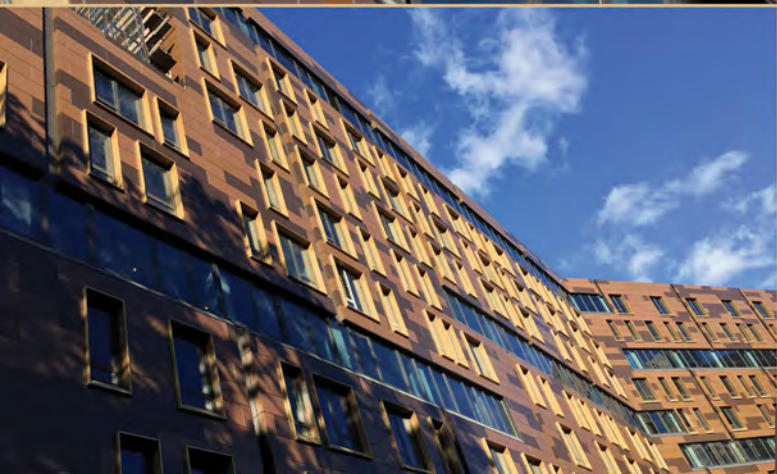
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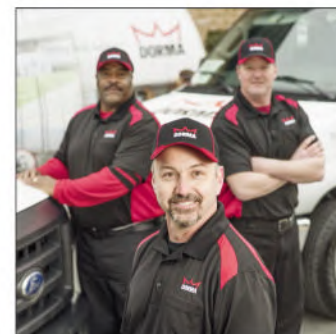
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It's the Top

The Empire State Building—a historic landmark retrofit for the future.

“ICONIC” MAY be the most overused word in architectural writing. Eye-popping new buildings are declared icons when the concrete has barely cured.

But last month, ARCHITECTURAL RECORD and its sister publication *Engineering News Record*, under the new ownership of BNP Media, moved into a true icon: the Empire State Building. Just as thrilling as the views from our offices on the 60th floor is the knowledge that we are working in a monumental landmark with an enduring hold on the national imagination.

The Empire State Building is the public's No. 1 favorite work of architecture, according to a survey by the AIA. Its status does not derive just from its height—it was the world's tallest building for more than 40 years (far longer than today's top tower, the Burj Khalifa, is going to hold the title) and now ranks 30th. And it doesn't derive its status only from its form, though as the structure soars 1,454 feet to the top of its spire, with its subtly elegant setbacks, it remains the most arresting peak on the New York City skyline.

Its design was actually more pragmatic than visionary (turn to page 33 to guess the architect), in order to maximize its real-estate value and minimize its construction time, says Carol Willis, founder, director, and curator of the Skyscraper Museum. “The architecture is streamlined, not so much in the sense of Art Deco design but as a machine-age celebration of efficiency,” she says.

From the start of erecting the steel frame, the construction took a mere 11 months—an extraordinary feat, notes Willis, not only because of the height but because of the scale: more than 2 million square feet of rentable space (the Chrysler Building, almost as tall, was completed in the same amount of time but has less than half the area). Once contracts were signed to design and construct the Empire State Building in September 1929, a deft choreography of fabrication, delivery to the site, and construction began. Materials included 57,000 tons of steel, 62,000 cubic yards of poured concrete, 200,000 cubic feet of Indiana limestone to clad the exterior, along with 6,500 windows, most with cast aluminum Art Deco spandrels—all standardized, of course—installed beneath them. The skyscraper's frame rose at the rate of more than one story a day. It was “an architectural design so magnificently adapted to speed in construction,” Paul Starrett, head of the construction company Starrett Brothers and Eken, later wrote in his memoirs—in which he also confessed that after his company completed the project in record time, he suffered a nervous breakdown.



“It is the most amazing can-do success story in American building,” says Willis.

The skyscraper, which cost \$25 million (more than \$350 million today), was an instant star, with New York Governor Franklin Delano Roosevelt among the luminaries attending its ribbon cutting in May 1931. Two years later, King Kong made Hollywood history climbing its pinnacle, and, over the decades, Charles Boyer, Cary Grant, and Tom Hanks all waited on the observation deck for ladies who never showed up. The building's celebrity outlasts them all: about 4 million people a year visit the observation decks on the 86th and 102nd floors.

Today, the Empire State Building is a national model for the sustainable retrofitting of aging commercial office properties. In 2011, after a \$550 million renovation, it became the tallest building to be certified LEED Gold. In addition, the firm of Beyer Blinder Belle meticulously restored its sumptuous landmarked lobby, providing a splendid welcome not only for tourists but for the thousands of people who come to work here each day.

Now, that's an icon. ■

Cathleen McGuigan

Cathleen McGuigan, Editor in Chief

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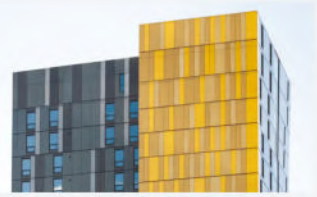


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perspective

Brasilia . . . was a city that was created out of nothing to be the center of government. And the architecture of Oscar Neimeyer is, I think, designed to show man's dominance over the land.

—NPR correspondent **Lourdes Garcia-Navarro**, on Brazil's role in deforestation before a climate-change summit in Paris last month.



A group at Leibniz University in Hanover, Germany, proposes adding light-frame structures on the roofs of existing buildings to house asylum-seekers flooding into the country.

European Designers Seek Long-Term Solutions to House Refugees

BY MICHAEL COCKRAM

ONE EVENING in September, an American couple traversing Europe camped after dark in a national park near Sundholmen, Sweden, along the Finnish border. At dawn they were awoken by a Swedish official and Europe's new reality: they had inadvertently pitched their tent next to a refugee encampment. What had been a resort is now packed with refugees from the Middle East, sleeping in bunk beds stacked to the ceiling in its guest rooms.

Similar arrangements can be seen throughout Europe in school gymnasiums and in antiquated airports—anywhere basic services can be provided. This humanitarian crisis is escalating: 744,000 refugees, most from the war-torn Middle East, have flooded into Europe this year. Sweden is expecting to take in an estimated 350,000 asylum-seekers by the end of 2015; Germany, under Chancellor Angela Merkel, nearly 1 million.

As the immigrants crowd into makeshift shelters and camps, similar to those the vaca-

tioners encountered in Sundholmen, architects and government officials are beginning to grapple with the task of creating more permanent—and humane—housing.

At the School of Architecture at Leibniz University in Hanover, Germany, the Welcome Architecture project is engaging government officials with innovative solutions. A year and a half ago, when the group of architects, academics, and students began the initiative, the city was expecting a total of about 2,500 refugees, according to Assistant Professor Simon Takasaki. “We’re now seeing about 800 refugees arriving each day,” he says.

The project looked for opportunities in the dense urban fabric of Hanover that would be suitable for new housing. Rather than reproduce the problematic model of isolating refugees on the periphery (as in the banlieues of Paris), Welcome Architecture is focusing on three promising strategies that will intersperse groups of newcomers throughout the city.

Since multistory parking decks in the city often operate at 40 percent capacity, the team proposed inserting housing into underutilized structures: the decks would provide a ready armature for infill housing. Second, numerous open lots, some left over from the destruction of WWII, haven’t managed to attract commercial development but are suitable for housing. The third option is to add light-frame housing units on top of existing flat-roofed buildings. Takasaki says that, rather than creating sprawl, these solutions increase the density of cities, an important issue in Europe. Although local officials have expressed interest, no timetable has been set for implementation.

For more immediate housing, several cities are repurposing shipping containers. A government program in Berlin, for example, is building six multi-story container villages throughout the city that will house 2,500 refugees. The developments are spartan, with narrow living areas in containers bracketing



Another project of Welcome Architecture proposes using existing structures as refugee housing to increase urban density throughout (far left). Meanwhile, an Austrian-based design group is proposing an inexpensive passive-house model, originally intended for low-cost student housing (left).

double-loaded corridors and common washing facilities. But because they lack adequate ventilation and soundproofing, they are only suitable for short-term housing, not the permanent housing believed to be needed.

Another challenge for new low-cost housing is meeting the stringent energy efficiency standards in many EU countries. In Austria, a passive-house concept, which was first developed by a consortium of nonprofits for affordable student housing, is drawing interest from several European cities, including Munich and Hanover, for housing refugees. The Green Flex Studio, designed by Lang Passive House Consulting and the Austrian firm F2 Architects, is a prefabricated 800-square-foot, self-contained dwelling that requires only a simple

six-pier foundation with water, waste, and electrical hook-ups.

Despite its modest \$160-per-square-foot price tag, the units meet the rigorous passive house energy efficiency standard by incorporating 18-inch insulated walls, ceilings, and floors; triple-glazed windows; and a high-efficiency ventilating heat exchanger. The units come essentially complete, including interior finishes, says Günter Lang of Lang Consulting. For a 10-unit pilot project in Aspern, Austria, this summer, the manufacturing process took two months and only a few weeks to install and finish the project.

As with all of these long-term solutions, the Flex Studio is still in the proposal stage. There are other, similar models, such as modular

wood housing produced by Bauer Products in Neukirk, Germany, which has begun manufacturing housing for refugees on a small scale. These strategies are a step forward, but each will take time to develop into solutions that address the magnitude of the crisis.

In the long term, many economists foresee the influx of migrants as a boon for Europe's economy, adding jobs in areas such as construction and bolstering shrinking populations. But the immediate concern is a humanitarian one. Chancellor Merkel—known as “Mama Merkel” to many refugees—is steadfast in her support for keeping the EU's doors open: “If Europe fails on the question of refugees—if this close link with universal civil rights is broken—then it won't be the Europe we wished for.” ■

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New Study Seeks to Bridge Architecture and Neuroscience

BY MIRIAM SITZ

IN NOVEMBER, TArch—the research laboratory of the Venice-based architecture firm TA Office—publicly launched a research project investigating the intersection of neuroscience and architecture by tracking human emotional responses to the built environment.



Neurologist Vittorio Gallese (above) and Davide Ruzzon of TA Office will lead the ROOMS project.

Neurologist Vittorio Gallese, physiology professor at the University of Parma in Italy and adjunct senior research scholar in Columbia University's department of art and art history, and Davide Ruzzon, founder and director of TA Office, are cocurating the crowd-funded study, called ROOMS, which will assess observers' emotional responses to images of airport lounges, classrooms, hospital rooms, and assembly halls.

"Aesthetic experience is crucial for cognitive neuroscience because it provides an ideal way of studying the variety of worlds we inhabit," says Gallese.

Beginning January 1, ROOMS will collect standardized black-and-white photographs of spaces from architects and designers across the globe. After selecting 40 depicted spaces, an assortment of individuals—including design professionals, laypeople, and 15 regular users of each space—will take an online test, answering five questions in rapid succession immediately after viewing the images.

With help from a board of scientific advisors, Gallese and Ruzzon will analyze the results and later release their findings.

Projects like ROOMS belong to a growing field of interest, says Meredith Banasiak, M.Arch., EDAC, a senior instructor with the University of Colorado's environmental design program who studies the connection among the built environment, body, and brain through the lens of cognitive science. "In the last 10 years, a lot more evidence-based research has shown strong relationships between the environment and brain and behavior," she says.

Margaret R. Tarampi, Ph.D. (psychology), B.Arch., a research associate at the Center for Spatial Studies at University of California, Santa Barbara, has also noticed increased activity in this emerging multidisciplinary field. "It's taken a while to be something researchers take up," she says, "but we're finally getting to a critical mass where both scientists and architects are asking how the built environment influences us. This kind of research can be a tool for architects to use."

Findings from cognitive science projects that focus on architecture—including TArch's ROOMS—could inform design decisions in significant ways, much as past studies have shown the presence of natural light and nature to improve patient outcomes in hospitals. "If we can choreograph sensory experiences more precisely," says Banasiak, "knowing how the environment affects people's emotions and physiological responses, like heart rate and stress levels—which, in turn, affect cognition and performance—then we can optimize health, comfort, and productivity." ■



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Libeskind's Jerusalem Tower Chopped, But Not Tossed

BY ESTHER HECHT

THE CONTROVERSY surrounding Daniel Libeskind's planned stone-and-glass pyramidal tower in Jerusalem reached fever pitch late last month. Following impassioned objections by groups and individuals, the city approved the plan on October 28th, but with major revisions. The officials reduced the height of the mixed-use building by more than one-third, from 539 feet to 355 feet. Additionally, they ordered the architect to replace the arched arcade around the base with retail businesses that open to the street, and forbade the placement of communication devices, such as cell phone towers, above the apex. A 10-year time frame was stipulated for completion.

Asked whether he would stay with the project despite the setback, Libeskind said in an e-mail, "We will continue full-speed ahead." Neither the building's pyramid shape nor its program—apartments, a boutique hotel, a museum, and an observation platform with a restaurant and café—will change, he claims.

The tower, which Libeskind calls "The Pyramid," is set to rise on a 1.7-acre plot in Jerusalem's downtown, near the Mahane Yehuda produce market, and surrounded by old, low-rise neighborhoods. In 2012 the city approved a Libeskind-designed 24-story tower (not a pyramid) for the site. This year, the architect, working with a new developer, sought—and won—initial approval for a different, and much taller, design.

During the summer, after excavation had begun and the city had posted a plan for public responses, critics voiced concern that the luxury tower would exacerbate the phenomenon of ghost apartments in the city—that is, luxury apartments occupied only briefly each year by foreign owners. Other critics joined the fray, particularly the Jerusalem branch of the Israel Association of United Architects (IAUA), which argued that there had been no public debate over the project and that approval had been granted by the city's planning committee, which consists of politicians, without the professional oversight of the Jerusalem District Planning Commission.

The association convened a public discussion on October 18, for which Libeskind and his wife and partner, Nina, flew in. Some 150 architects, geographers, and conservationists attended. Libeskind said he shared the developer's vision of creating a "wow" for the city, and that in a visit to Jerusalem to discuss the project, Mayor Nir Barkat had asked only whether it would be taller than the Egyptian pyramids. Libeskind assured Barkat it would be.

Opponents objected that Jerusalem is already a "wow" and does not need another tourist attraction. Many argued that the massive project was insensitive to the city's fabric, which was built up over centuries. Others objected to the proposed height, which grossly exceeded the 24-story limit set for the historical heart of the city by the municipal outline plan of 2000. Libeskind's associate on the project, Jerusalem architect Igal Levi, countered by saying that the tall, hollow apex "is just air."



A rendering of Daniel Libeskind's controversial Pyramid tower set to rise in Jerusalem. City officials slashed the height of the tower by one-third in late October.

Levi opened the door to objections by stating earlier that the pyramid is a Jewish symbol. In fact, many would agree that it is instead a grating reminder of the biblical story of the Israelites' enslavement in Egypt. The objectors countered with the biblical tale of the Tower of Babel. Some suggested that, at the very least, the project be moved away from the historical downtown.

The Pyramid Tower is to be Libeskind's second project in Israel. His one built project, a conference center in Tel Aviv, was completed in 2005. Looking ahead, the architect says, "Several projects are under way in Israel." ■

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Steven Holl Collaborates with Jessica Lang Dance Company

BY FRED A. BERNSTEIN

THE RELATIONSHIP between architecture and dance—the art of creating spaces and the art of navigating spaces—is fertile territory. Previous explorations have included Isamu Noguchi’s highly architectural sets for Martha Graham, and Merce Cunningham’s performances at Philip Johnson’s Glass House.

Now Steven Holl, whose architectural forms can be as fluid as a dancer’s limbs, has collaborated with the Jessica Lang Dance Company on a 20-minute piece called *Tesseract* of Time. Commissioned by the Chicago Architecture Biennial, it debuted at Chicago’s Harris Theater November 6. It will be performed at the Joyce Theater in New York in April, though on a smaller stage.

Holl and choreographer Lang used the proscenium stage of the Harris Theater (beneath Millennium Park) to explore four ways buildings can relate to the ground—under it, in it, on it, and over it—with each inspiring one part of their four-act composition.

Holl and choreographer Lang used the proscenium stage of the Harris Theater (beneath Millennium Park) to explore four ways buildings can relate to the ground—under it, in it, on it, and over it—with each inspiring one part of their four-act composition.

For the first two acts, the sets consist of images of architectural models, photographed in extreme close-up and projected on a screen. Initially, the images serve as mere backdrops. But later, with the screen lowered to the stage, the dancers appear to move through the models, a startling effect accomplished by shooting the performers against green screens and then overlaying those videos against images of the models. Other members of the Lang company dance in front of the projections, creating productive confusion between the real and the illusory.

These architectural models were created in Holl’s studio, under the supervision of project



Architect Steven Holl collaborated with choreographer Jessica Lang (left) to design an ethereal set (below) inspired by architectural models (bottom).



architect Dimitra Tsachrelia, as part of an ongoing investigation of complex forms, including mergers of spheres and tesseracts. (A four-dimensional form, a tesseract is to a cube what a cube is to a square.) Thirty different models were created, most of them table-top size, in concrete and wood. Holl says he wondered what it would be like to be inside the models, and then, serendipitously, biennial cocurator Sarah Herda proposed the collaboration with Lang. The result, says Holl, was a gift: “Jessica wanted to occupy the spaces, which to me was very exciting,” he said. “I could take the spatial research a bit further.”

Holl’s sets for the third and fourth acts, while somewhat more conventional, continue the exploration: nine dancers move in, under, and over three fragments of tesseracts made of fabric stretched across metal frames.

Calling Holl’s sets “gorgeous,” the *Chicago Tribune’s* dance critic wrote, “It’s unfortunate that the design often overshadows the dancing.” But why shouldn’t architecture take center stage? ■



noted

Perkins + Will Acquires Portland Design Associates

Architecture and design firm Perkins + Will has acquired London-based branding and design consultants Portland Design Associates. According to the firm, the addition of Portland—which has devised branding strategies for Heathrow Airport, CNN, and others—will strengthen the firm’s service offerings and customer experience.

World Building of the Year 2015 Announced

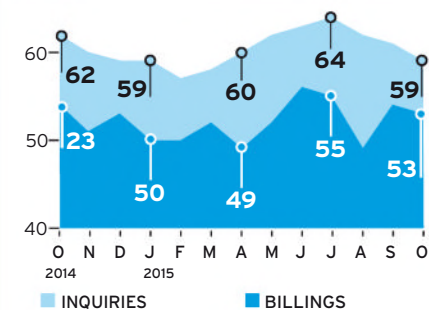
OMA/Buro Ole Scheeren’s *Interlace* complex in Singapore won this year’s World Building of the Year Award at the World Architecture festival. The residential building (RECORD, March 2014) is a Jenga-like arrangement of 31 six-story apartment blocks.

Harvard GSD Awards Veronica Rudge Green Prize in Urban Design

Harvard’s Graduate School of Design has announced the team of firms Burgos & Garrido, Porras & La Casta, Rubio & Álvarez-Sala, and West 8 as winners of the 12th Veronica Rudge Green Prize for Madrid Río, a new park that created nearly 300 acres of new public space for that city. The \$50,000 prize recognizes global urban planning projects that better the quality of life.

Foster + Partners to Design Master Plan for Downtown Cairo

London-based firm Foster + Partners has won a competition to create a plan for the Maspero Triangle District in downtown Cairo. Their plan would create commercial and retail opportunities, while creating new housing for people in the neighborhood’s low-income settlements.



Architectural Billings Index Holds Steady in October

Demand for design services remained on solid turf in October, according to the American Institute of Architect’s monthly Architectural Billings Index (ABI). Although that month’s score of 53.1 clocked in 0.6 points lower than September’s score, the AIA said that the construction sector is healthy. October also saw increased demand for multifamily construction. The October Project Inquiries Index scored 58.5.

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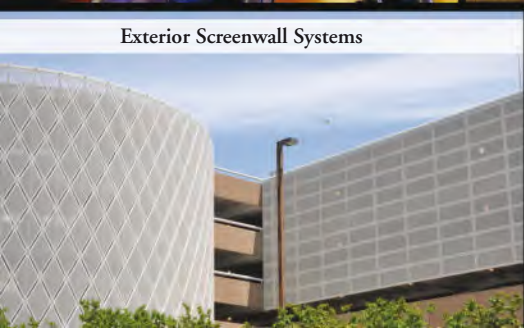
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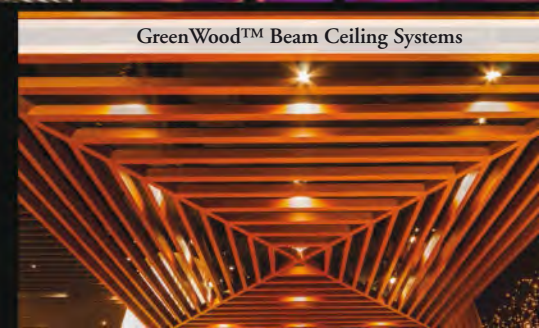
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perspective **house of the month**

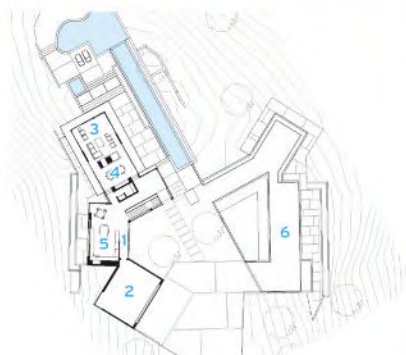
A CONCRETE DESIGN-BUILD HOUSE IN BEVERLY HILLS BY THE WALKER WORKSHOP EXHIBITS A MODERNIST FINESSE. BY SUZANNE STEPHENS



AS MORE architects get their hands literally dirty with the design-build process, this form of project delivery is resulting in some quite elegant structures. “The architect should be in charge,” says Noah Walker, whose Los Angeles firm recently completed an 8,000-square-foot house in a remote section of Beverly Hills. Walker, who has a contractor’s license as well as his architectural one, likes determining exactly how the scheme comes out.

The firm, founded 2009, was asked by a client to come up with a design for a 3.5-acre site that included a guesthouse where the client would live while the poured-in-place concrete main house was being completed. (The client sold the compound last summer to a Chinese media entrepreneur and his family.) Since the land came with 130 protected live-oak trees, Walker needed to design around their leafy presence. He did so by taking advantage of the rugged topography with a parti that gradually spills down a slope: the entrance, garage, and living and dining levels are located at the top, while the four bedrooms, plus gym, media room, and office of the main house are below. To make sure the lower level receives ample light, Walker pulled apart and cranked the plan, organizing one wing around a courtyard carved out of the terrain.

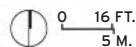
The concrete structure allows long-span spaces and also helps the house meet seismic codes, offer strong acoustical insulation, and provide planted terraces and a vegetated roof deck for the occupants. (The roof over the kitchen/dining and living area



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|--------------|------------|
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| 4 DINING | 10 BEDROOM |
| 5 KITCHEN | 11 MEDIA |
| 6 GREEN ROOF | 12 OFFICE |



A 75-foot-long lap pool with infinity edges runs by the living and dining areas at the front (top); the kitchen (middle) angles over a terrace edging the gym underneath. The dining area on the main level (above) is separated from the living area by the walnut-clad fireplace.

employs steel and wood framing.) To obtain sandblasted or smooth finishes, the team used varied kinds of medium-density overlay (MDO) formwork for the concrete pour. Inside, walnut panels give the interiors warmth, while ample glazing ushers in dramatic views.

Walker developed an enthusiasm for the design-build process when he started working for Gluck Partnership in New York, a firm at the forefront of putting designers in charge of construction. An alumnus of Harvard’s Graduate

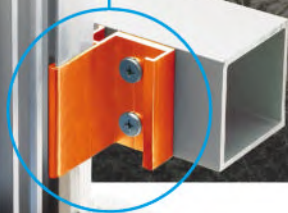
School of Design, he moved to Los Angeles in 2008 to join the design-build practice of Marmol Radziner before going out on his own. As Walker explains, “Doing your own construction influences the way you think about design. You have to be more responsible since you’re in charge of bringing it into the world.” ■



Unitized Panel System

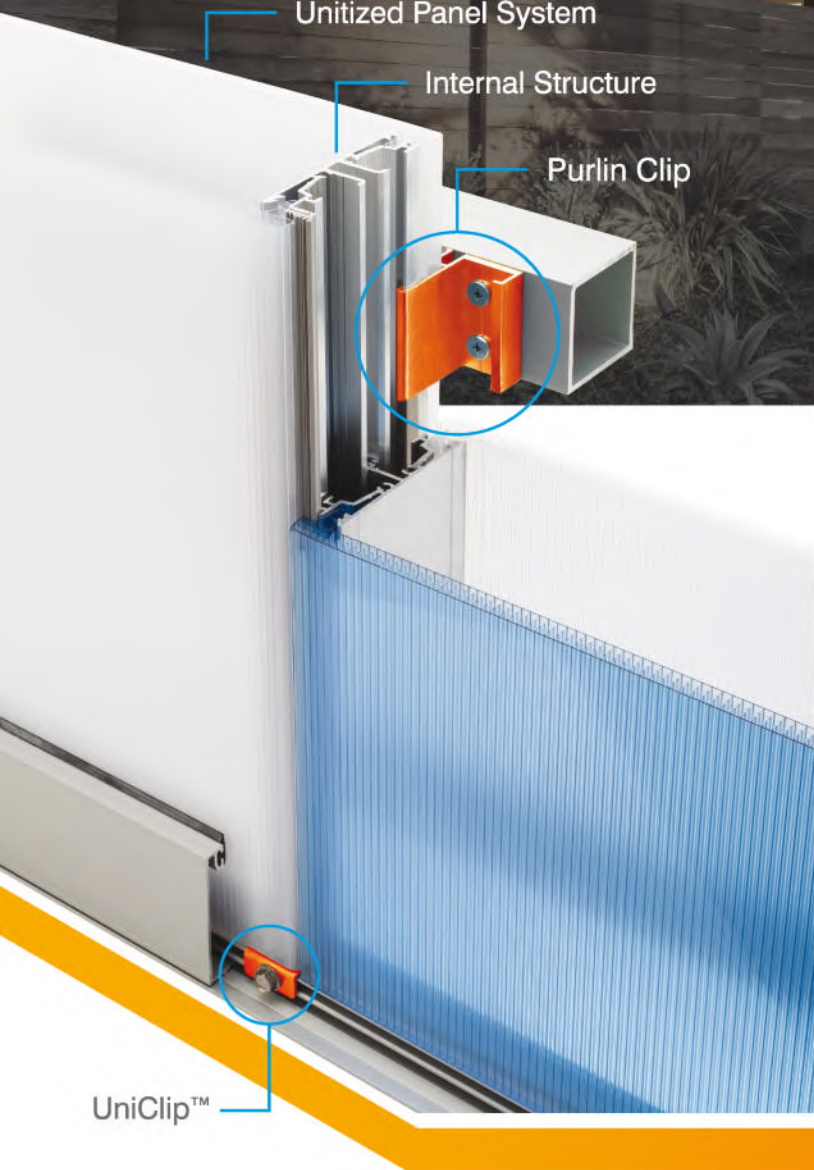
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The answer to the November issue’s Guess the Architect is **JOHN ANDREWS**, who designed Gund Hall for Harvard’s Graduate School of Design (1967–72), from which he graduated in 1958. He subsequently practiced in Toronto before returning to his native country of Australia.

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The Digital Sketchbook

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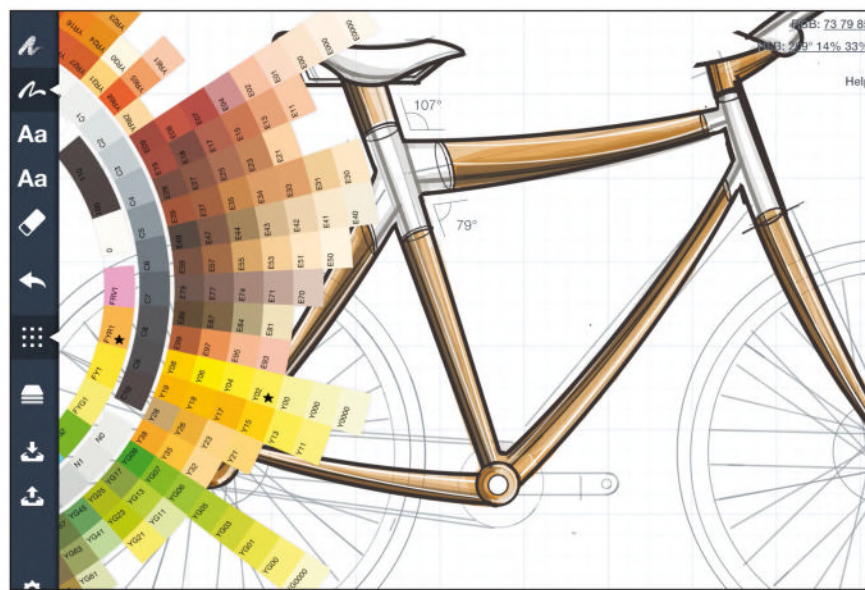
BY MICHAEL LEIGHTON BEAMAN

THE ADVANTAGES of using a tablet as a sketchbook are numerous, including its ability to share, post, or store digital sketches; incorporate images and photos; export to other formats or devices; and, of course, undo.

Apple's first tablet, the Newton Message Pad, debuted in 1993. It came with a stylus. With the development of the iPhone and the capacitive touchscreen, the stylus was abandoned in favor of the finger. But the physical immediacy offered by this technology is offset by its inability to record precise and nuanced marks, making drawing on an iPad a tedious experience for many. Despite these hardware limitations, there are options for those willing to overlook the tactile disadvantages in favor of the connectivity and capability offered by sketchbook apps. From simple journals to robust tool palettes, the following five apps offer a number of capabilities and drawing experiences for those ready to make the switch from pencil and paper. All can be used with a finger or a simple stylus. Adding a Bluetooth-enabled stylus can provide additional features including palm rejection, which differentiates between marks made by the stylus and errant marks of the hand.



Morpholio (free, \$0.99 per color palette, \$2.99 for eight tool types, and \$2.99 for 14 paper types) functions like a travel sketchbook, allowing users to add Post-it-style notes, photos, and images to sketchbook pages. Drawing tools are limited, and detailed sketches can be difficult to create, but drawing lines and flipping between pages is quick and responsive. The app is geared toward creating a multimedia book of ideas rather than producing individual drawings. Journal pages can only be saved as images, but Morpholio Journal is compatible with Morpholio's suite of design and presentation apps, making it a good choice for those already using their programs. morpholioapps.com/journal



Concepts by Top Hatch (free, \$7.99 with Pro Tools) strikes a balance between functionality and simplicity with a number of features well suited for architects. These include a precision mode that allows users to snap new lines to existing ones, an active dimension display (which shows the dimensional information of lines as they are being drawn), and vector line types. Lines remain crisp and clear when zooming in, allowing for very precise and detailed drawings. Sketches are saved as individual documents, which can be organized into groups or "stacks." Drawings can be exported as vector (SVG), CAD (DXF), image (PNG, JPG), and Photoshop files and uploaded to Dropbox or Adobe Creative Cloud accounts. The app offers four gridded backgrounds, as well as custom paper sizes, drawing units, and drawing scales. Layers can be created manually or automatically for each tool type. Overall, Concepts comes closest to the feel of drafting software such as AutoCAD or Vector Works, but remains simple enough to use for sketching. concepts.tophatch.com



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Sketchbook Pro from Autodesk (free, \$3.99 with Pro Tools Package) offers an extensive set of tools, 18 layers to work with, and an ability to export sketches as images as PDF, PNG, or Photoshop files. The app, which is available for a variety of devices, is not difficult to use. However, it is designed for versatility over simplicity. Sketches can be organized into folders, and images can be imported as drawing underlays. The app is structured around three tabs: tool types (pencils, pens, brushes, and graphic effects), layers, and preferences. A more minimal interface mode exposes only the drawing surface. The Pro Tools Package includes additional options, tool types, and an ability to create custom page sizes. It provides a broad set of options and customizable tools with an intuitive interface. Sketchbook.com/mobile



Forge from stylus maker Adonit (free) is designed for people who work quickly and iteratively. Sketches are organized as projects on an endless pinup board. They can also be arranged to create smaller collections of ideas or stored in the corners of the board to clear more space. An existing drawing, layer, or image can be used as the base layer of a new drawing to create multiple versions of a single image or idea. The drawing canvas is relatively sparse, with all options contained in a single menu tab, which can be hidden to provide more drawing area. Several drawings can be exported simultaneously as PNG or PDF files and uploaded to Dropbox or Adobe Creative Cloud. There are five configurable tool types, nine color palettes of five colors each, and a maximum of five layers per drawing. Drawing effects are soft, responsive, and surprisingly realistic. buildwithforge.com



Paper from FiftyThree Inc. (free) has a straightforward and user-friendly interface great for anyone new to using an iPad as a sketchbook. With seven brushes, a cut-and-paste tool, and a customizable color palette, it offers a good balance between simplicity and capability. Flipping between pages only requires a two-finger swipe, and when synced with the FiftyThree's digital stylus Pencil (starting at \$49.95), erasing and blending strokes can be done without the menu bar. Drawings can be shared as Photoshop, Illustrator, or JPG files, and entire notebooks can be exported as PDFs. Both drawings and complete notebooks can be uploaded to Dropbox, Google Drive, A360, Adobe Creative Cloud, or FiftyThree's collaborative Cloud platform, Mix. fiftythree.com

Michael Leighton Beaman, a visiting design and technology critic at the Rhode Island School of Design, is principal of the firms Beta-field and GA Collaborative.

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Finding a Better Way to Do Good

A New Orleans firm rethinks the way it does pro bono work.

BY MARTIN C. PEDERSEN

SOMETIMES GOOD intentions need proper structure—a process, as architects like to say. This was clearly the case for Eskew+Dumez+Ripple (EDR), the award-winning New Orleans firm that has played a key role in the post-Katrina revival of the Crescent City. Until recently, EDR's approach to pro bono work was loose and informal, but as the firm grew in recent years, that became unwieldy and ultimately unsatisfying. "We'd done extensive pro bono work in the past, but without focus," says Jose Alvarez, a principal at EDR. As a result, those efforts seemed to dissipate quickly. "We were looking to create stronger community bonds and more meaningful results," he adds.

Out of that desire to connect was born the firm's MLK Day of Service program. Held for the first time in January 2015 on Martin Luther King Jr. Day, the idea—originally hatched by Alvarez—combines the firm's annual research fellowship with a firm-wide day of service. (In 2015 its theme was community engagement.) As a first step, EDR's research fellow and event organizer Nicole Joslin sent out RFP's to community groups citywide in need of design services. Ten proposals were reviewed by an internal committee of the firm, which narrowed the list to eight. "We gave a presentation to the full staff of the eight, and then asked them to vote on their first and second choices," says Sabeen Hasan, a project architect and member of the selection committee. The top four finishers were chosen to participate in the program.

Everyone in the firm took part, devoting the entire day to a charrette with one of the community groups. There was one strategic stipulation: no principals or associates could be team leaders. "We wanted them to take a backseat and act as mentors and guides," Hasan says, "so that the younger staff could take lead roles in moving these projects forward." In the weeks leading up to the event, those team captains became the primary source of contact for the community organizations, responsible for further defining the scope of the work, the approach of the larger group on the actual day of service, and the inevitable follow-up that insured successful completion of the projects.

All four community groups had needs that could be met through some kind of design intervention, whether it was help in rehabilitating blighted houses (Youth Rebuilding New Orleans), design and construction of temporary



POP-UP ART For the Arts Council of New Orleans, employees at Eskew+Dumez+Ripple designed temporary art galleries, such as the one above, that would fit into open spaces on existing properties.

art galleries (the Arts Council of New Orleans), or a wayfinding and signage system for a new food market (ReFresh Coalition).

But the power of a properly staged brainstorming session can uncover some hidden needs. For example, Live Oaks Wilderness Camp—an organization that identifies a diverse group of future leaders, ages 10 to 12, and brings them together for 10 days in the summer—wanted flexible, low-cost structures for a temporary camp. ERD delivered these structures, but the camp also received something else that was indispensable: a way to tell its story. An EDR-produced video on Live Oaks helped jumpstart the organization's fundraising, which allowed it to fully book the camp and rent the land. "Had we not had that video," says Jack Carey, a vice president of Teach For America, which founded Live Oaks, "I don't know what I would have done, standing in front of a room full of potential donors." EDR hopes to create ongoing relationships with all of the groups, providing additional professional services, for example, to Live Oaks as they take steps to build a permanent camp.

In addition to supporting the professional development for younger staff at EDR, the day of service is an organic way to establish deeper

roots in the community. The potential impact could mean ongoing relationships with as many as 20 community organizations, a crucial outreach tool for a firm that has been transformed in the years following Katrina. "Before the storm, we were primarily a firm of Louisiana-born, Louisiana-educated designers," says Steve Dumez, principal and design director, who credits Public Architecture, the national nonprofit organization founded in 2002, for its role in inspiring the day of service. "Most of the staff we hired after Katrina were people who made a decision to come to New Orleans. They were young, idealistic professionals who wanted to make a difference."

All of them will get another chance next month, when a second MLK Day of Service is planned, on the theme of health and wellness. The firm intends to post a comprehensive guidebook for the program, in the hopes that other firms might adapt it to their own communities. ■

Martin C. Pedersen, a New Orleans-based writer and editor, is collaborating with Steven Bingler on an architecture and design website called the Common Edge Collaborative.

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Monographs in Disguise

In Situ: George Ranalli Works & Projects, by George Ranalli. Oscar Riera Ojeda Publishers, September 2014, 496 pages, \$75.

Public Natures: Evolutionary Infrastructures, by Weiss/Manfredi. Princeton Architectural Press, September 2015, 376 pages, \$50.

Learning Through Practice, by Rob Rogers. ORO Editions, February 2015, 220 pages, \$40.

Reveal, Filter, Evolve, Effect (Core), by FXFWLE and Liz Campbell Kelly. ORO Editions, September 2014, 320 pages, \$40.

Improvisations on the Land: Houses of Fernau + Hartman, by Richard Fernau, Laura Hartman, Thomas Fisher, and Daniel Gregory. Monacelli Press, October 2015, 182 pages, \$46.

By Alexander Gorlin, FAIA

AT A TIME when bookstores are a nostalgic throwback to the past, and Rizzoli, known so well for its architectural monographs, has just published *Kim Kardashian West: Selfish*, these six serious tomes present a brave face to the future. Nevertheless, architects seem to resist letting go of the monograph, the encapsulation of their careers that distills the best of their work. The great models are Palladio's *Quatri Libri*, Schinkel's *Sammlung Architektonischer Entwurf*, Aalto's *Complete Works*, and, of course, Le Corbusier's magisterial eight-volume *Oeuvre Complete*.

In recent years, monographs have become the Birkin bags of architecture—a “must have” accessory for every ambitious practitioner and a valuable marketing tool that can cost as much as \$100,000 for the architect to produce. The subject of the monograph must pay for photography or rights to publish photographs, the cost of writers to create the essays, and also commit to purchasing a certain number of

books in advance, not to mention forking over money to interns who redraw the plans, build models, and produce renderings. But websites are challenging books as efficient marketing tools, and publishers are finding that monographs don't make much money. Hence we see the growth of a new breed: the camouflaged monograph—which seems at first glance to be about larger questions facing architecture culture rather than strictly a survey of a particular architect. Whereas titles used to be simple—the multivolume *Richard Meier Architect*, for example—they now arrive with a theoretical promise.

Still, the five architectural firms behind the books here have



produced beautiful artifacts for the public, friends, clients, and admirers, each completely different in its approach and presentation. By far the most lavish and precious is *In Situ: George Ranalli Works & Projects*, which comes in a heavy slipcase. Drenched in deep-red, sensually slippery paper, the box opens to reveal, like a medieval illuminated manuscript, the totality of Ranalli's dedication to detail and materiality, a *gesamtkunstwerk*-type of career that ranges from hardware to master plans. Among my favorites are the extraordinary Saratoga Avenue Community Center in Brooklyn (2008) and the Atelier International Table Design (1993). Too bad more of Ranalli's work has not been built.

The title of Weiss/Manfredi's monograph, *Public Natures*:

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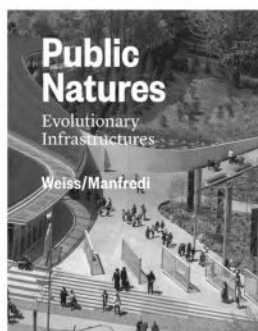
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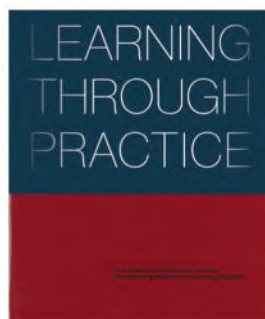


PREDICT DELICIOUS



Evolutionary Infrastructures, is a fancy way of saying how old highways, overpasses, train tunnels, and industrial waterfronts can be transformed into wonderful public parks and gathering places. The work is quite

spectacular, even if about 50 percent of what's covered is not infrastructure at all but devoted to brilliant educational and institutional buildings such as the Nanotechnology Center at the University of Pennsylvania in Philadelphia (2013) or the Novartis Headquarters in East Hanover, New Jersey (2013). Half of the book presents the firm's projects. The rest offers running commentaries on themes found in the work and is, at times, confusing, with long quotes by dead critics and architects such as Le Corbusier, Reyner Banham, and Colin Rowe.



Rob Rogers's *Learning Through Practice* seems at first to be the work of a young up-and-coming architect, since there is not much built work but lots of luminous renderings. Nary a hint is given about the previous

long, productive partnership Rogers had with Jonathan Marvel. The enthusiasm and clarity of the new public projects is infectious, however, and bodes well for the future.



FXFWOLE's series of four pamphlets in a box—*Reveal*, *Filter*, *Evolve*, *Effect* sound like instructions for a newfangled washing machine—is less effective because its unnecessary informality obfuscates the firm's formidable and varied global

projects. These throwaway pamphlets don't do justice to FXFWOLE's work.

Improvisations on the Land: Houses of Fernau + Hartman seems straightforward enough: the 18 houses by this San Francisco Bay-area firm are charming, playful riffs on vernacular barns and sheds, via Charles Moore's Sea Ranch, Frank Gehry's Venice Beach lifeguard house, and John Hejduk's animated figural works.

Carefully set in the landscape, they seem to have always been there. At times, though, the baroque efflorescence of sheds and gables devolves into a cartoon of a farmyard, and the later high-budget projects suffer from a self-awareness that



muffles the exuberant invention of the earlier buildings.

All in all, this is a worthy harvest of architectural monographs for your collection, cleverly concealed behind catchy titles and promises of profound contemplation. If I ever attempt another monograph of my firm's work, I am convinced it has to be based on the *Book of Kells*, with essays by Paul Auster, Pharrell Williams, and Fat Joe. ■

Alexander Gorlin, an architect who practices in New York City, writes frequently on design.

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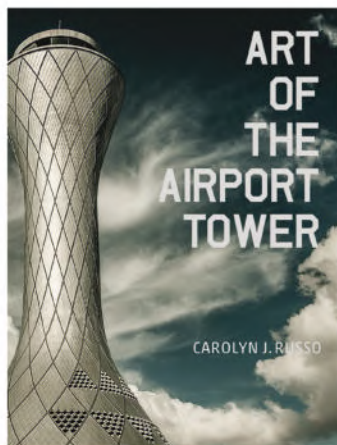
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BY JAYNE MERKEL

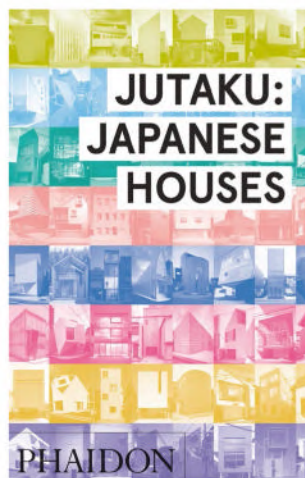
Art of the Airport Tower, by Carolyn Russo. Smithsonian Books, November 2015, 176 pages, \$45. This big, beautiful photographic survey of 85 historic and contemporary air traffic control towers from around the world and throughout history was published to coincide with an exhibition at the Smithsonian National Air and Space Museum. The show runs through November 2016 and will travel internationally in 2017. Handsome color and black-and-white photographs by Smithsonian photographer Carolyn Russo show the surprising variety of forms the towers take and the way many reflect local cultural traditions.



known, perhaps, for his delicate, cagelike 2013 Serpentine Pavilion in London, he also designed a bright blue shopping center in the Miami design district and a new campus for the Ecole Polytechnique at the Université Paris-Saclay (with Manal Rachdi OXO Architectes and Nicolas Laisné), which questions traditional ideas of inside and outside.

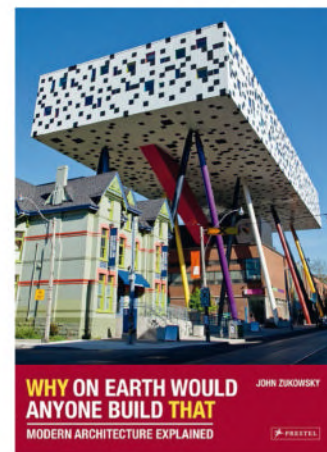
30:30 Landscape Architecture, by Meaghan Kombol. Phaidon Press, September 2015, 320 pages, \$75.

The one encouraging note amid the grim specters of climate change is the growing interest and burst of creative activity in landscape architecture today. This lavishly illustrated book presents the work of 30 of the most renowned landscape architects, along with their picks of the 30 top emerging landscape architects from 20 countries. The young profession, which appeared with urbanism in the 19th century, becomes increasingly important as more people move to cities. This book shows a surprising range of exciting approaches that landscape architects are taking today.



Why On Earth Would Anyone Build That? Modern Architecture Explained, by John Zukowsky. Prestel, September 2015, 224 pages, \$19.

This small but mighty and colorful (in every sense) guide to the apparently outlandish buildings that went up all over the world during the last 70 years. In two-page spreads with explanatory text and fact-packed sidebars, the former curator of the Art Institute of Chicago



manages to explain complicated and controversial buildings ranging from record-breaking skyscrapers to new buildings that pay "homage to the past" and those that derive from pop culture.

Le Corbusier, The Measures of Man, edited by Olivier Cinquandre and Frédéric Migayrou. Scheidegger and Spiess, 2015, 256 pages, \$49.

This handsome art-book-sized catalogue accompanied a commemorative exhibition of the architect's work at the Pompidou Center in Paris last summer. The show delineated Le Corbusier's evolving understanding of the human body in paintings, drawings, sculpture, models, furniture, buildings, and writings. Essays by the editors and 10 European (mostly French) scholars elucidate images and further the argument made by the show.

Sou Fujimoto, Architecture Works 1995-2015, edited by Sou Fujimoto. Toto, April 2015, 376 pages, \$58.

This self-published monograph surveys the work of one of the world's most interesting and inventive rising stars. Best

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The theater beckons passersby into the lobby (right) with its giant LED screen that references The Strand's past life as a movie house. The white space, with its strong grid, provides a quiet pause before visitors continue on to performance spaces.



The Next Act

SOM reinvents a 100-year-old theater for a new era.

BY BETH BROOME
PHOTOGRAPHY BY BRUCE DAMONTE

DRAMATICALLY FRAMED by Morphosis's glassy Federal Building looming behind it, the revived Strand theater, a gleaming red experimental performance space and education center for the American Conservatory Theater (A.C.T.) designed by Skidmore, Owings & Merrill, clicks into its site on San Francisco's Market Street like one of the final pieces of a complex puzzle.

Long neglected, the surrounding Central Market and Tenderloin districts have in recent years benefited from neighborhood regeneration efforts and the city's economic boom. The Strand—which began its life on the Great White Way theater row in 1917 as the Jewel movie house, later became an adult cinema, and finally was abandoned in 2003—was becoming progressively more conspicuous: an eyesore along a rapidly emerging corridor.

An intensive restoration, renovation, and adaptive-reuse project breathes new life into this century-old cinema while providing a second facility for a 50-year-old nonprofit arts organization. But it is also a linchpin, nodding to the civic

center and its cultural institutions across Market Street while knitting together the vibrant retail district to the northeast and the burgeoning residential and commercial development to the southwest—where Twitter and other tech companies are putting down roots.

Over 80 percent of the Strand's steel and concrete structure was salvaged and reinforced, load-bearing systems were retrofitted, and seismic upgrades were made. To transform the 725-seat single-auditorium movie house to meet A.C.T.'s needs for live theater and performances, a Master of Fine Arts program, as well as youth classes and rehearsal space, SOM's team of architects and structural engineers slipped three flexible spaces into the building's carapace.

Visible through full-height storefront windows, and just beyond the sidewalk where the homeless still camp out, a crisp, white three-story lobby animates and is animated by the street life. "The idea was to open to Market Street and engage," says design director Michael Duncan. "We wanted to connect and the Strand to become a meeting place," adds A.C.T. administrative project manager Denys Baker. To create this grand entrance while reducing loads (the building sits along the underground BART and Muni rail systems), the team ripped out an existing floor. This welcoming space invites passersby in to linger at The Strand's café, watch mesmerizing images cross an enormous LED screen, or climb up to one of the cantilevered steel balconies to gaze down at those below. Here, the interplay of activity inside and out is an improv theater in its own right.

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Above this space, on the top level behind restored casement windows, a 120-seat black-box theater, paneled in thin strips of reclaimed wood, can accommodate multiple configurations for rehearsals, classes, and performances.

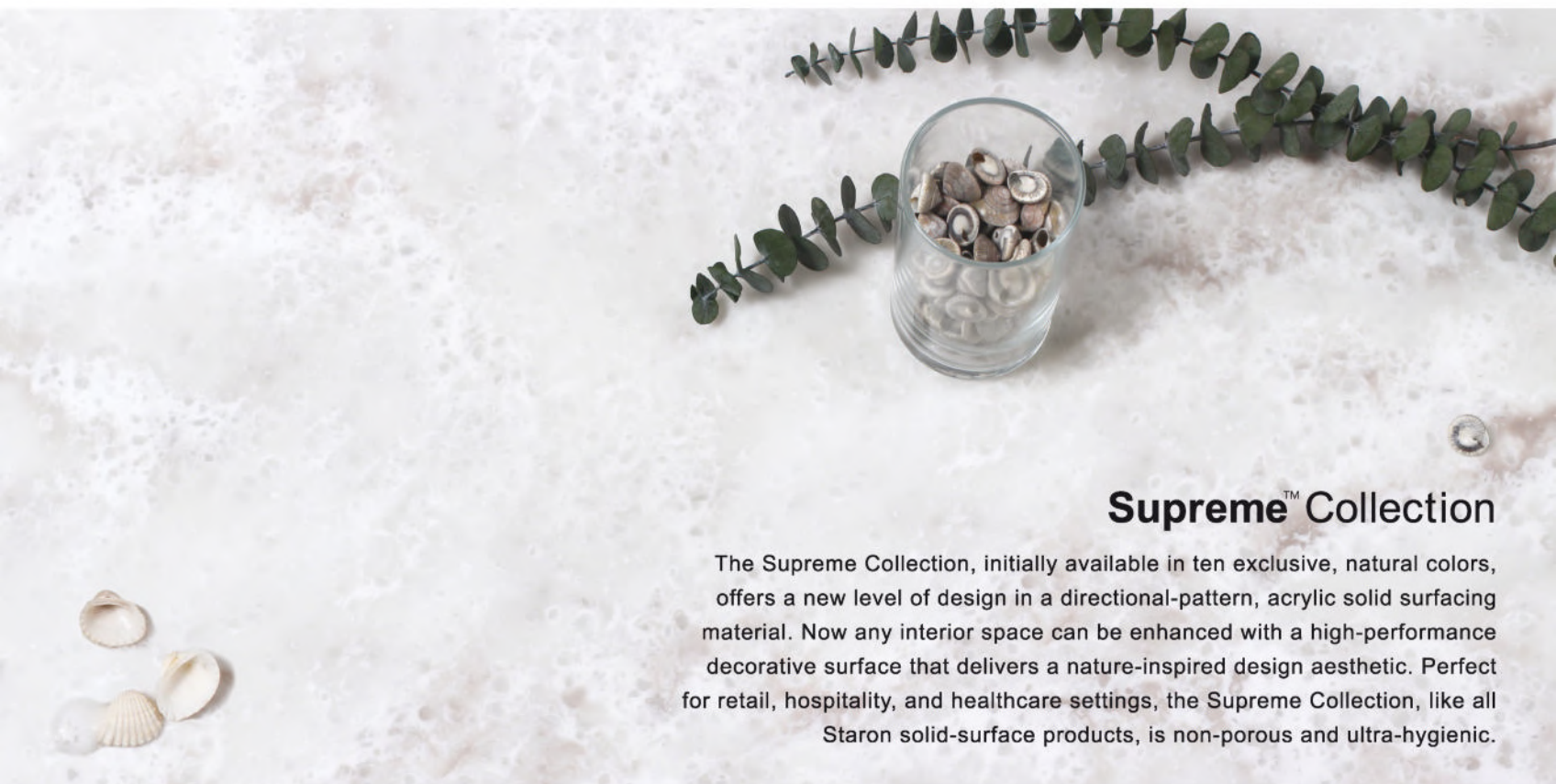
In the belly of the original cinema, the architects inserted a proscenium theater with movable risers for seating for up to 285 people. To bring the scale of this high space down and make it more intimate, while providing a framework for adapting acoustics, the team hung a series of perforated metal panels from the ceiling. And the proscenium serves double duty as a shear wall, stiffening the middle of the building. But care was taken to preserve the spirit of the old facility, and particular details have remained, such as graffiti backstage, which memorializes some of the less savory activity that took place during the Strand's squatter days. "We wanted to honor each era of the building and expose its history, and not take all of the kinks out," says Duncan, pointing to the original plaster walls (now painted a vibrant red), pilasters, and moldings, and noting that this had never been an ornate theater, always a workhorse. "But with the intervention, we wanted a contrast," he says.

On a recent fall afternoon, the lobby buzzed as teenagers hung out after class, and the older set socialized over coffee. While serving as a marquee for this thriving arts program, the building has quickly become a beacon for the neighborhood and an emblem of its evolution. ■

Originally a single-auditorium theater, the Strand now contains two main spaces. A shocking-red proscenium theater (above) blends original details with modern interventions. A black-box theater can be configured for a host of uses.



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FOUNDED: 2012

DESIGN STAFF: 15

PRINCIPAL: Yichen Lu

EDUCATION: Yale University, M.Arch., 2008; Tsinghua University, B.A., 2000

WORK HISTORY: Steven Holl Architects, 2010-12; Gehry Partners, 2008-10; Atelier FCJZ, 2003-05; China Architecture Design & Research Group, 2000-03

KEY COMPLETED PROJECTS: Shenzhen Bay Gallery, Shenzhen, China, 2015; China Pavilion for Expo Milano 2015, Milan, 2015; AVIC Gallery, Guiyang, China, 2014

KEY CURRENT PROJECTS: Xiaojingwan masterplan, Shenzhen, China, 2016; CRLand Archive Library, Shenzhen, 2016; MiMA Public Space Renovation and Extension Project, New York, 2016; 42nd Street Penthouse Gallery, New York, 2016

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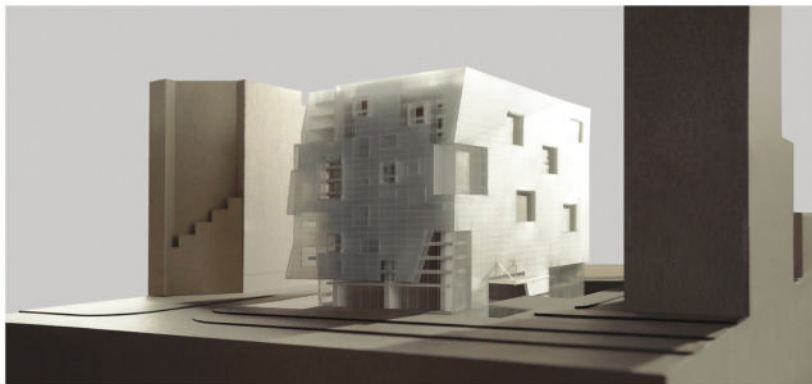
SHUTTLING THROUGH time zones is second nature for Yichen Lu, the 39-year-old founder and principal of Studio Link-Arc. Lu—a Shanghai native who doubles as an associate professor at Tsinghua University in Beijing—spent this year bouncing between New York and China, with frequent stops in Italy to supervise the construction of the Milan Expo’s China Pavilion. But despite the firm’s global reach, each of its projects remains deeply local. Its aim is to build structures that foster dialogue between people and their natural surroundings. By weaving nature into the built environment, Studio Link-Arc aims to construct what Lu calls a “second nature” of its own.

“Nature, rather than man-made structures, is the eternal theme of architecture,” Lu says. This idea shone through every bamboo panel of the China Pavilion’s roof, a four-layer feat of digital fabrication and parametric design that hovered over a carefully paced sequence of spaces. The temporary pavilion was built for the six-month Milan Expo, which ended on October 31. However, the structure’s roof, which merged the profile of a city skyline with topographical curves, evoked the permanence of an urban landscape. The sun beamed through a translucent PVC membrane beneath the panels, casting shadows that stretched and shifted across the pavilion’s interior as the day passed. “It’s a building that can record time,” Lu says. Such fluid yet precise interactions with the elements occur at varying scales across Link-Arc’s portfolio, from renovations to new gallery spaces. In the firm’s current furnishings project for Milan’s 2016 Design Week, nature serves as an inspiration, as the team is experimenting with patterns and folds that mimic mountains and waves.

Lu likens the firm’s design process to the creation of a storyboard in film: in the China Pavilion as well as in its gallery projects, the transitions between one space and the next are carefully choreographed. Limiting the size of their buildings is crucial to the dance. Even with big residential developers in China, the firm commits only to projects at fewer than 100,000 square feet in size. With high-rises shooting up all over the country, staying relatively small creates “a lot of economic pressure,” Lu says, but the 15-person firm remains adamant about building on a limited scale at a careful pace.

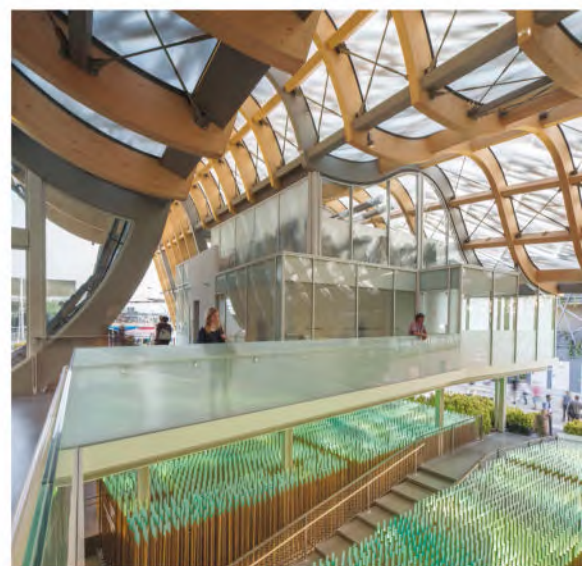
After earning his undergraduate degree from Tsinghua University and his M.Arch. at Yale, Lu worked for Yung Ho Chang at Atelier FCJZ—China’s first independently licensed firm. According to Lu, Chang’s aim was to “redefine contemporary architecture in China” and to promote dialogue between Chinese architects and the rest of the world. Inspired by Chang to think globally, Lu spent two years working for Frank Gehry, his Yale advisor, on the Guggenheim Abu Dhabi, and then spent another two years as a project manager in China for Steven Holl before opening his own office in 2012. At both firms, Lu gained experience with cultural projects, which make up most of Studio Link-Arc’s work, but he hopes to expand his portfolio to include schools and more commercial projects.

Currently, the firm is working on a roof terrace atop a residential building in Manhattan, a library in Shenzhen, and several competition entries across Europe. Says Lu, “Traveling keeps us sharp to our surroundings and to cultural differences.” *Rebecca Seidel*



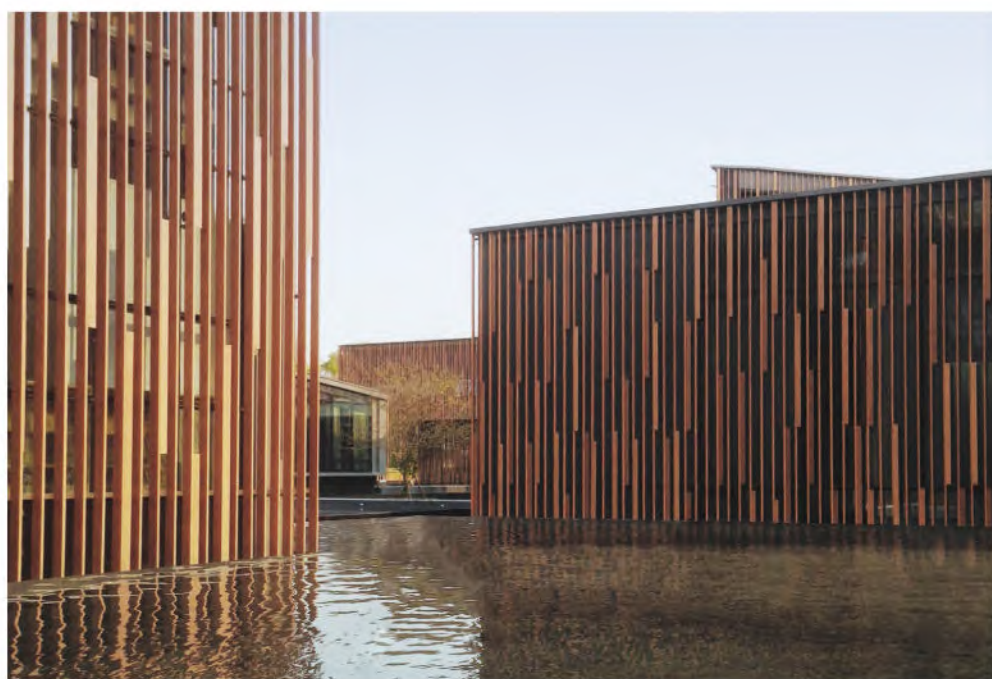
Fraser Suite Hotel

The architects transformed a modernist dormitory-style apartment building in Shenzhen’s Huaqiangbei district into a 200-room boutique hotel, aiming to distinguish it from the lighter, glass-clad office buildings nearby. Layering a volumetric facade onto the existing substantial concrete structure, they attuned each side to its urban context: the western facade features subtractive voids that frame views of a city park, while the northern face contains additive “sunlight rooms” that are angled upward to welcome daylight and preserve privacy (a busy street runs below). The other two facades are flatter, giving adjacent buildings breathing room.



Milan Expo: China Pavilion

Envisioning a “Land of Hope” that would merge the urban and the pastoral, Studio Link-Arc and a team from Tsinghua University designed a long sequence of exhibition spaces shaded by a sloping roof. The timber-framed, bamboo-paneled roof bridges a mountainous silhouette on its south end (left) with a profile of the Beijing skyline on its north end. The architects used parametric analysis to match 1,052 shingled bamboo panels to the shape of the roof’s curvilinear structure; they ended up with 287 distinct panel shapes. A waterproofing PVC membrane and a series of stainless-steel rafters complete the four-layer roof system.



AVIC Gallery

A reflecting pool unifies this cluster of cubic structures, located at the center of a dense residential development in Jinyang, southwest of central Guiyang. The buildings—which include a reception area, private meeting rooms, an exhibition space, and a café—are clad in patterned metal screens resembling bamboo groves. Because the buildings are situated at varying elevations, they each establish a distinct visual relationship with the pool. Countering a topographic depression at the project site, the architects raised the ground plane to establish this new set of sectional relationships.

Studio Farris

Antwerp, Belgium



FOUNDED: 2008

DESIGN STAFF: 15

PRINCIPAL: Giuseppe Farris

EDUCATION: IUAV, Venice, M.Arch., 1999

WORK HISTORY: No previous employment

KEY COMPLETED PROJECTS: City Library Bruges, 2015; Park Tower, Antwerp, 2014-15; Farmhouse, Lennik, 2013; VRT Radiohouse, Leuven, 2012; Flemish Parliament, Brussels, 2010 (all in Belgium)

KEY CURRENT PROJECTS: Antwerp Zoo, 2016; Headquarters De Persgroep, Kobbegem, 2017; Diamond Quarter, Antwerp, 2018 (all in Belgium)

WWW.STUDIOFARRIS.COM

An Italian architect finds fertile soil in the Low Countries for his convention-challenging designs.

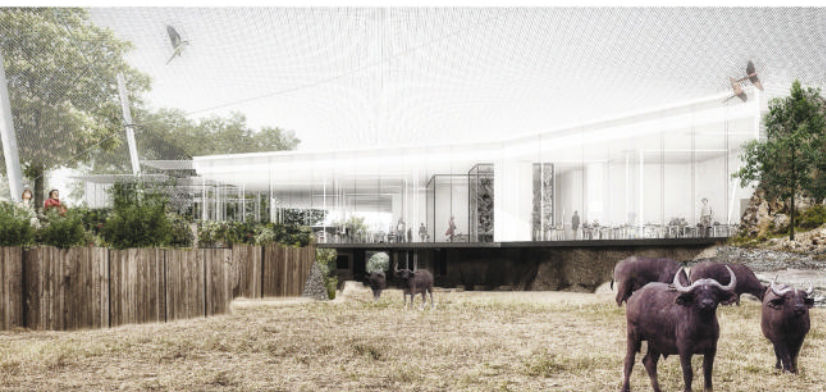
THERE IS no aesthetic signature to the diverse buildings produced by Studio Farris since its formation in Antwerp, Belgium, in 2008. They range from a renovated farmhouse with a quietly subversive relationship between new glass and rustic brick to an intentionally iconic “woven” tower proposed for Dubai. What connects them, suggests founder Giuseppe Farris, 43, is not a house style but its opposite—a pragmatic approach that eschews preconceptions and proceeds from the critical interrogation of a brief.

It was this propensity to question that guided Farris’s path to Antwerp from his home on the Italian island of Sardinia. He studied first in Venice, under Aldo Rossi and Manfredo Tafuri, before moving abroad in search of alternatives to Italy’s architectural conservatism. In London he shadowed a friend at the experimentally inclined Architectural Association, though he did not formally enroll. “Super Dutch” architecture was then grabbing international attention, and Farris headed to the Netherlands and neighboring Belgium in 2001 to take advantage of “a very energetic moment in those countries when every studio was looking for new people and ideas.”

The opportunity to establish his own office came with a commission to design a house for a friend, and another for the farmhouse. But it was Belgium’s well-run competition system that gave an outsider the chance to make public buildings. His first success was a project to redesign the entrance hall of the Flemish parliament. Farris’s proposal challenged assumptions inherent in the brief, setting the pattern for subsequent projects. The requirement to accommodate a space-hungry mix of activities threatened to compromise appreciation of the historic interior, so Farris proposed a lightweight two-story pavilion at one end of the room, within which multi-functional spaces support the heterogeneous program. Its formal and material language derives from the architecture of the hall, drawing attention to its surroundings as well as itself.

Reconciling a respect for context with the desire to give an intervention its own character was also a central preoccupation in the extension of a public library in Bruges. While the low-rise addition is formally subordinate, its rusty steel cladding contrasts with the white plaster of the historic building, introducing a deliberate “tension” between the two. This feeling for the particularities of place has deep roots. “It is my cultural baggage,” Farris explains. “Every Italian architect is born in a place with a lot of history, where you have to be careful of the consequences in adding the new to the old.” But his work is refined by “the critical ability that you gain by working outside the culture in which you were born.”

Developing an international perspective was one of Farris’s aims in establishing his practice. The studio is beginning to work overseas and is pushing into new professional territories, as in a project for a radio station that encompasses the design of its furniture and graphic identity. Looking more broadly, Farris says, “We want to make buildings that can improve the quality of the city, and of life.” *Chris Foges*



Antwerp Zoo

A restaurant under construction at the Antwerp Zoo comprises a 500-seat indoor dining area and a 500-seat outdoor terrace under canopies of varying height, borne by slender columns. The building sits at the conjunction of key routes through the park. Its irregular plan and form is intended to present intriguing prospects to approaching visitors. An underpass running beneath leads to an adjacent aviary.



City Library Bruges

Occupying a tight, asymmetric urban site in Bruges, this Cor-Ten steel-clad extension to a public library was intended to give it greater prominence on the street without overshadowing other institutions sharing the existing building. Large windows at each corner of the 6,000-square-foot building counteract the sense of disconnection from the outside world sometimes found in libraries, while skylights provide additional daylight. Book storage is grouped in the center of the plan, with working areas around the perimeter.

Park Tower

Comprising 360 dwellings, the 256-foot-high Park Tower is among the tallest in Antwerp. Above commercial premises at ground level, 10 floors of studio apartments accommodate students and single-person households, while elderly-care facilities are incorporated alongside larger apartments in 10 additional stories above. Each unit has a private balcony, shielded from sea-winds by a delicate veil of fixed frosted-glass panels that lend depth and animation to crisp white concrete facades.



Arch Studio Beijing



FOUNDED: 2010

DESIGN STAFF: Varies between 7 and 10

PRINCIPAL: Han Wen Qiang

EDUCATION: China Central Academy of Fine Arts, M.F.A., 2005; China Central Academy of Fine Arts, B.F.A., 2002

WORK HISTORY: Zhong Mei Han Mo Design, 2005–09

KEY COMPLETED PROJECTS: Rongbaozhai Coffee Bookstore, Beijing, 2015; Teahouse in Hutong, Beijing, 2015; Great Wall Art Museum, Zi Bo City, 2015; Renovation of Xinsi Hutong House, Beijing, 2014; Lelege Art Space, Beijing, 2014; Rongbaozhai Western Art Gallery, Beijing, 2013; Courtyard House, Beijing, 2010

KEY CURRENT PROJECTS: Villa in Hai Tang Gong She, Beijing, 2016; Organic Farm, Tangshan City, Hebei Province, 2016; Poly Music World, Beijing, 2016

WWW.ARCHSTUDIO.CN

A 5-year-old firm uses tension between the historic and the modern to create harmonious places.

A **SHORT** walk down a ramshackle alley typical of Beijing's *hutong* neighborhoods leads to a pivoting steel door deeply recessed between a pair of gray-brick buildings. Go through it and you are immediately swept away from the noise and frantic pace of the big city. A sleek glass corridor connects a trio of the tiny courtyards that comprise *hutongs* and a set of one-story structures, three of which are new and two that have been restored. Old and new, indoors and out fuse seamlessly. What had once been a crumbling courtyard residence now serves as a teahouse and retreat for the owner, a dealer of painting and calligraphy. The way the design resolves opposing elements says much about the work of Han Wen Qiang, who founded Arch Studio in Beijing in 2010. "What I want to do is find the wisdom of Chinese tradition and convert it to the construction of contemporary space that responds to the needs of today's society," says Han.

Born in Dalian, a coastal city about 300 miles east of Beijing, Han studied architecture at the China Central Academy of Fine Arts (CAFA) in Beijing, where he now teaches. As a student at CAFA, one of the top arts schools in China, he was drawn to architecture because it could "influence or even change people's lives," he says.

Since founding the studio, he has executed a series of striking renovations that create bold juxtapositions between old and new. In doing so, he finds a way of anchoring the modern in China's cultural heritage—using proportions and spatial strategies that obey the old rules. At the teahouse, for example, the new buildings occupy the same footprints as previous structures on the site and the glass corridor serves as a modern extension of the courtyards it helps define. For the Rongbaozhai Coffee Bookstore, also in Beijing, Han preserved the pseudo-Classical Chinese facade from the 1980s in a sly nod to recent history, while inserting an elegant, almost Zen-like, interior where glass walls promote transparency and a coffee bar/cashier in the center of the main floor helps bring the bookstore into the 21st century. A skylit courtyard in the back of the store and planters set within slender iron bookshelves connect visitors to nature, an ancient theme in Chinese architecture. Like that found in traditional Chinese gardens, the nature here is "artificial," carefully orchestrated to focus attention on particular views and to recall famous poems and paintings.

Han has worked on a number of projects for cultural organizations, transforming existing buildings into modern spaces for art. Not far from the bookstore, he took another traditional Chinese structure and created a sleek home for the Rongbaozhai Western Art Gallery. Using wood-slatted screens, a glass-enclosed stair, and cool white surfaces, he ensconces visitors in a cocoon of soothing materials and light. "I want my architecture to be slow-paced and friendly," says Han, "and to create a harmony with nature and history." He has also designed projects for the Lelege Art Space, a gallery in Beijing, and the Great Wall Museum of Fine Art, an old industrial building in Shandong Province he adapted for cultural uses. He is currently working on an organic-food factory and a waterfront teahouse, both in a rural part of Hebei Province.

Asked about his approach to history, Han says, "Architecture is like a man—it has a past and a future. When I renovate a building, I think it should reflect traces of time, because that is part of its story and shouldn't be erased. New and old should be able to coexist and communicate with each other." *Clifford A. Pearson*

Rongbaozhai Western Art Gallery

Located in a two-story building on Liulichang West Street in Beijing, this project for the Rongbaozhai Western Art Gallery was inspired by traditional Chinese screens, which are recalled in folding partitions that can reconfigure a large space on the second floor as smaller galleries. The partitions have wood slats at the top and bottom to allow light and air to circulate and are cousins to the fixed floor-to-ceiling slats on the first floor (left). A wall of wood drawers and inset vitrines on the first floor, along with a glass-enclosed stair and polished white floors throughout the project, establish a minimalist aesthetic that is sleek but engaging.



Teahouse in Hutong

After analyzing the five small structures of a crumbling courtyard house in one of Beijing's *hutong* neighborhoods of courtyards and alleys, Han decided to repair the two oldest and rebuild the other three. He inserted a glass-enclosed corridor that snakes around the 4,850-square-foot L-shaped compound to define a trio of small new courtyards. The original wood columns and restored wood roof timbers in the old structures bring the past alive in this contemporary place for enjoying tea and retreating from the hectic pace of modern Beijing.





Courtyard House

As he does in many of his projects, Han manipulates traditional materials and strategies here to create a thoroughly modern work. This 3,200-square-foot house in an old part of Beijing has the same gray bricks as its older neighbors, but they're set in courses with spaces in between, so light and air can filter into an entry courtyard. Two other yards—on one side and at the rear—create an intriguing back-and-forth between inside and out and bring daylight into the small building on a tight site.



Great Wall Museum of Fine Art

Arch Studio converted an old pharmaceutical factory in the town of Zi Bo in Shandong Province into a museum, taking advantage of the long-span concrete structure to display art. The architects designed a glass-walled hallway that weaves around and inside the 40,000-square-foot structure from the 1940s, contrasting new and old and connecting a series of galleries, a bookstore, a tearoom, and a multifunction space.



Rongbaozhai Coffee Bookstore

After a recent renovation, an old-fashioned store in Beijing that sold Chinese paintings, calligraphy, and books has become a modern bookstore that serves coffee and brings plenty of daylight to reading and selling spaces. Han cleared out small, dark rooms to create flowing spaces and a small skylit courtyard in the back. Bookshelves made of slender iron bars and thin iron plates allow views through the store and include small planters that add touches of green all around. A new glass curtain wall set behind an existing pseudo-Classical Chinese facade from the 1980s expresses a sophisticated layering of history.



Losada García Architects

Cáceres, Spain/San Diego



FOUNDED: 2008

DESIGN STAFF: 4

PRINCIPALS: Ramiro Losada Amor,
Alberto García Jiménez

EDUCATION: Losada Amor: UE-Madrid, M.Arch.,
2006; Universidad de Cáceres, M.Eng., 2001.
García Jiménez: UE-Madrid, M.Arch., 2008;
Universidad de Cáceres, M.Eng., 2004

WORK HISTORY: Losada Amor: Mecano,
2006-07; Rueda Pizarro, 2005; F.O.A. 2004.
García Jiménez: De La Puerta Asensio, 2008-11;
Rueda Pizarro, 2007-08

KEY COMPLETED PROJECTS: La Gota Cultural
Center/Tobacco Museum, Navalморal (Cáceres),
Spain, 2015; STEAM Pavilion, San Diego, 2015;
Plaza Castilla Kiosk, Madrid, 2014; ARCO Fair of
Art Stand, Madrid, 2010

KEY CURRENT PROJECTS: Peraleda House,
Peraleda (Cáceres), Spain, 2014-16; Torres
House, Navalморal (Cáceres), Spain, 2015-16;
Interior Library, San Diego, 2016

WWW.LOSADAGARCIA.COM

In the face of a weak economy, two partners expand their practice across continents.

GLOBE-TROTTERING AND media savvy, up in the Cloud and down-to-earth, Ramiro Losada and Alberto García represent a new breed of Spanish architect. While previous generations often sought the limelight by editing a magazine, as did Rafael Moneo, who cofounded *Arquitecturas Bis* in the 1970s, Losada, 35, and García, 33, launched Studio Banana TV, a multimedia platform that produces interviews and documentaries about design, art, and culture on the Web. They opened their first office in Madrid in 2008, but work was scarce due to Spain's economic crisis. Losada decamped for southern California, where he teaches at the New School of Architecture & Design in San Diego, and García returned to the rural province of Cáceres, in western Spain, where they both grew up and were childhood friends. To maintain this bicontinental partnership, the two communicate daily via WhatsApp, in the car or on the jobsite, as if they were both still back in Madrid.

Web-based media have influenced the concepts and values on which the men build their designs. In their largest project to date, La Gota Cultural Center and Tobacco Museum in their hometown of Navalморal, the irregularly stacked, glazed floors are screened by a mesh of ceramic tiles mounted on wires. With its lack of depth and visible structural support, this fabric-like curtain reads in photographs almost as a computer rendering. According to the architects, it creates "a dematerialized elevation of refined geometries."

The conceptual element of their designs tends to be visual associations. Thus they compare the overlapping floors of La Gota Center to the branching pattern of leaves of a tobacco plant, in that each of them are both "alike and different." For the Espacio Gourmet, a food kiosk in Madrid's main business district, they found inspiration, without a trace of critical irony, in the modest social housing from the early 20th century that survives nearby.

Both partners trained as project managers before going on to study architecture, and this background gives them a solid hold on construction detailing. "In rural Cáceres, you can't always work with every construction system," Losada points out. "But we understand this not as a problem, but an advantage." Meanwhile, in San Diego, he has been learning new management techniques, which he brings back to Spain.

Though they both worked at different times for Madrid architects Óscar Rueda and José Pizarro, and profess admiration for Luis Mansilla and Emilio Tuñón, they don't consider themselves disciples of anyone in particular, as was usually the case when Spanish architecture was more locally bound. "This probably has a lot to do with the internationality of the places where we've studied and worked," Losada observes. For Losada and García, like others of their generation, one of the challenges of contemporary practice is how to move in this virtual, dispersed, and quickly changing world without losing touch with solid ground. *David Cohn*



Espacio Gourmet (Plaza Castilla Kiosk)

The houses-like form and open facades of this long-term food kiosk, a sidewalk concession in a prominent Madrid plaza, are inspired by the "economical houses" from the early 20th century near the architects' former Madrid studio and the vibrant social life they promote. The structure was bolted together and enclosed with a lightweight insulated facade system finished in stucco for the roof and exterior walls, and ash wood for the interiors. Services are located in a basement and an attic-like upper level lit by a scattering of round skylights. The life of the bar spills out onto the surrounding sidewalk.



La Gota Cultural Center/ Tobacco Museum

This competition-winning project combines galleries for paintings by local artist Sofía Feliu and temporary art exhibitions with a museum dedicated to tobacco, the region's principal crop. The glazed levels are superimposed in an irregular, crisscrossing pile that the architects compare to the branching leaves of a tobacco plant, producing balconies on every side. The facades' ceramic screens evoke the louvered openings of traditional tobacco-drying sheds. They also filter sunlight and create an insulated air cushion in front of the sheer glass walls. An entry plaza features a vertical garden planted with tobacco and local vegetation, which extends into the lobby.



Peraleda House

Located in a rural town in western Spain, the house is relatively closed to the street but opens up around an interior garden, overlooked by a fully glazed upper gallery. The stone of the facades was mandated by local building ordinances to maintain the character of the town. Its deeply set staggered openings respond in scale to those of a church across the street, and reference works such as Ronchamp or Mansilla and Tuñón's León Auditorium, according to the architects. "We maintain the memory of the place on the exterior," Ramiro Losada explains, "but contemporize the interior facade, where we had more freedom."



O-OFFICE Architects

Guangzhou, China



FOUNDED: 2007

DESIGN STAFF: 12

PRINCIPALS: Ying Jiang and Jianxiang He

EDUCATION: Jiang: Ecole d'Architecture de Versailles, D.P.L.G., 2004; South China University of Technology, B.Arch., 1999; He: KU Leuven, M.Arch., 1999, M.E. in Arch., 2000; South China University of Technology, B.Arch., 1996

WORK HISTORY: Jiang: BURU II, Belgium and China, 2005-07; AAUPC, Paris, 2004-05; He: CITIC ADI, 2003-07; VK Group, Belgium, 2001-03.

KEY COMPLETED PROJECTS: iD Town Art District, Shenzhen, 2014; Silo Reconversion, Shenzhen, 2013; Silo top office, Guangzhou, 2013; EMG Art Gallery, Guangzhou (all in China)

KEY CURRENT PROJECTS: Silver Tower, Nanning, 2016; Tian An Cloud Hall, Shenzhen, 2017 (both in China)

WWW.O-OFFICEARCH.COM

A love of China's abandoned industrial heritage inspires the bold work of a rising firm.

IN 2005, architects Jianxiang He and Ying Jiang were working on the Guangzhou Baiyun International Convention Center, a project by the Chinese-government-run CITIC ADI and its design partner, Belgian firm BURU II. At the time, He was the chief architect for CITIC ADI in South China and Jiang was working for BURU II. While the enormous project taught the two architects much about design, construction, and even their own society, they were left “feeling disappointed about the situation,” says Jiang, specifically about issues relating to “speed, quality, quantity, and powerful clients.” She adds: “Very few people care about the quality and cultural value of architecture. That’s really sad for us.”

So, He, 43 years old, and Jiang, 39, who are married, decided to open an independent studio in the southern Chinese city of Guangzhou and find private clients—no small feat, considering that so many projects in China are sponsored by the government. But the architects have developed a steady stream of work that allows them to tackle some of the most pressing problems facing their region, from its abandoned industrial sites to the lack of affordable housing to a skyline thick with anonymous skyscrapers.

The couple met through mutual friends while they were studying in Europe (she in Paris, he in Belgium); even though they both received their B.Arch. degrees at the South China University of Technology in Guangzhou, they didn’t cross paths there. Each grew up in Guangzhou and has powerful memories of it as an industrial hub and the communal living and working that came along with that. “After the reform policy, everything changed rapidly,” says He, referring to Chinese leader Deng Xiaoping’s economic reforms of the late 1970s and early 1980s. “A lot of this old industry went bankrupt. The city grew really fast, but within the city center, there were a lot of ruined conditions and vacant factories.”

Jiang and He have a fondness for these vacant factories. They’ve made their office at the top of a silo building in the city’s old downtown. For the 2013 Bi-City Biennale of Urbanism\ Architecture, organized by Hong Kong and Shenzhen, China, the architects inserted new paths, stairs, and walkways into a former glass factory in Shenzhen. Many of the walkways were made of glass, allowing visitors views of different levels above and below them. And at an abandoned dye factory on a 20-acre site in Shenzhen, the architects converted three buildings into galleries and workshops, a museum, and a modest hotel. This was an unusual project, says Jiang, because most developers want to demolish these kinds of sites. Even though a conversion takes more time and effort—for both the developer and the architects—it is worth it to O-OFFICE and the client, who gets a distinctive property that stands out from the rest of the market. “There is something really special about these sites—the history, the people who used to work there,” says Jiang.

“We see these historic industrial buildings as a new opportunity for the city,” adds He. “Outside of this area, the city is generic—skyscraper housing, offices, shopping malls without real context. We try to keep a critical distance from that.” *Laura Raskin*

Silver Tower

Tired of homogenous skyscrapers, Jiang and He designed this 330-foot-tall office tower in Nanning as an antithesis to the generic architectural character of most Chinese development. Efficient in form and plan, the typical office floors were separated by the architects into two sections sandwiched between three layers of panoramic glass. The rest of the facades are clad in a screen comprised of 9½-inch-by-9½-inch aluminum crosses, inspired by traditional window lattices in southern China.





Silo Reconversion

For the 2013 Shenzhen\Hong Kong Bi-City Biennale of Urbanism\ Architecture, O-OFFICE installed a series of ramps, walls, terraces, and glass floor panels in a Shenzhen industrial silo that was part of the former Guangdong Floating Glass Factory, one of the main sites of the three-month-long event. The installations provided unusual and hair-raising views through a rugged emblem of the region's not-so-distant industrial past.





GZ Specimen Gallery

Working again in a former factory, the architects designed an art gallery in Guangzhou, China, for EMGdotART Foundation, which has locations also in Peking, Shanghai, and Venice. Respecting the rectangular Brutalist concrete building, O-OFFICE inserted a cross-shaped public space for exhibitions and performances. The ceiling above is clad in translucent polycarbonate panels, with LEDs inside, making a clear distinction between old and new and balancing the factory's heavy materials with something light and ethereal.



Silo-Top Office

The architects converted the top of a 1960s silo structure at a former beer factory in Guangzhou, China, into their own studio. The office has views of the Pearl River, generic high-rises, and the city's old downtown. The upper portion of the building was pocked with square holes (for dumping wheat berries into the silos), so the architects filled most of these openings with metal planters. They also built a bridge connecting the top of the silos with a vertical-transportation tower at the east end.





iD Town Art District

O-OFFICE converted three former dye-factory buildings in Shenzhen, China, into a museum, gallery, and hotel for a new “tourist district.” For the gallery, the architects left an industrial workshop untouched and inserted a set of steel boxes that can rotate to maximize airflow and handle different needs. They also transformed an open concrete pavilion that was the packing area into the main exhibition space for the museum. For the hotel, they framed windows on an old workers dormitory in pop-out black-steel boxes and reconstructed dorm rooms on the ground floor to create a pair of large public spaces.

Mork Ulnes Architects

San Francisco/Oslo



FOUNDED: 2005/2006

DESIGN STAFF: 8

PRINCIPAL: Casper Mork-Ulnes

EDUCATION: Columbia University, M.S. Advanced Architectural Design, 2002; California College of Arts, B.Arch., 1997

WORK HISTORY: Modern Cabana 2005-11 (founding partner); Pfau Architecture, 1995-2005

KEY COMPLETED PROJECTS: Mules Ear Dr. Residence, Tahoe, CA, 2015; Akersveien Residence, Oslo, 2014; Meier Rd. Pavilion, Sonoma, CA, 2014; Meier Rd. Studio, Sonoma, CA, 2012; Trinity Rd. Residence, Sonoma, CA, 2011; Moose Rd. Residence, 2011; 20th St. Residence, San Francisco, 2011

KEY CURRENT PROJECTS: Mylla Cabin, Nordmarka, Norway, 2015; Svaestien, Ås, Norway, 2015; Adobe Way, Sonoma, CA, 2016; Trinity Rd. Guesthouse, 2016; California College of Arts, 2016

WWW.MORKULNES.COM

A bicultural practice produces a growing body of work distinguished by a quirky minimalism.

AS WITH culinary innovations like Korean beef tacos or the Cronut, architecture often benefits from cross-cultural influences. In the case of Casper Mork-Ulnes, his Norwegian origins combined with a California upbringing—thanks to a diplomat father—have turned out to be a happy fusion. “[We] Scandinavians are very stoic and practical,” he says. “But from living in California, this emphasis on functionality is cross-pollinated with a sense of optimism and playfulness. My architecture isn’t monastic in its simplicity.”

This freewheeling West Coast spirit comes across in the architect’s primarily residential practice. Mork-Ulnes designed a getaway in rural northern California that is essentially three periscopes pointed at different views; he reimagined a barn with an expressive butterfly roof and enough reclaimed barn siding for several hipster cafés; and he created a curving concrete dining pavilion with plants growing through holes in the floor and nicknamed it “the Amoeba.” It’s easy to imagine these buildings—along with the rest of the architect’s body of work—beginning as simple but evocative sketches. The 42-year-old architect originally attended San Francisco’s CCA (California College of the Arts) in the mid-1990s with the intention of becoming an artist or graphic designer. But his imagination was captured by some Aldo Rossi drawings, and a studio class with California modernist Jim Jennings led him to pursue his studies in architecture instead.

After completing a master’s degree in advanced architectural design at Columbia, he was among a group of architects who were drawn to the possibilities of prefabricated buildings. He cofounded a company called Modern Cabana, which produced more than 100 wood-clad studios, shipped as panels so customers could assemble the units themselves. The experience, along with his native *Janteloven* (a Norwegian term for modesty and restraint), has given Mork-Ulnes an affinity for limited budgets and particularly for economical claddings, including skateboard-ramp material and bonderized sheet metal. He has also used a combination of tar and linseed oil as an exterior wood finish, which is common in Scandinavia, but rare in the U.S.

In 2011, he moved his family to Oslo, a change of address precipitated by his wife, an interior designer with the firm and a fifth-generation San Franciscan, who wanted the experience of living in Europe, both for herself and their two children. He still maintains an active practice in San Francisco and hasn’t left his sunny California optimism behind. He is close to completing an 800-square-foot ski cabin in the wilds of Norway that emphasizes indoor-outdoor living. Instead of having a single pitched roof, the cabin has been deconstructed into a group of shed-like forms so that snow will collect and slide away from its two courtyards. “The design is 100 percent driven by the climate,” says Mork-Ulnes. Back in California, he’s also working on a master plan for a 30-acre development of modest ski-in cabins—a modern take on the European tradition of cross-country skiing to a warming hut. “It’s about cutting away the fat and paring away to the essentials,” says Mork-Ulnes. “Sometimes luxury is about simplicity.” *Lydia Lee*



Hanbury Street

For a 2014 competition that stipulated the redevelopment of an existing commercial stable in London’s hip Shoreditch district, Mork-Ulnes inserted a two-story mirrored cube within the glaze-roofed courtyard. This satisfied the client’s need for additional office space, while maintaining the historic nature of the building’s facade. Suspended from four pedestrian bridges, the hovering cube features a roof garden and effectively dematerializes, reflecting the textured brick walls around it.



Moose Road House

Two couples who purchased property in the Northern California town of Hopland asked Mork-Ulnes for a retreat that would take advantage of the site's three main views and would also leave the trees on the site intact. The home branches around the native oaks, using a steel-pier foundation to avoid damaging tree roots; its three prongs point squarely at the views. Built for \$170 a square foot, it has a simple floor plan that wastes no space on corridors, using bathroom volumes to delineate the two bedrooms. To keep costs down, the design team used bonderized sheet metal as cladding, unfinished plywood on the walls, and oriented strand board floors bleached with a traditional Scandinavian lye solution.



Meier Road Barn + Amoeba

Mork-Ulnes (with SFOSL) replaced a dilapidated barn on a three-acre family compound in Sonoma County with a contemporary version to house an art studio, a small office, and workshop. To maximize height and daylight, he inverted the classic gable into a butterfly roof. The building still cleaves to the agricultural vernacular with the extensive use of reclaimed barn siding. An adjacent concrete dining pavilion, dubbed the Amoeba, opens to a garden. (The architect is currently working on a design for a new guest-house on the property, which has a 1930s bungalow as its primary residence.)

Studio Anne Holtrop

Amsterdam/Bahrain



FOUNDED: 2009

DESIGN STAFF: 6 (3 in Amsterdam; 3 in Muharraq, Bahrain)

PRINCIPAL: Anne Holtrop

EDUCATION: HTS Utrecht, B.S. Building Engineering, 1999; Academy for Architecture, Amsterdam, M.Arch. 2005

WORK HISTORY: Krijn de Koning, 2005–09

KEY COMPLETED PROJECTS: Museum Fort Vechten, Bunnik, the Netherlands; National Pavilion of the Kingdom of Bahrain, Expo Milan, 2015; Batara, Wageningen University, Wageningen, the Netherlands, 2013; Temporary Museum, Heemskerk, the Netherlands, 2010; Trail House, Museum De Paviljoens, Almere, the Netherlands, 2009

KEY CURRENT PROJECTS: Relocation of the National Pavilion of Bahrain, Muharraq, Bahrain, 2016; Qaysariya Suq, Muharraq, 2016; Conversion of the former king's house to a museum, Muharraq, 2016

WWW.ANEHOLTROP.NL

Cross-pollination between disciplines and cultures informs the work of this self-starting architect.

THE 38-YEAR-OLD Dutchman Anne Holtrop talks about his work with an artist's sensibility, extracting form from existing, or completely random, conditions. He counts among his influences more artists than architects, and his first works were temporary structures, each within a museum context. That blurred line between art and architecture is one that Holtrop has been straddling his entire life.

As a child, Holtrop dreamed of going to art school, but his father encouraged him to pursue architecture instead. After completing four years at a technical school—where he “learned to construct things and calculate structures,” he says—he enrolled in the Academy of Architecture in Amsterdam. Though well-known in the Netherlands, the school doesn't have quite the international reputation of the nearby Berlage Institute. “It was a very Dutch environment,” Holtrop recalls. Tutors included OMA partner Reinier de Graaf and the leader of the Dutch structuralist movement, Herman Hertzberger. Yet today, according to Holtrop, people are surprised to learn he is from the Netherlands when they see his architecture. “This makes me happy, because my work is a very personal investigation.”

During his studies, Holtrop worked at several Dutch firms, including Claus en Kaan Architecten, and completed a research project with de Graaf. But upon graduation, he took a job as an assistant to artist Krijn de Koning. Influenced by an earlier generation of conceptual artists like Christo and Jeanne-Claude and Daniel Buren, whose large-scale pieces interact with the landscape or built environment, de Koning makes site-specific works that are part architecture and part sculpture.

“For me, the work of those artists is very architectural with respect to size and location,” Holtrop says. But unlike architects, they don't necessarily begin projects in response to a commission. “That helped me to start my own practice, convincing me to take a more autonomous position rather than waiting for an assignment from a client.”

Holtrop relied on grant money instead of the resources of a client to build his first architectural projects. The Trail House and the Temporary Museum were sinuous plywood structures, the form of the first inspired by the existing contours of the landscape, the latter derived from inkblot drawings. “Those were spatial investigations, and the material was not important at all,” admits Holtrop. “Plywood is a cheap material that made it possible to build all those curves.”

Those early temporary works gave way to substantial projects for Holtrop's small but global practice, including the competition-winning Museum Fort Vechten in Bunnik, the Netherlands, and the Bahrain Pavilion for the Milan Expo 2015—each one, says the architect, an “appropriation of form.” According to Holtrop, the design for these concrete structures did not change at all from the initial concept. “What I proposed in the museum competition, we completely made, with no concession,” he says. “I'm sure I could not have done these buildings in this way if I had not done the other works.”

The Bahrain Pavilion, which is being transported to Bahrain itself as a permanent museum and botanical garden, has led to other projects in the small Middle Eastern nation, where Holtrop now lives with his wife. With offices in both Amsterdam and Bahrain, he continues to approach his work—including a residential project in Spain—as an artist. “What I'm interested in is how architecture can appear, not from a problem-solving perspective but my own point of view.”

Josephine Minuttillo

Batara

Its name taken from the Arabic word for “hewn,” Batara is an outdoor pavilion within an arboretum, one of many works collected by Wageningen University in the Netherlands since the 1970s. Holtrop calls it a “material gesture” whose free form emerged from pouring concrete within the existing contours of the ground. The walls have a soft, smooth inner side and a rough outer skin. “Normally, you construct, build up, assemble,” Holtrop says. “Batara is the opposite. Its form appears from the act of taking away.”





Bahrain Pavilion

The winning entry of an invited competition, the Bahrain Pavilion for the Milan Expo 2015 takes as its blueprint an abstract drawing of arcs and straight lines. “I wanted to work with a more geometrical pattern,” Holtrop explains. “Bahrain has a very ancient civilization; temples from that time are built of very different-sized blocks and arches.” The final composition features 350 unique concrete elements that separate indoor and outdoor spaces. The structure, including gardens, will be transported to Bahrain as a permanent museum.



Temporary Museum

For this 500-square-foot, temporary exhibition space in Heemskerk, west of Amsterdam, Holtrop invited several artists to show their work. The project, built in 2010 and open for two months, was a spatial investigation made of plywood. The form of the sinuous structure developed from hundreds of inkblot drawings that Holtrop created.

Museum Fort Vechten

Built in the center of one of more than 40 19th-century forts in the Netherlands, this museum welcomes visitors to a once-inaccessible area, teaching them about the history of the former defensive point. The 20,000-square-foot, below-grade structure features a 230-foot-long poured-concrete wall.

Baldrige Architects

Austin, Texas



FOUNDED: 2006

DESIGN STAFF: 10

PRINCIPAL: Burton Baldrige

EDUCATION: Columbia GSAP, M.Arch., 1999;
University of Texas School of Law, J.D., 1993;
University of Texas, B.A. & B.B.A., 1990

WORK HISTORY: Peter Gluck and Partners
Architects, 2001-05; a+i design corp., 2000-01;
Deamer & Phillips, 1998-2000

KEY COMPLETED PROJECTS: Gardner
Restaurant, 2014; Waller Creek, 2014; Baldrige
Architects' offices, 2013; Casis Elementary
Outdoor Learning Center, 2012; Stubb's
Greenroom, 2011; Deep Eddy Residence, 2010;
Avenue G Studio, 2009; Kimber Modern Hotel,
2009; Mohle House, 2006 (all in Austin, Texas)

KEY CURRENT PROJECTS: Branch House,
Austin, 2016; High Road House, Travis County,
2016; Ledgecroft House, Fredericksburg, 2016;
Hotel Rainey, Austin, 2017; Holy Cross Hall, St.
Edward's University, Austin, 2017; Arrive Hotel,
Austin, 2017; Pinwheel House, Austin, 2018 (all
in Texas)

WWW.BALDRIGE-ARCHITECTS.COM



A locavore firm imbues its designs with an “exuberant sense of sobriety.”

ALTHOUGH BURTON BALDRIGE, 49, entered the profession later than some, he has made up for lost time since founding his eponymous firm less than 10 years ago. Following law school at the University of Texas in Austin, and a four-year stint as a commercial litigator in New York, Baldrige switched gears, graduating from Columbia University's architecture program in 1999 and going to work for Peter Gluck. He moved to Austin in 2002 to serve as construction manager and on-site architect for Gluck's ambitious Floating Box House, then stayed in the city after the project wrapped up, establishing his own shop in 2006.

A native Texan, Baldrige has spent roughly half his life in the capital city and witnessed its evolution over the years. He recoils at the idea that Austin has one singular identity. “We don't embrace the faux narrative of an in-your-face, alt-country, hillbilly Frankenstein, Disney World version of Austin,” the architect says. Instead, the firm imbues designs with “an exuberant sense of sobriety”—treating each project's site and program with a quiet reverence.

The 10-person office splits its time among residential, commercial, and institutional projects, with frequent forays into adaptive reuse. A focus on tailoring spaces to experiences and interactions drives Baldrige's work. “We make sure there's complete simpatico between what the client needs and what would improve the site to really take a project to the next level.”

Designs for ground-up commercial projects, like the forthcoming Hotel Rainey in Austin, consider the adjacent public spaces in order to integrate seamlessly with the existing and future environment. For the boutique hotel, the architect is working with the city to reimagine the service alley behind the building as a public street and to provide a secondary entrance. “It has unwittingly become a much larger and cooler project,” he says, “because now we're talking about place-making.”

This attention to context is also apparent in the firm's adaptive-reuse work. Baldrige Architects' own office (a concrete-masonry building that was formerly a warehouse for a TV repair business) and the post office-cum-restaurant Gardner (ARCHITECTURAL RECORD, September 2015) retain details from the original structures but reinterpret them in new ways.

When the 2008 recession hit, small public jobs sustained the young firm—both creatively and practically. “We were faced with the problem of trying to carve out our identity and convey our ambitions in an environment where there wasn't any money,” he says. “But you can do pro bono work no matter how bad the economy, since the mission of those projects is to lose money,” he jokes.

Lean days now past, the firm continues to pursue pro bono and public projects, including an open-air classroom for Casis Elementary School in 2012 and the temporary 2014 light installation Tracing the Line for the Waller Creek Conservancy. “We chase these small public projects,” Baldrige says. “They're a chance to do more speculative work and are good exercises in getting the team to loosen up and see possibilities we could employ in larger projects.”

Today, Baldrige says it's a great time to be an architect in Austin. “I've found myself turning down projects that five years ago I'd have gnawed off my arm to take.” With out-of-town jobs in the pipeline, such as a desert-modern residence in the Texas Hill Country town of Fredericksburg, and plenty on its plate in Austin, the office finds itself pushed and pulled in new ways. “There's a constant tension between our desire that everything be thoroughly detailed and considered, but also not letting that hold back the more ambitious thinking on the projects,” says the firm's founder. “Overall, it's the cohesiveness of the idea that always matters the most.” *Miriam Sitz*

Outdoor Learning Center

An outdoor classroom, completed in 2012 for Casis Elementary School, exemplifies the type of small-scale, fast-paced, public design-build projects that the firm often pursues apart from its residential and commercial work. “It's extremely fun to work with a program free of things like mechanical infrastructure and plumbing,” Baldrige says. “We were liberated from the codes that constrain design, and everybody got a taste of what the potential of architecture is.”



The Pinwheel House

The triangular multilevel residence with a sloping green roof has three wings, each meeting particular programmatic needs, that project from a central entertaining space. Public areas are connected around a conversation pit at the building's core, while private spaces are seamlessly secluded. "The initial equilateral-triangle shape had to do with getting out of the critical root zone of the trees," Baldrige explains. "How it pinwheels around a central node and cascades down is a function of the site."



Tracing the Line

The firm completed the temporary installation *Tracing the Line* for the Waller Creek Conservancy last November, using LED lights to create a meandering path of luminaires. "Our goal was to make something stunning," Baldrige says, "to provide a way for people to have a real physical experience of the entire length of the creek," a once-forgotten waterway that is now being revitalized. "And to do that with a budget of \$15,000 was just the world's most perfect problem."



Atelier ARS^o Guadalajara, Mexico



A legacy of industry and modernism provides a foundation for a firm that is just a decade old.

“THE ACROBATIC novelty of much of today’s architecture doesn’t interest us,” says Alejandro Guerrero. He and Andrea Soto describe themselves as traditionalists, with one caveat: their tradition is modernism. Both graduates of the Instituto Tecnológico y de Estudios Superiores de Occidente (ITESO), in Guadalajara, Mexico, Guerrero, 38, and Soto, 28, also grew up in that city, surrounded by modernist buildings, including work in the manner of Le Corbusier and Ludwig Mies van der Rohe. Guerrero founded Atelier ARS^o in Guadalajara in 2005, around the time he completed an extraordinary house on Lake Santa Maria del Oro, in Nayarit, Mexico, that seems to mimic Mies’s Farnsworth House. The idea behind quoting Mies, Guerrero says, is the same idea Mies had when he borrowed from Prussian architect Karl Friedrich Schinkel: “continuity.” Nonetheless, he says the building doesn’t copy the Farnsworth so much as critique it by, for example, using sliding glass doors, so air flows through the building. “Despite their visual similarity, they are quite different,” says Guerrero.

Soto joined as partner in 2010, in time to work on a house in Mar Chapálico that has large expanses of glass covered by panels of woven palo dulce wood. Since then, the designers, who are married, have completed several other houses in which modern structures—made of glass, steel, and concrete—are inflected with vernacular materials and forms. And they have taken the same approach to much larger projects, such as the Levering Trade Headquarters in Zapopan, Mexico, a sawtoothed building that makes industrial architecture beautiful. It’s a trick they also pulled off with a small building at ITESO, with elegant proportions that belie its utilitarian function as a painting shed.

Their breakthrough project may be their corn-processing plant for Novasem, in the desert outside Acatlán de Juárez, Mexico. The plant is composed of a kit of parts that they couldn’t alter much but were able to arrange in ways that shape several acres of the barren site. So interested are the couple in landscape that Soto is pursuing a master’s of landscape architecture at Harvard GSD while Guerrero holds down the fort in Guadalajara. “We began questioning the traditional separation of architecture from urbanism and landscape,” says Soto. “We have become convinced that the approach should be inclusive.”

In addition to more than a dozen completed projects in Mexico, the pair has created thoughtful entries for international competitions. One sought ideas for reusing the giant circular hole dug in Chicago for an unrealized Santiago Calatrava tower; their response was an underground columbarium that, in size and shape, recalls the Pantheon in Rome. It would, Guerrero says, provide “a multisensory experience. You could not only observe the space, you also could feel its coldness because it was underground, and you could smell the vegetation we had chosen.” And they designed a memorial for crime victims in Orange County, California, based on forms they call “timeless and universal.” Their guide was Adolf Loos’s admonition that among architects’ creations, only tombs and monuments are art. But Atelier ARS^o’s residential and commercial work seems to disprove that. *Fred A. Bernstein*

FOUNDED: 2005

DESIGN STAFF: 4

PRINCIPALS: Andrea Soto, Alejandro Guerrero

EDUCATION: Soto: Harvard GSD, MLA candidate 2017; ITESO, B.A., 2011; Guerrero: Universitat Politècnica de Catalunya, Barcelona, M.Arch., 2006; ITESO, B.A., 2000

KEY COMPLETED PROJECTS: TID Annex, ITESO University, Guadalajara, 2015; Levering Trade Headquarters, Zapopan, 2014; House and Studio in Mar Chapálico, Ajijic, 2014; House with 7 Courtyards, Zapopan, 2011; SMO House, Santa María del Oro Nayarit, 2005 (all in Mexico)

KEY CURRENT PROJECTS: Café Marina, Puerto Vallarta, 2015; Cultural Promotion Center, ITESO, Guadalajara, 2016; Atalaya House, Zapopan, 2016; Novasem Headquarters, Acatlán de Juárez, 2017 (all in Mexico)

WWW.ATELIERARS.COM



Mine the Gap

When the Chicago Architectural Club solicited ideas for using the vast round hole dug for an unrealized Santiago Calatrava spire, ARS^o responded with plans for a columbarium reached by a spiral stairway, which they conceived as a “sacred space for the city.” Its resemblance to the Pantheon is the kind of connection between buildings of different styles and eras that the architects have dubbed “intertectonicity.”



Levering Trade

In a warehouse for a marketer of electronic devices, the architects referenced 20th-century industrial buildings with sawtooth roofs, in this case emphasizing the “teeth” by exposing steel beams on the articulated front facade (which is made of cement panels and corrugated metal). In a simple yet effective formal move, they reversed the northernmost sawtooth to give symmetry (and thus importance) to the portion of the building containing meeting rooms for employees and clients.



Orange County Memorial

Avoiding what they see as a trend toward arbitrariness, ARS° prefers to work with architectural elements that it considers elegant and timeless. In this case, for a crime victims' memorial, those elements are the stela and the burial mound. They arranged 10 stelae (each lined in bronze) on one mound to create a linear void as a shimmering space of remembrance.



Novasem Grainery

Novasem, a company engaged in the production and processing of corn, commissioned this plant on the outskirts of Guadalajara. A pair of granaries in Cor-Ten steel is as monolithic as Richard Serra sculptures, positioned to create a linear space reminiscent of the architects' Orange County Memorial. Other buildings similarly frame and inflect nature. "A project of industrial architecture can become a landscape project," says Soto.



TID Annex

The small building at the Instituto Tecnológico y de Estudios Superiores de Occidente is used by architects and design students for applying paints and varnishes. To provide adequate ventilation, the architects designed it as a large flue. Its steel frame is fitted with oversized doors that are themselves covered in pinewood louvers. With light filtering between the louvers, the low-cost structure looks more like a Japanese teahouse than a shed with utilitarian functions.

OBBA Seoul



FOUNDED: 2012

DESIGN STAFF: 4

PRINCIPALS: Sojung Lee, Sangjoon Kwak

EDUCATION: Lee: University of Pennsylvania, M.Arch., 2008; Ewha Womans University, B.A., 2002; Kwak: Yonsei University, B.S., 2006

WORK HISTORY: Lee: MASS Studies, 2009-12; OMA (Rotterdam), 2008-09; OMA (Rotterdam), 2006-07; Kwak: MASS Studies, 2010-12; Space YEON Architects, 2006-10

KEY COMPLETED PROJECTS: The Oasis, Yongin-si, Korea, 2015; Open & Closed, Seoul, 2015; 50m² House, Seoul, 2015; Beyond the Screen, Seoul, 2013

KEY CURRENT PROJECTS: The Layers, Ganghwa-do, Korea, 2015; G House, Gyeonggi-do, Korea, 2016; HWN HQ, Seoul, 2016; Four Little Houses, Seoul, 2016; RK Tower, Seoul, 2017.

WWW.O-BBA.COM

A couple pushes the boundaries of local materials and methodologies to create a new design language.

“**THE WAY** we work together is like a ping-pong game,” says Sojung Lee, 36, about her partnership with Sangjoon Kwak, 35, in the Seoul-based OBBA (Office for Beyond Boundaries Architecture). “Instead of saying, ‘This is my work, and this is yours,’ one person will have an idea, then bounce it to the other. By doing that, we develop the idea and make it more concrete.” Unlike other architectural duos, where each partner brings his or her expertise to the union—the aesthete and the engineer, the designer and the businessman, the theorist and the realist—Lee and Kwak’s strength is in their cooperation.

The couple’s collaboration began at MASS Studies, a firm founded by Minsuk Cho in Seoul. (Cho’s former firm, Cho Slade Architecture of New York, was a Design Vanguard winner in 2000.) The two worked together on several MASS Studies projects and shared their frustration when those projects did not get built. In 2012, Lee was offered a commission while still working at MASS Studies. She asked Kwak, who had recently left the firm, to join her on the job, and OBBA was founded. The partners set up an office space in a soon-to-be-demolished building adjacent to the project site.

Lee and Kwak’s business partnership soon morphed into a romantic partnership. This was a risky move, Lee admits, as the end to one relationship might mean the end to the other. That didn’t happen, and one year after OBBA was founded, the workmates got married.

OBBA’s work in and around Seoul exhibits its local influence. Residential projects with austere brick walls and minimal fenestration may appear to Americans as severe, but, more accurately, this housing is a reflection of both the commonness of brick construction in Korea and local residents’ specific sense of privacy. Lee contrasts Korean housing with what she saw in the Netherlands, where she worked for OMA. There, houses had big openings onto the street, and the Dutch didn’t seem to care if people looked inside. In Korea, people do care, and OBBA’s work reflects this.

But it would be simplistic to say that OBBA merely responds to local precedents. Instead, the partners push themselves to work with new materials and new methodologies. Take, for example, OBBA’s first project, Beyond the Screen, a multifamily apartment building in a dense urban neighborhood. The architects used an openwork brick wall to screen a circulation/activity space from onlookers. But this element also serves as an attraction and a light source when viewed from the interior, and as camouflage for air-conditioning units when seen from the street.

In its first three years, OBBA has focused on housing. Lee says she would like to add cultural buildings and other programs to her firm’s repertoire, yet she does not want to expand the office to do so. OBBA now has two fresh-out-of-school employees who join the two partners in the conversations that drive the work. But the firm has no immediate plans to grow any larger. There are only so many places at the ping-pong table. *Clare Jacobson*



The Oasis

Built on the grounds of Alvaro Siza’s Amore Pacific Research and Design Center in Yongin-si, this bean-shaped exhibition pavilion provides seating and a sunshade for visitors to an art installation. Walls made of cotton thread appear from a distance to move and shimmer like rain, thus extending the oasis metaphor.



Beyond the Screen

OBBA's first project, this multifamily apartment building in Seoul, is actually two buildings connected by a brick-screened circulation/activity space. Partner Sangjoon Kwak says the space is as active in reality as it appears in the firm's design drawings. "When we visited it, we saw that many people put their plants in it, and little kids from the building played there. That was the moment we said, 'Yeah, this is really working.'" One of the apartments is shown (right).





50m2 House

This house for newlyweds on a budget sits at the edge of a low-income neighborhood in Seoul. Its small size keeps it from appearing ostentatious (and from having to follow regulations to build a parking space), while its combination of different materials and colors reflects the variety seen in neighboring homes. OBBA took advantage of the site's steep slope to create unique sectional experiences, which include a high counter in the kitchen that extends into a low dining table in the living room.



Open & Closed

This house in Seoul, built for an extended family in an increasingly multifamily neighborhood, stacks three floors of rooms to allow for a generous outdoor space and for openings to light and views. Quarters for the client's mother on the ground floor, the client's family on the third floor, and shared living space in the middle provide a balance of communality and privacy.

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ARTS CENTERS

As shown on the following pages, an assortment of arts centers in far-flung locations—from an Alpine mountaintop to a northern-Chinese wetland, from a small city in Spain to a warehouse in Brooklyn—all share one characteristic: ebullience. They also solve the various challenges of their sites and specific programs with structural and formal ingenuity that speaks to the creativity of their architects.



CaixaForum | Estudio Carme Pinós | Zaragoza, Spain

LEVITATING MASS

At a dynamic arts center, L-shaped volumes seem to float as they cantilever out to the surrounding city.

BY DAVID COHN

PHOTOGRAPHY BY RUBÉN B. PESCÓS

“Everything I do is aimed at dynamizing my work,” Carme Pinós declares, “because dynamism communicates lightness.” Indeed, everywhere you turn in the CaixaForum, the arts center she has built in Zaragoza, Spain, something seems to be in motion. It can be the pairs of entwined columns in the lobby, angling away from each other like swirling dancers, or the massing of the building itself, where the two L-shaped volumes containing the galleries cantilever out in different directions from the circulation core.

Pinós employs these active forms to create a sense of vibrant urban place in a desolate area formerly occupied by a rail yard. The project, the winner of a 2009 competition, was part of a large urban redevelopment plan, but neither the neighboring commercial buildings nor the large park behind them materialized, due to Spain’s economic crisis. The latest in a number of CaixaForums, sponsored by La Caixa Bank and dedicated to traveling art exhibitions as well as social and educational programs, the Zaragoza venue is an example of how the private sector has taken a lead role in commissioning Spanish architecture as funding for public works disappears. Despite its bleak surroundings,

UP IN THE AIR The building is raised two stories to free the ground plane (opposite). Perforated sheet-metal cladding gives the bulk a lighter feeling. At the back of the building (left), an outdoor emergency stair zigzags between dark polished-concrete supporting walls.



the center is a success, the Barcelona-based architect states, attracting 400,000 visitors in its first year.

Pinós conceived the project as a portal between the historic city center and the working-class neighborhood literally on the other side of the tracks. The main volume is lifted a full two stories above the ground, “allowing the park to pass through the building and reach the city,” says Pinós. The ground-floor lobby under it is roofed by a publicly accessible terrace, a prefabricated concrete slab that floats in a daring cantilever over its glass walls.

The twin projecting volumes of the galleries, which also contain



classrooms, offices, and a top-floor restaurant, are created from irregularly formed cubes overlapping in plan and shifted in section by one floor. Their outer faces are clad in gray metal panels, crisscrossed by patterns of perforations and backlit at night, giving the mass a sense of the lightness Pinós strives for. In contrast, L-shaped walls of dark polished concrete enclose the narrow side walls of the voids left by the intersection of the two volumes. The large trusses under the cantilevers are hidden behind the perforated cladding, but the ones at the roof, which respond to the tension loads of the overhangs, are exposed dramatically in the skylit ceilings of the top floor.

With its stacked organization, the building relies on elevators for circulation to the upper floors and escalators from the lobby to an underground auditorium. Additional escalators link the two galleries, located on different floors. Visitors can also use the public stair, whose triangular layout is boldly outlined by tube lighting that dances up the undersides of the balustrades.

“The idea was to make a more fluid connection between exhibitions,” Pinós explains. “The galleries are staggered in relation to each other, so when you leave one and approach the window in the escalator lobby, you see the city under the other. It gives you a moment of transi-

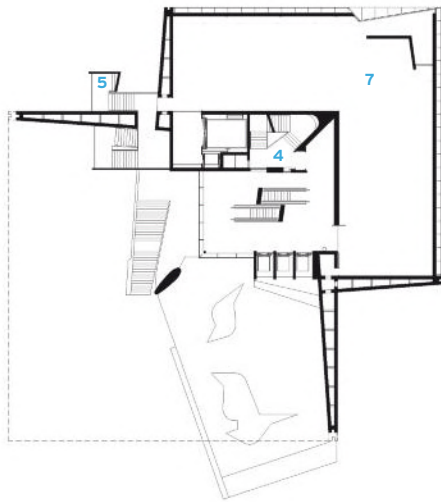


THIRD-FLOOR PLAN

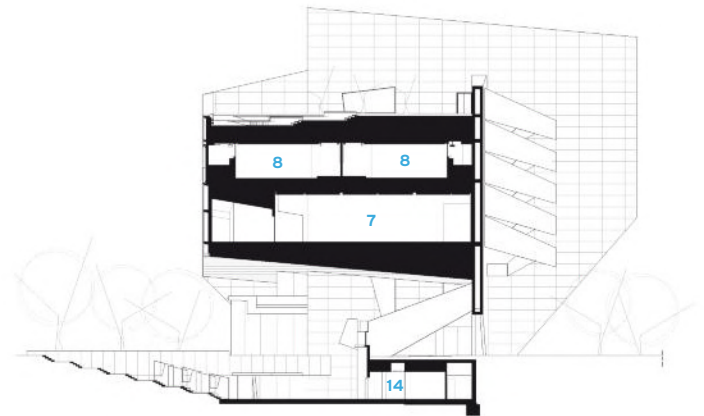
0 30 FT.
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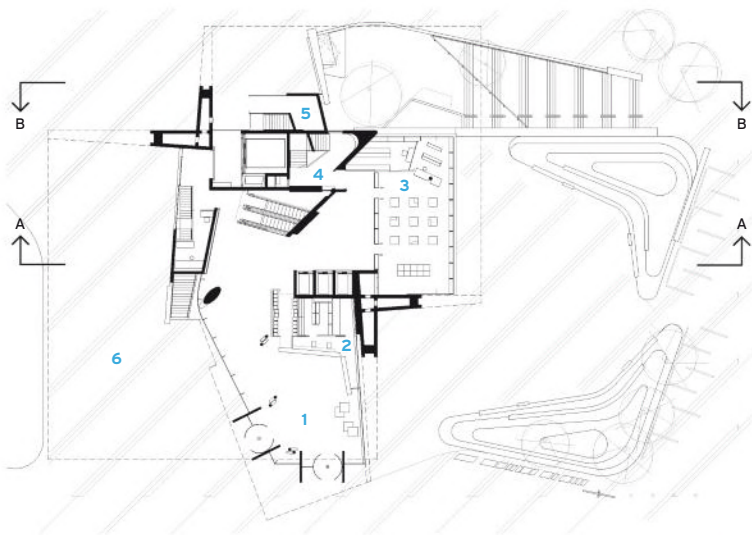
FOURTH-FLOOR PLAN



SECOND-FLOOR PLAN

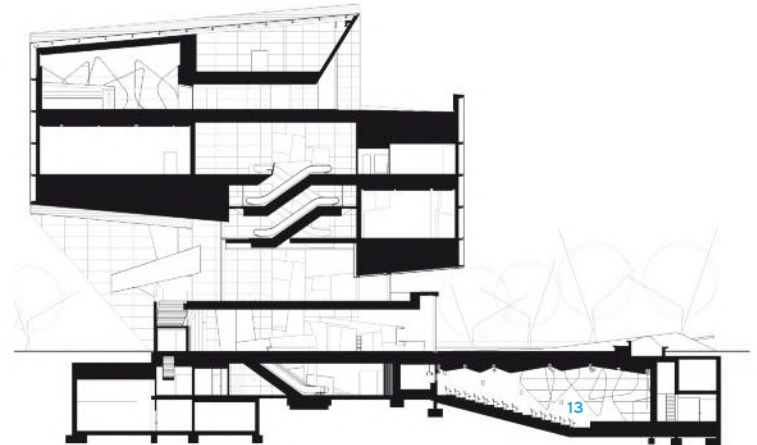


SECTION B - B



GROUND-FLOOR PLAN

0 30 FT.
10 M.



SECTION A - A

- | | | |
|-------------------|-------------------|---------------|
| 1 ENTRANCE LOBBY | 6 PLAZA | 11 KITCHEN |
| 2 INFORMATION | 7 EXHIBITION | 12 OFFICES |
| 3 SHOP | 8 CLASSROOM | 13 AUDITORIUM |
| 4 MAIN STAIR | 9 CHILDREN'S ROOM | 14 VIP ROOM |
| 5 EMERGENCY STAIR | 10 RESTAURANT | |



tion.” The galleries’ elongated shape, she points out, maximizes the linear feet of wall, for a more efficient use of the spaces when mounting exhibitions.

In its raised superstructure and vertical distribution, Pinós’s design is similar to the CaixaForum Madrid by Herzog & De Meuron (RECORD, June 2008, page 108), where the Swiss architects lifted an old factory into the air to create a public plaza under it. In the Madrid CaixaForum, the public stair is more accessible, but the building lacks the ample views and natural light of Zaragoza, or luxuries such as its rooftop terrace, planted with olive trees.

There is a lot going on in Pinós’s design: you see lively patterns and surging forms at every turn, as in the fabric and acoustical wood paneling in the auditorium, or the curving, movable wood screens of the restaurant. Then there are those dancing columns in the lobby,

CANTILEVER CENTRAL

The volume of the arts center (above) hovers over the glazed lobby and projects over a smaller rooftop terrace. The main interior stair (right), triangular in plan, is punched up with red vinyl floors and balustrades of wood veneer.





credits

ARCHITECT: Estudio Carme Pinós – Carme Pinós Desplat, principal in charge and lead designer; Samuel Arriola, project manager; Elsa Martí, team

ENGINEERS: Boma Inpasa SL (structural); INDUS Ingeniería y Arquitectura (building services, cost consultant, quality surveyor)

CONSTRUCTION COMPANY: UTE Forum Zaragoza

CLIENT: Fundación “La Caixa”

SIZE: 91,350 square feet

COST: \$16.5 million

COMPLETION DATE: March 2014

SOURCES

ALUMINUM PANELS FOR FACADE: Arasaf Industrial

GLASS: Vidrio

DOORS: Gismoero

STEPS AND PREFAB SLABS: Terrazos y Derivados Huesca

ELEVATORS: Kone



INTERIOR ANIMATION

The skylit top-floor restaurant (this page) features acoustic baffles with wavelike shapes. While the galleries are more neutral (opposite, top), their ceilings are enlivened with diagonal ventilation slots. The auditorium in the basement (opposite, bottom) employs both free-form baffles and a rippling ceiling for acoustical modulation.



which disappear into the irregular skylights of the aforementioned lower terrace cantilevered over the lobby. Splashed with natural light, the columns seem to hold up nothing at all (they discreetly intersect with the ends of beams in the skylight well). But Pinós handles these formal caprices with authority. With her first partner, the late Enric Miralles, with whom she collaborated until 1991, Pinós was a pioneer in this kind of free-form experimentation. In the aftermath of Spain's economic debacle, such exuberance has come to seem extravagant and wasteful. But the architect says that the cost of her design, at 15 million

euros (\$16.5 million), is actually quite reasonable. She notes that modest finishes, such as floors of vinyl, industrial parquet, and concrete resin, help compensate for the expensive structural solution.

The CaixaForum is Carme Pinós's most accomplished and important work in Spain to date. As she states in her project brief, "We want our building to be a symbol of technical progress and the generosity of culture—it should reflect only the best our age has to offer." In this high aim, she has certainly succeeded, maintaining a steady course through the adverse circumstances of the moment. ■

Harbin Opera House | Harbin, China | MAD Architects

DANGEROUS CURVES



From the bridge connecting bustling downtown Harbin to bucolic Sun Island, the new Harbin Opera House comes into view, with its impressive sloping forms that suggest the snow-capped mountains found in this northern Chinese region. Emerging from the surrounding wetlands, the building's double-humped silhouette rises to an apex of 183 feet and curls around mounds of glass panels that appear to burst forth like spikey balloons.

Designed by MAD Architects, which has offices in Beijing and Los Angeles, the 850,000-square-foot theater complex serves as a glittering new icon for a city once known mostly for its winter snow festival. MAD, founded by Yale-trained Ma Yansong in 2004, won the commission for the project in an international competition in 2010. "As a public building, it has to be an open, accessible place," says Ma. "It has to be dramatic. When people enter it, they need to feel they're onstage, that they're performers," adds Ma, who was chosen last year to design *Star Wars* producer George Lucas's Museum of Narrative Art in Chicago. Ma completed his first project

in Harbin in 2013, the 656-foot-long China Wood Sculpture Museum.

The new Harbin project—which includes a pair of theaters, dressing rooms, rehearsal halls, and support spaces, as well as a separate conference center and hotel that are still under construction—was envisioned as a "city landmark to showcase Harbin's own DNA and cultural heritage," says Liu Zhenbo, the director of the government's Harbin Songbei District Construction Management unit, which commissioned the project. Built in the 444-acre Sun Island nature park, the opera house opened in October.

Visitors to the project not only can go inside it, they can climb it. A long set of granite steps—open to the general public as well as ticket-buying opera goers—runs up the building's great curving roof, offering spectacular views of the city's skyline and the Songhua River. In a nod to treks up China's sacred mountains, as immortalized in traditional poems and paintings, the walkway snakes up the building, culminating in a rooftop landing. "The building goes from horizontal to vertical," says the architect. Visitors can't see the rooftop terrace from

The sensual lines of a performing-arts complex express a city's bold bid for attention.

BY ALEXANDRA A. SENO

PHOTOGRAPHY BY ADAM MØRK

MAGIC MOUNTAIN The 850,000-square-foot complex rises from a 444-acre park a 20-minute drive from downtown Harbin. The Opera House, with its two theaters (right in photo) opened in October, while a convention center and hotel, also designed by MAD, is still under construction (left in photo).

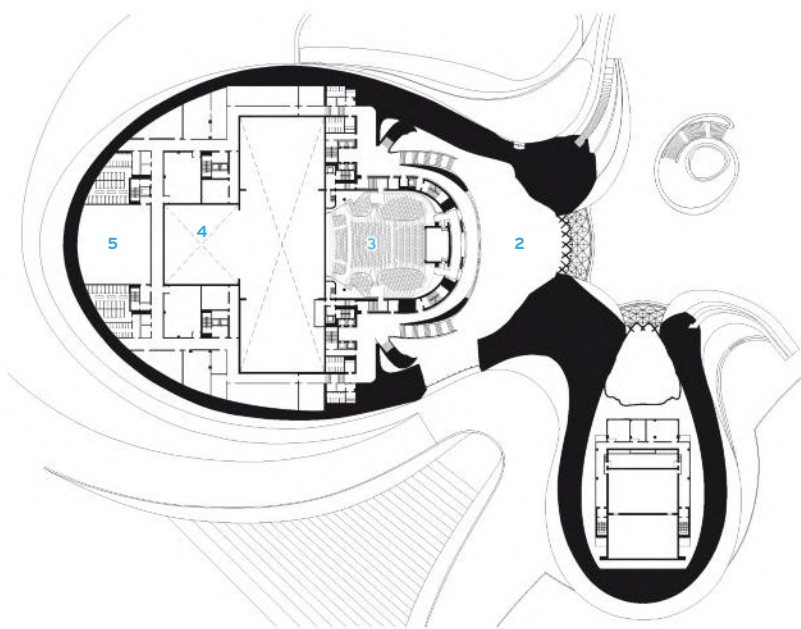


the ground, so “it’s like a temple. You go to a public but kind of secret place and have a conversation with the sky.”

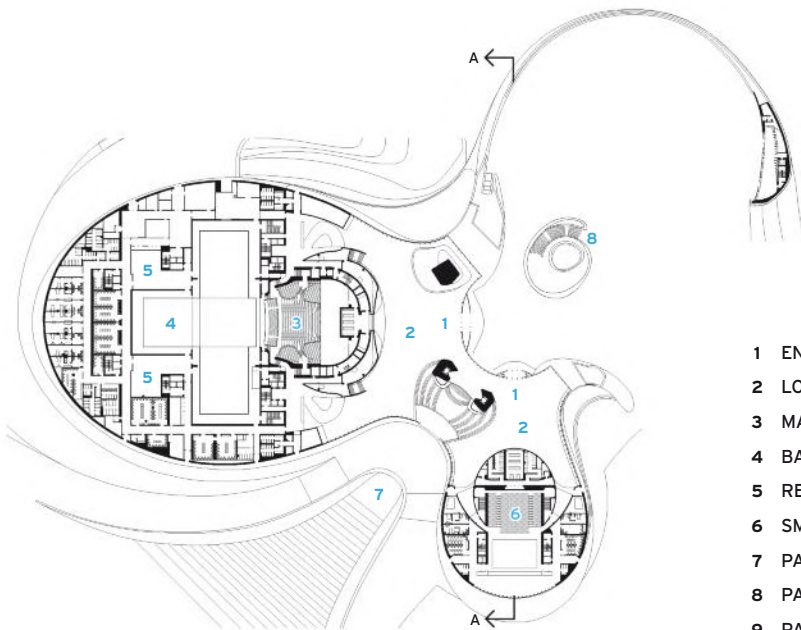
MAD worked with engineers at the Beijing Institute of Architectural Design to develop the intricate steel skeleton supporting the building’s mountainous forms. From inside, the opera house feels like a snow cave, with passages of white curved concrete walls and ceilings. Faceted glass skylights—built with a customized system to melt actual snow and direct it into drains—flood the grand lobby with sunlight, precious in China’s northern regions. Polished marble floors equipped with radiant heating make the space comfortable in the winter, when temperatures can drop to 37 degrees below zero Fahrenheit.

From the lobby, visitors see the undulating wood facade of the larger performance venue, clad with bent narrow planks of Manchurian ash. Ma says that he and his team chose the wood—a common material in the area—to



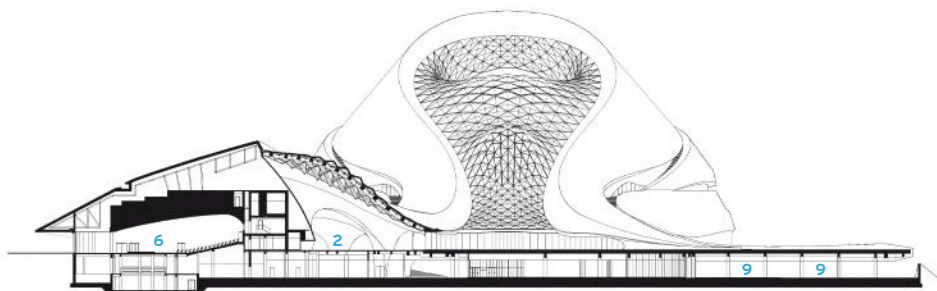


SECOND-FLOOR PLAN



- 1 ENTRY
- 2 LOBBY
- 3 MAIN THEATER
- 4 BACKSTAGE
- 5 REHEARSAL
- 6 SMALL THEATER
- 7 PARKING ENTRY
- 8 PARKING EXIT
- 9 PARKING

FIRST-FLOOR PLAN



SECTION A - A



evoke the warm interior of a musical instrument.

The large theater, which seats 1,600, has an elevated stage and the usual orchestra pit. The same curved wood found on the theater’s lobby facade wraps around balconies, box seats, walls, and ceilings inside the theater. Wanting audience members in the less expensive upper seats to feel “a little bit special,” Ma ensconced the top tier in leather walls and adorned it with a crystal-encrusted edge lit by LEDs that can change color.

The big theater is designed acoustically to cater to both Western and Chinese operas—the former usually relying on unaided sound projection, while the latter has performers using microphones. (The architects report that the Harbin Symphony Orchestra, founded by Russian émigrés in the early 1900s and reputed to be China’s oldest, recently performed at the venue and found the acoustics to be superb.)

The smaller theater, which fits 400 people, is a rectangular hall with raked seating. Gray wood panels, some perforated, clad the walls to optimize sound. Floor-to-ceiling glazing behind the stage can be closed off by curtains to darken the room and absorb sound.

MAD is currently busy with other ambitious projects in China, the United States, and Europe. It recently completed Huangshan Mountain Village, a large residential complex in Anhui Province, and is working on the Pingtan Art Museum in Fujian Province, a mixed-use residential development in Los Angeles, and a residential renovation project in Rome.

Harbin, the capital of Heilongjiang Province, has a population of 4.5 million and dates back to the late 19th century, when an influx of Polish immigrants arrived to build the Czarist Russia-funded Chinese Eastern Railway, a critical link connecting the Trans-Siberian Railway with China. Today, the city is not only an important commercial and indus-

IT'S A WRAP A ramp incised in the side of the building takes visitors to a terrace above the main theater (opposite). The interior facade of the theater is clad with narrow bent pieces of Manchurian ash (this page).







NORTHERN LIGHTS
Skylights bring daylight, a precious commodity in this northern part of China, into the main lobby (opposite) and a rehearsal studio (this page).



credits

ARCHITECT: MAD Architects – Ma Yansong, Dang Qun, Yosuke Hayano, directors

ENGINEERS: Beijing Institute of Architectural Design (structural); Beijing Construction Engineering Group (structural, civil, mechanical)

CONSULTANTS: Turenscape and Earthasia Design Group (landscape); Zhang Kuisheng Acoustics Research Institute of Shanghai Modern Design Group (acoustics); Toryo International Lighting Design Center, Beijing United Artists Lighting Design (lighting); Inhabit Group, China Jingye Engineering (facade/cladding); Gehry Technologies (BIM)

GENERAL CONTRACTOR: Beijing Construction Engineering Group

CLIENT: Harbin Songbei District Construction Management

OWNER: Harbin municipal government

SIZE: 850,000 square feet

COST: withheld

COMPLETION DATE: October 2015

SOURCES

CURTAIN WALL: Shenyang Yuanda Enterprise Group

ROOF TILES: Dalian PengHong Floor Products

WOOD SHELL FOR THEATER: Shenzhen ZongFuTai

MARBLE FLOORING: FuJian Huahai Stone

ACOUSTICAL CEILINGS: Beijing Wufu Wood





MOOD SWINGS

The architects orchestrated the interiors to contrast. For example, cool spaces, such as the upper lobby, with its white fiber-reinforced plastic lattice (this page), and those given a visual warmth by undulating wood cladding, like the 1,600-seat main theater (opposite, bottom). A lobby stair combines both warm and cool elements in its design (opposite, top).

trial hub, but is one of the country's most popular tourist destinations, thanks to its extreme winter weather and diverse offerings of performing arts. In the cold months, visitors and locals revel in Harbin's frozen landscapes and world-renowned ice-sculpture festival. In the summer, the city hosts European-style music programs. Thanks to its history as an outpost of Russian culture, Harbin boasts China's oldest music academy.

MAD's bold design for the opera house, says Liu, the client, helps establish Harbin as a place with "its own unique contemporary charac-

ter," one that is rugged, powerful, and dynamic. In recent years, Chinese cities have erected magnificent public buildings—airports, museums, performing-arts centers—spending large sums to assert their cultural greatness. It has yet to be seen if they can generate the content and programming to properly activate these buildings. But the architectural swagger already matches the aspirations. ■

Alexandra A. Seno is a Hong Kong-based journalist who contributes regularly to The Wall Street Journal and other publications.

Messner Mountain Museum Corones | Zaha Hadid Architects | Bolzano, Italy

ON TOP OF THE WORLD

A mountaineering museum puts the daunting and spectacular landscape around it into sharp focus.

BY VERENA WISTHALER AND SUZANNE STEPHENS



PASTORAL SUMMIT

Zaha Hadid's Messner museum, on top of Kronplatz Mountain in northern Italy, looks down to the Val Badia below. The winding path takes visitors from cable cars to the entrance.





ROOMS WITH A VIEW

The entrance portal (above), and an ancillary bay next to it, face northeast toward a slightly rocky but level terrain. On the opposite side, three hooded projections (right) jut out from the earthy mound in different directions. The poured-in-place concrete structure, clad in glass-fiber-reinforced concrete panels, bends to frame the panoramic views, especially dramatic in the cantilevered observation deck (opposite).



Designing a museum is nothing new for Zaha Hadid Architects. Creating one on top of Mount Kronplatz in northern Italy is something else entirely. The 10,800-square-foot structure, which opened in July, is 7,464 feet above sea level. It is the sixth edition in the Messner Mountain Museum (MMM) network. Initiated in 1995 by the fabled 71-year-old Reinhold Messner, a South Tyrolean who has climbed 14 mountains over 8,000 meters (26,247 feet) high, the six exhibition spaces explore different aspects of the history of mountaineering in general, with some attention to the local geography. While Messner located most of his museums in old castles and forts, he buried one totally underground in a slope halfway up the 12,811-foot-high Ortler peak. This latest museum, on Kronplatz—his final one—is not only higher, but very different. Called

the Messner Mountain Museum Corones, its contoured forms project energetically from an earth-covered mound to offer staggering, vertiginous views of the surrounding mountains.

Zaha Hadid's involvement in the sky-high museum began when she won an invited competition to design a peak-top observation deck for Skirama Kronplatz/Plan de Corones, a consortium of cable-car and ski-lift operators, to boost tourism after the ski season ends. When Messner approached Skirama with his idea for a museum on Kronplatz, the company head, Andrea del Frari, suggested Hadid do it. The choice of Hadid was not a stretch: she had designed the Bergisel Ski Jump at Innsbruck in 2002, and four Nordpark Cable Railway stations there in 2007. While Messner, who studied civil engineering, was not deeply familiar with her work, the architects in her firm found him to be open

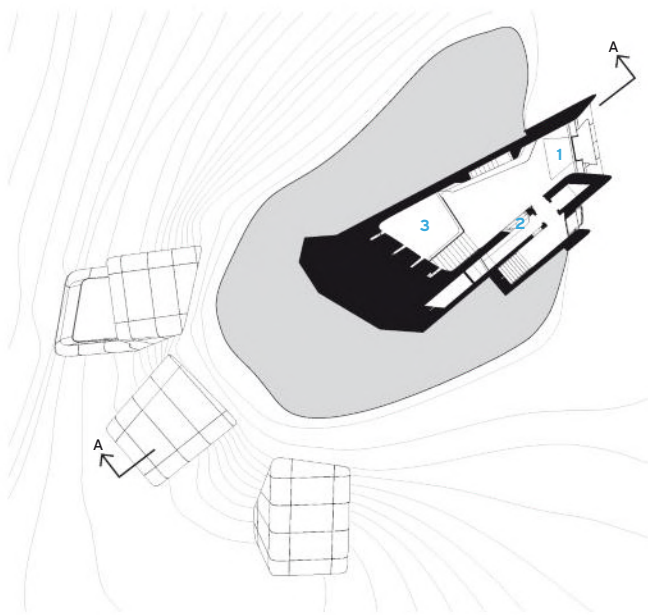
to Hadid's biomorphic interpretation of his program. Intensely involved in the design process, he wanted the museum to be partially subterranean. "We really liked Messner's idea of reducing the building's impact on the alpine site by putting it underground," says Peter Irmscher, a member of Hadid's team, about the sculptural, poured-in-place concrete structure burrowed within nature. And the observation deck that Skirama initially wanted was incorporated into the scheme. While Del Frari makes light of building at that altitude—"We are used to this. We don't rely on helicopters, just trucks going up the roads," he says—Irmscher points out that the sheer height and long months of snow limited construction to the summer. It took three years to build.

After arriving by cable car, you enter the curvilinear concrete portal on the northeast into what looks like a beehive. From the lobby, you descend stairs and ramps to a choice of three pronglike spaces. From the outside, the stubby projectiles look like a trio of giants' hoods; from the inside, they capture breathtaking views of the Zillertal Alps and the Dolomites.

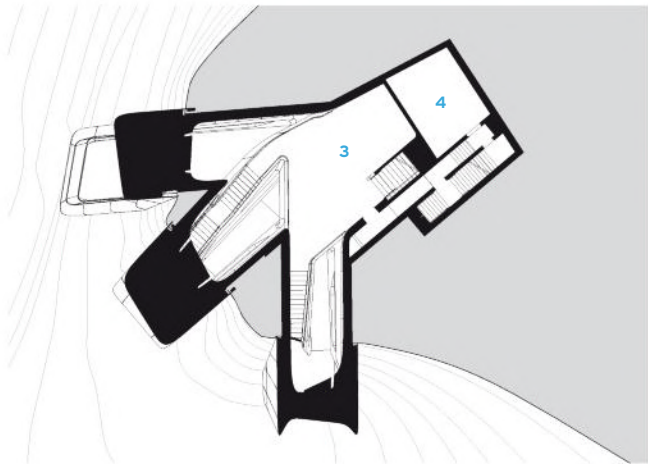
You do not encounter these vistas upon initially entering the cavelike interior. At first, you see an aluminum ladder mounted near the entrance, used by sherpas to help climbers ascend Mount Everest. (Messner used ladders when he conquered the mountain in 1978, but he did forgo supplemental oxygen.) As you descend the levels toward the source of daylight, you find the first window looks toward farmers' houses in the valley below as well as the massive wall of Heiligkreuzkofel mountain, which Messner considers his most difficult climb. A second, lower level allows you to see the Peitlerkofel, the peak enclosing the valley where Messner was born and raised. Finally, on the lowest level, you step out on the observation deck, jutting out toward Ortler, the highest peak of the eastern Alps. The breathtaking panorama is 270 degrees.

On display within the curvilinear, fluid spaces are paintings of mountains from Messner's private collection, including an evocative contemporary oil of Mount Everest by Jürgen Städtner and *Grosse Karte des Alpinismus* (the *Grand Map of Alpinism*) by Stephan Huber, who worked with Messner on creating this

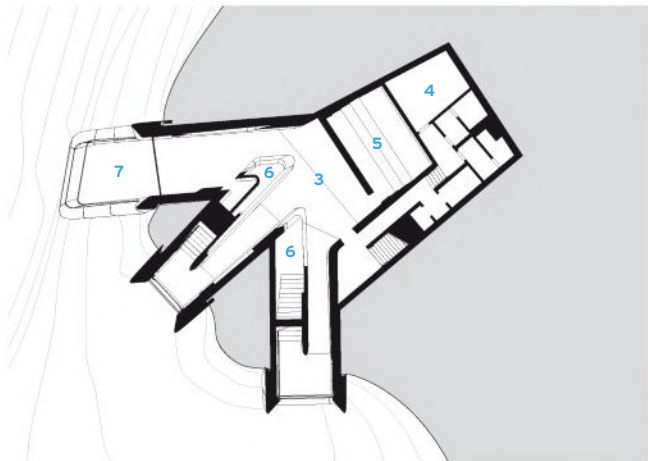




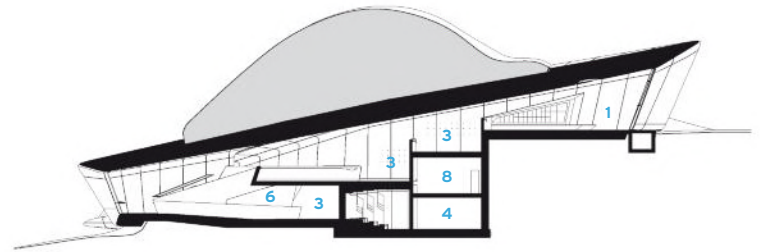
ENTRANCE LEVEL



LEVEL TWO



LEVEL ONE



SECTION A - A

- 1 ENTRANCE
- 2 TICKETS
- 3 EXHIBITION
- 4 STORAGE
- 5 CINEMA
- 6 DISPLAY CASES
- 7 OBSERVATION DECK

credits

ARCHITECT: Zaha Hadid Architects – Zaha Hadid and Patrik Schumacher, design principals; Cornelius Schlotthauer, project architect and design team; Peter Irmsher design team and project team; Markus Planteu, Claudia Wulf, project team

ASSOCIATE ARCHITECTS: IPM
ENGINEER: IPM (structural); Jud & Partner, mechanical; Studio GM (electrical)

CONTRACTORS: Kargruber & Stoll (concrete shell and exposed concrete); B&T & Technologie (concrete facade)

CLIENT: Skirama Kronplatz/ Plan de Corones

COMPLETION DATE: July 2015

SIZE: 10,800 square feet

COST: \$3.3 million

SOURCES

GLASS: Guardian Industries, UK

BALUSTRADES: Sunglass Srl

ELEVATORS: Kronlift

LOCKS: E. Schäfer

FLOORS: Bodenservice Srl

artwork of maps, photos, and text related to scaling peaks around the world. Also on display are such historic tools used in climbing as a hammer belonging to Paul Preuss, the Austrian alpinist, and other related artifacts.

It's understandable if the visitor is torn between enjoying the extraordinary views outside and studying the works within. Messner's daughter, Magdalena, coordinator of the six museums, initially worried that the architecture would contrast too starkly with its figurative contents. Today she finds the building remarkable in the way it fits into the landscape.

But father and daughter weren't the only ones unfamiliar with Hadid's approach. Skirama's builders weren't fluent in the language of Hadid's boomerang-shaped forms. In this case, the process involved pouring the reinforced concrete as canted planes and then fitting curved precast panels of glass-fiber-reinforced concrete into place on the exterior and interior surfaces, in order to give the volumes the sinuous contours for which Hadid's work is so well-known. Nevertheless, Irmischer found the construction crew was "passionate and ambitious," and the workers achieved a high level of execution. The ladder on display at the entrance is an apt symbol for the entire production of this museum, since plenty of mental ladders had to be climbed to end up with this result. Even Messner himself was open to climbing a metaphorical one with this design. ■

Verena Wisthaler is a freelance journalist in the South Tyrol and the coeditor for an annual publication of culture and society, 39Null.



ON A CLEAR DAY

Stairs from the top entrance level lead down past paintings and paraphernalia related to mountain climbing (opposite). Each of the projecting windows is angled in a different direction, including one facing south (above). A large cantilevered terrace extends dramatically from its curved hood (right).



National Sawdust | New York | Bureau V

PITCH PERFECT





A chamber-sized venue in Brooklyn rewrites the score for classical and experimental music.

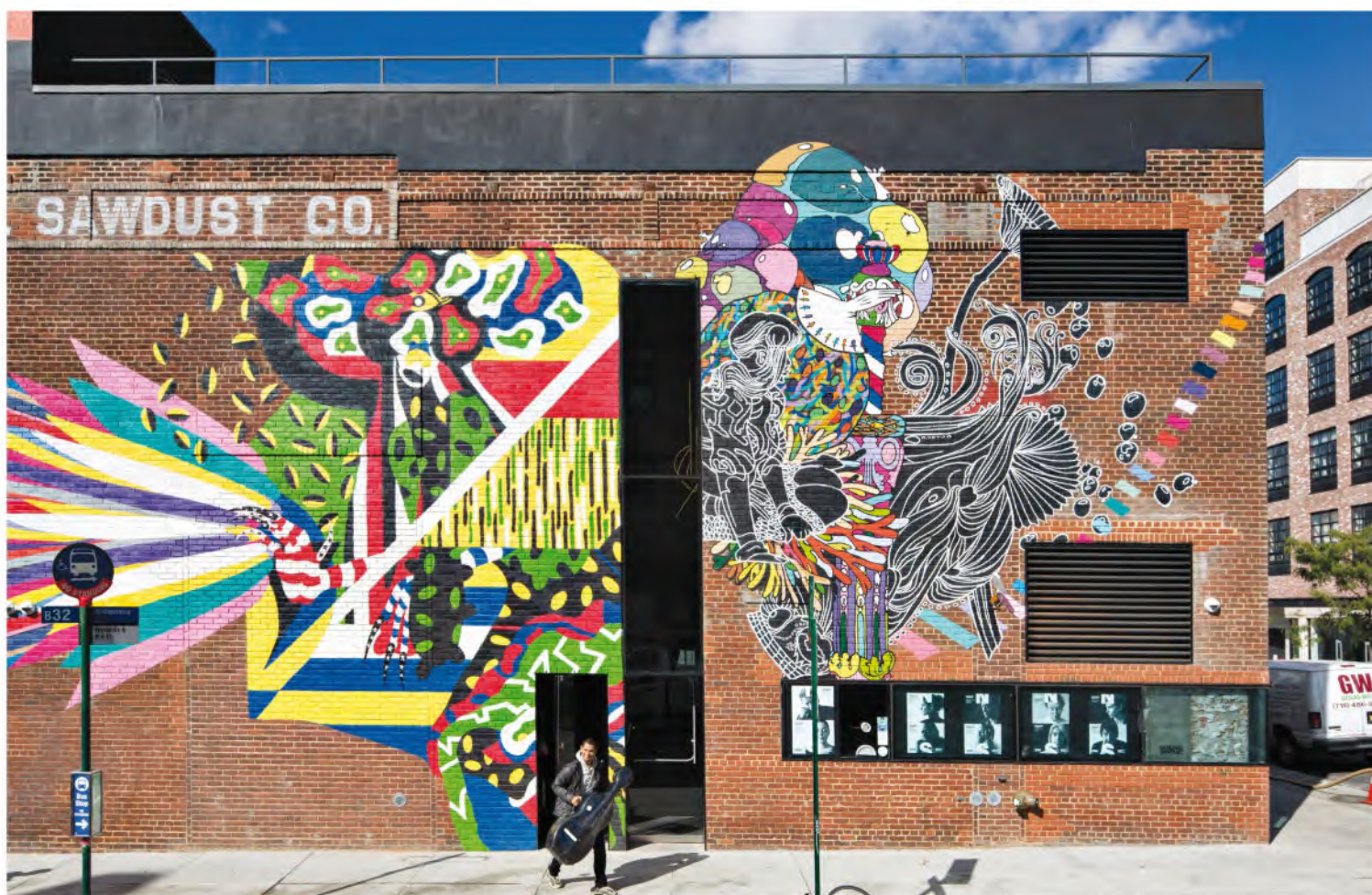
BY ANNA FIXSEN

A graffiti-covered factory in Williamsburg, Brooklyn, may not seem the most likely of venues for classical music. But the firm Bureau V took cues from the world's most revered concert halls to create National Sawdust, an artist-led performance space for the cultivation of new musical composition. It is, however, anything but traditional.

"We wanted a space that represents the mood that something important could happen here," says Peter Zuspan, one of the designers.

National Sawdust is the dream of Kevin Dolan, a retired tax attorney and music buff. Dolan wanted to build an experimental incubator to kick-start the careers of young composers, with space to write, record, and perform. In order to be successful, it needed to be at once acoustically outstanding and architecturally iconic. "This is a way to maintain the culture of live performance for types of music that would otherwise not be sustained," explains Dolan, "and introduce patrons to music that they would otherwise never hear."

FROZEN MUSIC
From a balcony, concertgoers can gaze down into the performance hall, which, at capacity, can accommodate 350 people. This volume is wrapped in a riotous array of laser-cut aluminum acoustic panels (left). On opening night, Canadian throat singer Tanya Tagaq (above) performed a tempestuous set with Wilco's Glenn Kotche.



Dolan enlisted the rookie local firm Bureau V to design a home for the fledgling nonprofit institution. Zuspan, who had cofounded the office with Stella Lee and Laura Trevino just a year earlier, was introduced to Dolan through an artist friend. Zuspan in turn called upon Arup (whose team he had worked with prior to starting Bureau V) to lend acoustical expertise.

Dolan says he told the team, “I want a space where, whether you are 25 or 65, you have the same reaction—that it’s amazing. I said we’re either going to build something we are all proud of or not going to build anything at all.”

While the search for a site was on, the team began to establish the parameters for the project. Raj Patel, who leads Arup’s work in acoustics, audiovisual services, and theater, saw similarities in National Sawdust’s mission and earlier modes of performance. “When Beethoven first performed the *Eroica*, it was in a relatively small room,” he says. “It would have been like a rock show in a club today—people would have been blown off their feet by the complexity and the changes in dynamics.” National Sawdust aspired to provide a similarly visceral experience.

Based on findings in Arup’s New York SoundLab and investigations of historic spaces—in particular, a room in the 18th-century palace of Esterháza in Hungary where Joseph Haydn wrote much of his music—the team determined that the optimum spatial configuration would be a room that was 100 feet long and 50 feet wide, with a minimum ceiling height of 25 feet. A serendipitous bike ride took Zuspan past a shuttered warehouse three blocks from Brooklyn’s northern waterfront, a factory that once pulverized wood into sawdust (the equipment was later repur-

AMERICAN GRAFFITI

A custom neon-and-marble light fixture by Bureau V hangs above a chasmic void between the concert hall and service areas (this page). The faceted openings for the box office and bar are lined in bronze (opposite, bottom). Outside, existing graffiti on National Sawdust's brick facade was embellished by São Paulo and Brooklyn-based artists Assume Vivid Astro Focus (opposite, top).





posed to crush glass for fish tanks). The interiors were in poor shape, but it had good bones. Basement excavation started in 2011.

The space needed to accommodate a dizzying range of musical styles—from opera to drone metal—and it had to be acoustically isolated, especially from the rumble of the L subway line just one block away. So the design team opted for box-in-box construction, inserting a volume into the brick warehouse. This concept drove Bureau V's aesthetic approach. "Everyone knows the postindustrial art-space typology in Brooklyn," says Zuspan. "We thought it would be a good juxtaposition to put something inside that was crystalline and bespoke."

From the east facade, concertgoers enter into a canyon-like vestibule between the performance hall and an area for the bar and box office. Angular walls in this foyer, clad in obsidian-black glazed tile, jut outward like facets on a gem.

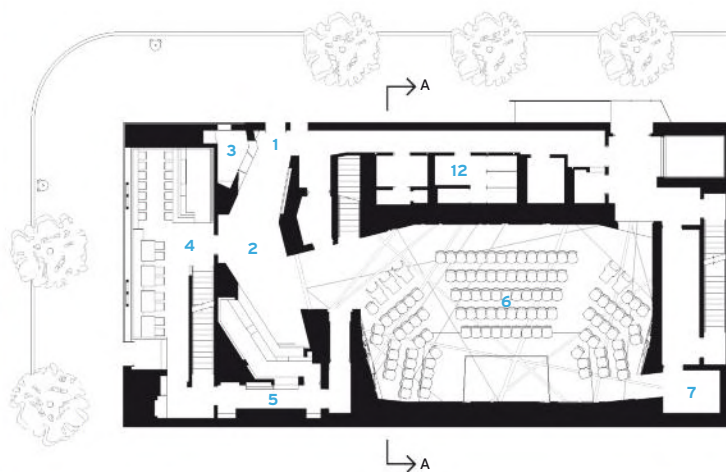
This enigmatic enclosure divulges little of the visual punch to come. Through a 10-by-10-foot sliding door, the hall opens into a double-height performance space, clad in a stunning composition of white, shardlike acoustic panels sliced by 4-inch- to 12-inch-wide channels that course



SECTION A - A

0 15 FT.
5 M.

- 1 ENTRANCE
- 2 LOBBY
- 3 BOX OFFICE
- 4 RESTAURANT
- 5 SERVICE AREA
- 6 PERFORMANCE HALL
- 7 BACKSTAGE
- 8 CONTROL BOOTH
- 9 BALCONY
- 10 LIGHT-RACK ROOM
- 11 DRESSING ROOM
- 12 RESTROOM



GROUND FLOOR

0 15 FT.
5 M.

around the space like black ribbons. The effect is startling, like standing in the midst of a lightning storm.

Every part of the concert hall was determined by computer modeling and meticulous acoustic testing. In order to insulate the space from outside noise and vibrations, the performance hall has a multilayered concrete floor slab and concrete-block walls, isolated from the existing structure on a chassis of springs. The geometric wall panels are made from custom-fabricated laser-cut aluminum and backed with a high-end speaker fabric. They are visually translucent—backlit with dimmable fluorescent lighting—and the perforated pattern in the aluminum allows for 65 percent openness, as stipulated by Arup's acoustic recommendations. Behind these panels is an 18-inch space, within which curtains can be opened or closed to accommodate different acoustic needs.

From concept to completion, National Sawdust took nearly seven years. And there is still more to come—a full-service restaurant is anticipated to open in the building early next year, and nearly 500 performances are already booked at the venue for 2016.

When the house officially opened on October 1 the acoustic panels were bathed in jewel-colored light, and the diverse sounds—from performances by mezzo-soprano Eve Gigliotti, folk artist Chris Thile, Wilco's Glenn Kotche, Nico Muhly, and Philip Glass—electrified the air. "Nothing quite like it exists in New York City, or anywhere else in the world, and it must be seen (and heard) to be believed indeed," said the *Village Voice* in its review.

"When I walked in and saw the walls lit up, it was beyond my wildest dreams," says Dolan. "It was just dazzling." ■



credits

ARCHITECT: Bureau V—Peter Zuspan, Laura Trevino, Stella Lee, principals

ARCHITECT OF RECORD:
SLAB Architecture

ENGINEERS: Arup (acoustics, AV, theater, lighting, fire); RSE Associates (structural); Plus Group Consulting Engineering (m/e/p); Carlin Simpson & Associates (geotechnical)

GENERAL CONTRACTOR:
Alcon Builders Group

CLIENT: Kevin Dolan

OWNER: National Sawdust

SIZE: 14,200 square feet

COST: \$16 million

COMPLETION DATE: October 2015

SOURCES

BUILT-UP ROOFING: Johns Manville Tapered Systems

GLASS: Diversified Glass and Storefronts

ACOUSTICAL DOORS: IAC Doors

PAINTS AND STAINS: Benjamin Moore, Sherwin-Williams

LOBBY TILE: Design and Direct Source

PERFORMANCE HALL ACOUSTIC

SKIN SYSTEM: Seetin Design

ACOUSTIC PANELS:

Acoustical Concepts

WOOD FLOORING: Ebony & Co.

CUSTOM CHANDELIER: Bureau V

THEATRICAL LIGHTING: ETC

PIANO LIFT: Autoquip

ACOUSTICAL SPRINGS AND ISOLATORS:
Kinetics Noise Control

AUDIO AND AUDIOVISUAL SYSTEMS: Altel Systems

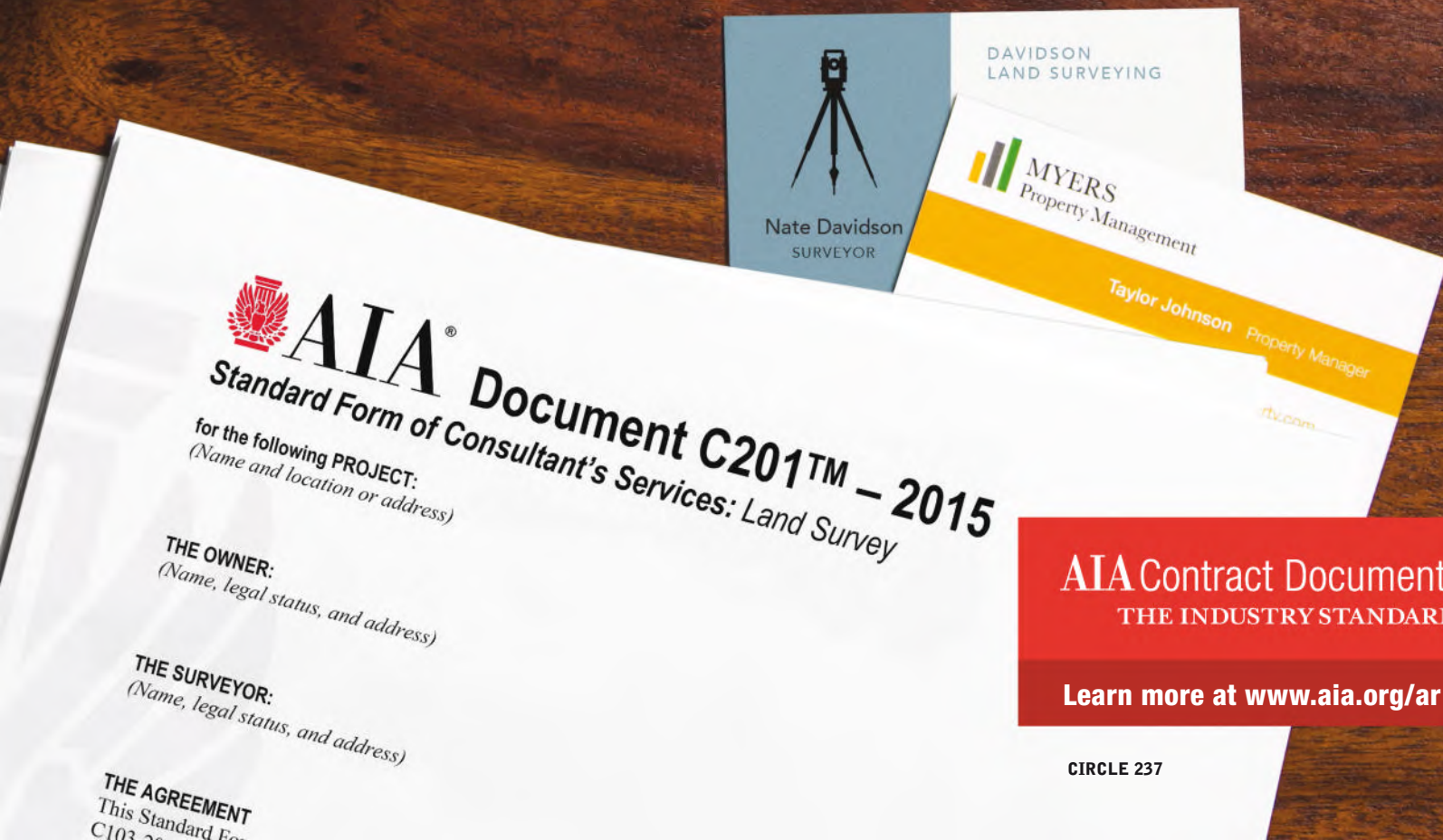
LIFT OFF

The white maple performance floor can be easily reconfigured through a series of manually lifted hydraulic floor panels. One such section accommodates National Sawdust's Bösendorfer piano. When flat, the floor puts audience members face-to-face with performers. Gambian musician and composer Foday Musa Suso (opposite) plays the kora, a 21-stringed instrument, on opening night.

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Poppers and Floppers and Porches, Oh, My!

Gensler creates a building that breathes for a client with a deep commitment to sustainability.

By Joann Gonchar, AIA
Photography by Connie Zhou

GENSLER'S NEW 545-foot-tall Tower at PNC Plaza is hardly the tallest skyscraper in downtown Pittsburgh. That distinction belongs to Harrison, Abramovits & Abbes's 841-foot-tall U.S. Steel Tower, built more than four decades ago. But, even so, PNC can make some large claims for its new headquarters. The financial services corporation boasts that the \$400-million project, which officially opened on October 1, is *the* greenest office tower—not just in the city, but the world.

The 33-story building may not be tall and trim, but its curved and cranked shaft and its angled cap are signs of its preoccupation with sustainability. And its green aspirations didn't just come out of the blue—the company has a long history with sustainable building. Its real-estate portfolio includes a 650,000-square-foot operations center in Pittsburgh, which held the title of being the largest LEED building for several years after its certification in 2000. PNC was also instrumental in the creation of the LEED volume program, certifying its first 12 bank branches in 2006. Its Washington, D.C., headquarters, completed in 2010, was one of the first Platinum buildings in the nation's capital. The company now claims more than 250 LEED-certified buildings worldwide.

But for this project, which Gary Saulson, PNC's director of corporate real estate, refers to as “beyond Platinum,” the LEED plaque was not the ultimate objective. “Certification was more of a confirmation rather than the goal,” says the project's sustainability consultant, Tom Paladino, CEO of Paladino and Company. Here, PNC employed a more expansive, and

OFF THE GRID

The tower is rotated off the street grid so that the slanted cap of its solar chimney (this page) faces south and captures the maximum amount of thermal energy. Among the several types of facade systems is a west-facing shallow double skin (opposite).



less quantifiable, definition of “green” that included social aims such as workplace innovation and community building. “This is not a typical paradigm,” says the Gensler principal in charge of the tower, Doug Gensler. “We needed to rethink the current way of measuring building performance.”

Of course, this broader definition of greenness and a more conventional one based on

resource conservation are not mutually exclusive. The tower is projected to use about half the energy of a more typical office building that complies with the 2007 version of the ASHRAE 90.1 energy standard.

This anticipated performance is the result of a host of tightly integrated sustainable strategies instead of one particular technology. But the single feature that may make the



biggest contribution is the building's ability to "breathe." For a considerable portion of the year, the Tower at PNC Plaza will rely on operable windows and flaps in its sophisticated glass skin to bring in fresh air, rather than on mechanical ventilation. This move alone should produce significant savings, since the operation of HVAC systems is responsible for more than a third of overall

energy consumption in a typical tall office building, according to the Council on Tall Buildings and Urban Habitat.

Before the 1950s, skyscrapers were constructed without mechanical ventilation or cooling. But given current comfort expectations and Pittsburgh's climate, eliminating active climate-control systems in PNC's new tower was impractical. However, analysis by

Buro Happold, the project's structural and mechanical engineer, showed that temperature and humidity conditions would still allow natural ventilation for about 42 percent of working hours. The project team felt this figure was substantial enough to warrant a hybrid approach combining natural ventilation with mechanical systems such as energy-recovery air handlers, high-efficiency boilers



and chillers, and active chilled beams.

A solar chimney is literally at the center of the innovative fresh-air strategy. It comprises two shafts in the tower's core that extend from the lowest office floor to its crown, where they are joined by a 5,000-square-foot chamber topped with a glass roof. This cap, sloped and angled toward the south, includes a concrete slab under the glass that is ribbed and painted black in order to trap solar radiation. The configuration capitalizes on the stack effect, which creates a pressure draw, pulling fresh air through the operable facade, across open office areas, and finally vents it through the solar chimney. During cooler weather, the chamber can also preheat outdoor air before distribution to the rest of the tower.

The envelope plays a key role in this climate-control scheme. The building has several double-skin types, but the primary one, cladding the north and south elevations, is made up of laminated glass on the exterior, an insulated glazing unit (IGU) on the interior, with a 30-inches-deep cavity in between. The IGU incorporates a coating to help retain heat during the winter, but because the cavity includes automated shades, no solar-controlling, low-E coating was necessary. The resulting assembly is about 87 percent transparent.

When humidity, temperature, and air quality conditions are ideal—primarily during the spring and fall—the building management system (BMS) opens poppers (tall and narrow windows on the outward-facing skin) and

INDOOR-OUTDOOR When temperature and humidity conditions are right, tall and narrow “poppers” (opposite, left) on the exterior of the north and south facades, and sill-level vents on the interior open, letting fresh air in. The system includes wood-framed sliding glass doors that occupants can operate in order to stand on the “porch” (above) within the double-skin cavity.

floppers (vents at sill level on the inner skin) to let fresh air flow into the workspaces. According to its designers, the tower is the first in North America to employ a double skin in combination with a solar chimney to passively bring in fresh air.

This facade has several additional modes of operation. For example, during the summer, the poppers can be opened, and the floppers left closed in order to cool the cavity and help



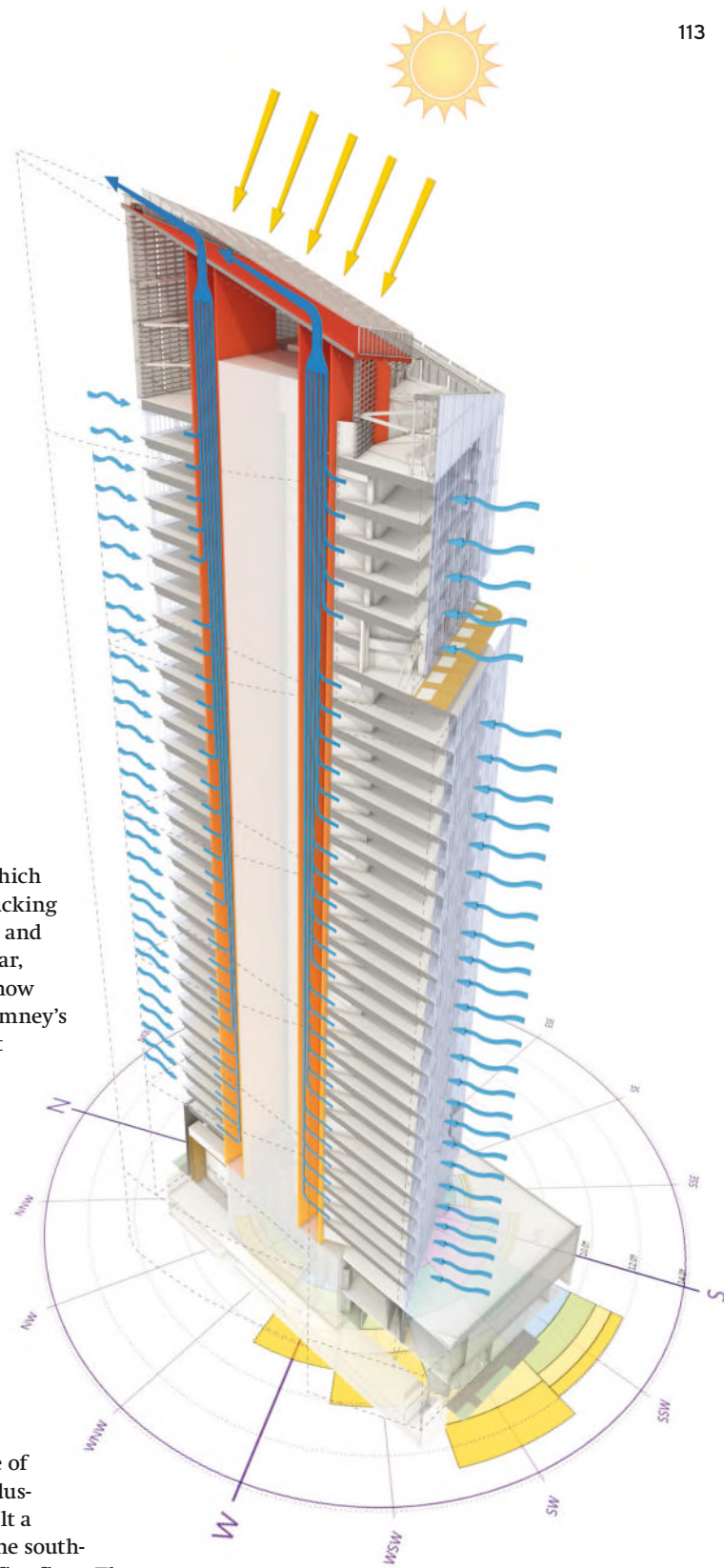
maintain comfortable indoor temperatures. In the winter, both poppers and floppers can be kept closed, allowing the air between the two skins to heat up and act as a thermal buffer, performing in much the same way as winter clothing. “It’s like wearing a fleece with a shell over it,” explains Benedict Tranel, a principal at Gensler and the project’s technical director. “The inner facade is insulating, while the outer one keeps the water out.”

Although the double skin is almost entirely automated, occupants are given some individual control. By turning on a green light mounted on the ceiling of the office area, the BMS lets employees know when they can open wood-framed sliding glass doors that are part of the interior-facing skin without interfering with the active climate-control systems. They can slide these doors open just a crack, or open them wide enough to step out onto what we referred to as a “porch”—a metal louvered floor that runs in the cavity. By including this element, the design team hopes occupants will have a more direct connection to the city and the outdoors than they would have sitting at their desks.

Getting a grasp on how the natural ventilation system would perform required extensive energy modeling as well as computational fluid dynamics (CFD) studies. The engineers combined these analyses with physical models, building an approximately 8-foot-by-8-foot mockup of the solar chimney’s cap during schematic design and mounting it on the roof of another PNC building nearby. The data

gleaned from this mockup, which was outfitted with sensors tracking surface and air temperatures, and monitored for more than a year, helped the team understand how much thermal energy the chimney’s concrete could store and what weather extremes it would experience in each season. It also helped validate the virtual analyses. “We found that the mockup was behaving in a similar way to our computer models and this gave us confidence in our simulation data,” says Denzil Gallagher, a Buro Happold principal.

Team members built a second mockup during the construction-document phase of the project at a Pittsburgh industrial park. This time, they built a 1,200-square-foot portion of the southwestern corner of a typical office floor. They used it over the next 2½ years to review and tweak a wide variety of building components and systems, including the double-skin facades and the integration of the natural ventilation strategy with the active HVAC equipment. The designers evaluated options for the automated shades, considering factors like what amount of perforation would provide the right balance of glare reduction,



TOWER OF POWER The solar chimney comprises two shafts in the building’s core. These extend from the lowest office floor to the crown, where they are joined by a 5,000-square-foot chamber topped with a concrete slab and a glass roof.



GROUND-FLOOR PLAN

TYPICAL LOW-RISE FLOOR
(TOP OF NEIGHBORHOOD)

- 1 LOBBY
- 2 RETAIL
- 3 CORE
- 4 LOADING
- 5 OFFICE
- 6 NEIGHBORHOOD
- 7 SOLAR CHIMNEY

daylight penetration, and visibility. They also tested elements such as the double skin's manually operated wood-framed doors—which at 10 feet tall and 5 feet wide weigh more than 600 pounds—to make sure they were easy enough for employees to slide open. In addition, they studied how best to configure the office furniture so as not to impede the flow of outdoor air coming in through the low-level floppers, determining that cubicle partitions shouldn't extend to the floor.

HVAC systems are responsible for more than a third of overall energy consumption in a typical tall office building.

As part of satisfying PNC's workplace innovation aims, the project team created a variety of workspaces within the building, so employees need not stay in their individual cubicles. Each of these spaces has its own climate-control strategy. For example, every two office floors share a living room-like, double-story space intended for informal meetings or collaborative tasks. These west-facing "neighborhoods" include different kinds of upholstered seating around small tables and are enclosed behind a shallow dual-glass skin with a cavity that is only 8 inches wide. This skinnier facade does not have poppers or floppers, but it incorporates automated shades and is continuously ventilated from the exterior to prevent heat gain from the late-day sun.

Near the top of the building, above the stacked neighborhoods, a sky garden offers yet another alternative for employees. In this five-story-tall atrium, which sits behind a cable-net wall of laminated low-iron glass, occupants can work against the backdrop of the city's skyline, its rivers, and famous bridges. Although facility managers have the ability to control conditions for special events like parties or receptions, in general the temperature here is allowed to fluctuate, tempered

only by its radiant floor. The space, which includes native plantings that change with the seasons, is intended to provide a setting that is similar to the outdoors, but sheltered from the wind and rain.

PNC also considered community-building efforts as integral to the project's mission. These run the gamut from job-creation initiatives, such as persuading the curtain wall contractor to set up a local assembly factory, to the skin's aesthetic expression, which, because of its highly transparent double-skin system, allows a strong visual connection between inside and out. "PNC didn't want a fortress," says Gensler.

One of the more notable demonstrations of the company's commitment to the city is the

credits

ARCHITECT: Gensler – Doug Gensler, principal in charge; Hao Ko, architectural design director; Lisa Adkins, project director; Benedict Tranel, technical director; Anastasia Huggins, David Hall, Gunwook Nam, Alison Wilkinson, Daniel Nauman, Jorge Barrero, Ethel Macleod, Eugene Lee, Joe Chisholm, Brent Van Gunten, Len Sciarra, Philip Kaefer, Joel McCullough, Rich Peake, Mariana Vaida, Jessica Yin, Yooju No, project team

CONSULTANTS: Buro Happold (structural, m/e/p, fire protection); Civil & Environmental Consultants (civil); Heintges (facade); Studio I (interior lighting); Fisher Marantz Stone (exterior lighting); Paladino (sustainability); LaQuatra Bonci Associates (landscape); ESI (lobby beacon)

GENERAL CONTRACTOR: PJ Dick

CLIENT: PNC Financial Services Group

SIZE: 800,000 square feet

PROJECT COST: \$400 million

COMPLETION DATE: October 2015

SOURCES

CURTAIN WALL: Permasteelisa

PODIUM CLADDING: Gartner, NBK

TOWER TOP CLADDING: Centria

GLAZING: PPG

WOOD-FRAME WINDOWS: Solar Innovations

INTERIOR LIGHTING: Finelight, USAI

EXTERIOR LIGHTING: WE-EF, iLight Technologies

DIMMING: Lutron, ETC

OFFICE FURNITURE: Hayworth, Tuohy

BUILDING AUTOMATION: Automated Logic

SHADE CONTROL: MechoSystems

FACADE MOTORS: Window Masters

The Tower at PNC Plaza includes special perimeter spaces that are designed to promote circulation and collaboration between floors. These double-height “neighborhoods” promise variety and a strong connection to the surrounding environment.

The SolarTrac® System sustains this connection by automatically adjusting louvered blinds and roller shades. The system optimizes the influx of light and heat along the building’s glazed double curtainwall, maximizing views, keeping people comfortable, and, in general, making a neighborhood feel like a neighborhood.




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Everything but a cup of sugar.



The Tower at PNC Plaza: Roller shade and louvered blind automation by SolarTrac® from MechoSystems.



HIGH LIFE The tower provides several types of environments as alternatives to employees' individual cubicles. These include double-story "neighborhoods" (below) for every two office floors and a five-story-tall sky garden (left) on the tower's 28th floor. Both are intended as places for breaks and small, informal meetings.

skyscraper's water-recycling system. It will reclaim and treat stormwater, as well as gray- and blackwater, using it for toilet flushing, irrigation, and as makeup water in the cooling tower. Combined with low-flow fixtures, this strategy will reduce potable water consumption by an estimated 77 percent. But more important for the city and its infrastructure, that means diverting the majority of the building's wastewater from Pittsburgh's overburdened combined sewer system.

Even though the building is complete, and over half of its eventual 2,000 occupants have moved in, it will take time to understand how well it is actually functioning. Paladino will be working with the commissioning agent and owner to conduct measurement and calibration over the tower's first four seasons and track performance. But it will probably be more difficult, yet no less important, to understand how well employees take to their new home. Will they have serendipitous meetings with their colleagues in the double-story neighborhoods? Will they eat lunch in the sky garden? Will they take advantage of the porch within the double skin? "The tower will be successful," says Gensler, "when users embrace their role." ■



Continuing Education



To earn one AIA learning unit (LU), including one hour of health, safety, and welfare (HSW) credit, read "Poppers and Floppers and Porches, Oh, My!," review the supplemental

material at architecturalrecord.com, and complete the online test. Upon passing the test, you will receive a certificate of completion, and your credit will be automatically reported to the AIA. Additional information regarding credit-reporting and continuing-education requirements can be found online at continuingeducation.bnpmmedia.com.

Learning Objectives

- 1 Explain the integration of natural and mechanical ventilation at the Tower at PNC Plaza.
- 2 Explain how the tower's climate-control system operates in different seasons and different conditions.
- 3 Describe the design and simulation process that helped refine this climate-control scheme.
- 4 Outline the history of natural ventilation in office towers.

AIA/CES Course #K1512A

FOR CEU CREDIT, READ "POPPERS AND FLOPPERS AND PORCHES, OH, MY!" AND TAKE THE QUIZ AT CONTINUINGEDUCATION.BNPMEDIA.COM, OR USE OUR ARCHITECTURAL RECORD CONTINUING-EDUCATION APP, AVAILABLE IN THE ITUNES STORE.

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CIRCLE 216

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Record Products 2015

A jury of three architects, two lighting designers, and one interiors director selected the best new products of the year, choosing from the hundreds of entries submitted to ARCHITECTURAL RECORD's annual competition. Jurors rated each hopeful according to innovation, usefulness, and aesthetics. We showcase the winners and their flashes of genius on the following pages.



PAGE 120



BEST IN CATEGORY denotes the winner that received the highest total score in the group from the jurors.



EDITORS' CHOICE denotes the RECORD staff's selection from among the category's top-scoring entries.

Written by **Linda Lentz, Rita Orrell, and Julie Taraska**

Edited by **Julie Taraska**

Jurors' portraits by **Axel Depeux**

Jurors *All jurors are based in New York City*

Sara Agrest, AIA, IIDA, LEED AP

Agrest is the director of interiors at Dattner Architects. With over 20 years of experience in architecture and interiors, she previously served as the director of design for Equinox. She is currently working on projects for the Estée Lauder Companies, Hilton, and NYU Medical Center.

Brett Andersen

A principal designer at Focus Lighting, Andersen joined the firm in 1996 with a background in theatrical design. He has since worked on projects including the Atmosphere Restaurant of the Burj Khalifa in Dubai and the Space Shuttle Pavilion at the Intrepid Museum. He also has spoken at numerous industry conferences, including HD Expo.

Charlie Dumais

Dumais is the design and marketing director for BOLD (Brian Orter Lighting Design). He leads the design of projects ranging from hotels, restaurants, and resorts to private residences, residential towers, and office spaces. Current works of note include Pier 57, Union Square Café, offices for Google, and the Bowery branch of the Ace Hotel.

Stephan Jaklitsch, AIA

The founding principal of Jaklitsch/Gardner Architects counts among his projects Toro/Ishi/Ku, the Marc Jacobs retail flagship in Tokyo; the Terrain vase for the Museum of Modern Art Design store; and resilient residences for the post-Sandy "Build it Back" program. He is vice president of Open House New York and an urban beekeeper.

Vivian Lee, AIA, LEED AP

Lee is an associate partner at Richard Meier & Partners. Her current portfolio includes residential projects in Taiwan, a boutique hotel in South Korea, and the Teachers Village Charter School and Workforce Housing in New Jersey. Lee also worked on the Italcementi i.lab—one of the first LEED Platinum-certified laboratory buildings in Italy.

Anne Schiffmann, AIA, LEED AP BD+C

A senior architect at Snøhetta, Schiffmann counts the New Central Library in Calgary, Ryerson University Student Learning Center in Toronto, and the SFMOMA expansion in San Francisco among her projects. Prior to joining Snøhetta, she worked with Diller Scofidio + Renfro and Rice+Lipka Architects.

Facades

Window Walls | Glazing | Cladding | Thermal & Moisture Barriers



Best in Category

Laminated Slump Glass with SGX

Pulp Studio, California Glass Bending, and Belzberg Architects collaborated on this panel system comprising a vacuumed layer of SentryGlas Expressions (SGX) PVB substrate sandwiched between slabs of slumped, laminated glass. The shape, thickness, curvature, and pattern of the panels may be customized, with sizes up to 96" x 180" available. Suitable for interior or exterior applications, the glass was developed for the Gores Group headquarters in Beverly Hills, California, shown at left. pulpstudio.com CIRCLE 100

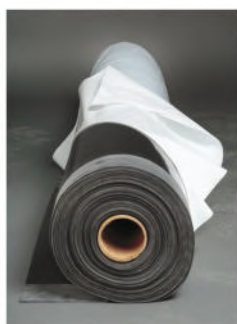
Formawall Graphix Series with Directional Reveals

This line allows specifiers to customize a single wall or roof insulated metal panel with up to 24 horizontal, vertical, and diagonal reveals. The reveals can vary in size, color, and face texture; they also can feature integrated components such as windows and louvers. By making one panel look like several, the product reduces both installation time and the risk of air and water infiltration. centriaperformance.com CIRCLE 103



Craft Paint-Grade Brick & Block

These off-white masonry veneer bricks and blocks make custom paint jobs quicker by presenting a less-absorbent surface than their touchstones. They come in three styles: a coarse brick, a squat and long rectangle, and a blocky Midcentury Modern shape. creativemines.us CIRCLE 104



RubberGard EPDM SA

The only self-adhered EPDM rubber roofing membrane on the market, RubberGuard ensures full coverage across openings, significantly reduces installation time, and can be applied at temperatures as low as 20°F. The 60mm-thick VOC-free membrane meets or exceeds all ASTM requirements. Its release liner is also 100% recyclable. firestonebpc.com CIRCLE 101



ProSeal

This ultra-low VOC spray foam for commercial and residential applications allows trade workers to safely reenter the space after one hour of active ventilation and for homeowners to reoccupy it after two. Consisting of a base seal and a resin, ProSeal offers an R-value of 7.1 and an improved yield to meet today's strict building code requirements. icynene.com CIRCLE 102



Matterhorn Metal Roofing

Available in realistic Shake, Slate, and Tile profiles, this 100% recyclable steel roofing features a patented paint coating that can reflect up to 65% of solar radiation. This high-performance product, which is approved for use in harsh climates, also supports clean water runoff. matterhornmetalroofing.com CIRCLE 105





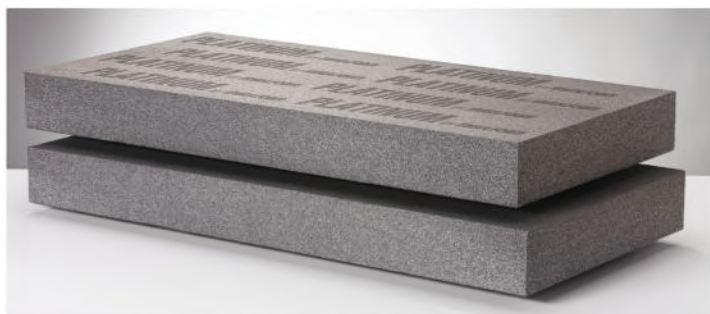
“More than a 100 million birds die each year in North America due to collisions with glass. AviProtek E offers an attractive, effective solution that building owners can easily incorporate into their structures.”

Stephan Jaklitsch



AviProtek E Glass

This low-E product keeps birds safe by adding acid-etched patterns onto the outside of PPG Industries' energy-saving Solarban glass. Tested by the American Bird Conservancy, AviProtek comes in three linear and two dot patterns. Two glass colors and a 6mm thickness are standard; custom options are available. walkerglass.com CIRCLE 108



Platinum Graphite Polystyrene (GPS) Insulation

Made with Neopor, a rigid foam from BASF, this insulation has high-purity graphite integrated into the polymer matrix of its expanded polystyrene. The result is that this 100% recyclable product has R-values that increase as the temperature decreases—rising from 4.3–4.6 at 75°F to 4.9–5.0 at 25°F. It also offers exceptional vapor permeability.

insulfoam.com CIRCLE 106



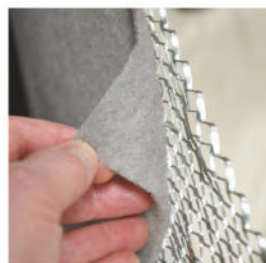
Editors' Choice



Solarban 90

This low-E glass provides superior solar-control performance without a noticeable reflected color. In a standard 1" insulating-glass unit, it offers a solar heat gain coefficient of 0.23, a visible light transmittance of 51%, and a light-to-solar-gain ratio of 2.22. It also can be combined with clear, Starphire Ultra-Clear, and performance-tinted glass in various applications.

ppgideascape.com
CIRCLE 107



LathNet

LathNet is an all-in-one mesh-and-lath drainage system for adhered masonry. Created by Mortar Net Solutions in partnership with ClarkDietrich Building Systems, it offers a continuous plane between the lath and structural wall, preventing mortar bridging and eliminating the need to install yet another weather-resistant barrier. Made of polyester, the mesh is 50% recyclable; the steel lath is 100% recyclable.

mortarnet.com CIRCLE 109

Openings

Windows | Doors | Hardware | Daylighting Tools

Ezy Jamb Trimless Door Frame

This trimless jamb system wraps the drywall during framing; when then mudded and painted, the frame blends seamlessly into a wall, resulting in a clean finish. Made with 100% recyclable steel, Ezy Jamb has reinforced edges. A collection of complementing hardware is also available.

ezyjamb.com CIRCLE 110



Best in
Category



Entice Entrance System

Balancing aesthetic preferences for visual transparency with code requirements for weather resistance and energy conservation, this system of aluminum extrusions clad in stainless steel offers door-stile widths as thin as 1½" and depths as shallow as 2½". Entice is suitable for use with glass doors, entry walls, sidelights, and transoms and has the ability to support handle hardware on 1" thick insulating glass. It comes in four models and a variety of finishes. crl-arch.com CIRCLE 111

ThermaShade Sun Shade System with Exposed Anchors

YKK's new system includes a thermally broken attachment anchor that reduces solar heat gain while maintaining the curtain wall's U-performance—an option not often found. It is available with two attachment options: concealed fasteners for a clean, integrated look, or exposed fasteners for an industrial aesthetic. ykkap.com CIRCLE 112



Dayliter Shading

This unique interior system comprises operable fabric lightshelves that bounce sunlight onto the ceiling and deep into the room, even when the main shades are closed, and integral roller shades with torsion drive and optional motorization. The pairing's effect is to reduce glare and luminance ratios, as well as heat and energy consumed. Sizes range up to 91" long x 21" deep, with options including linked lightshelf assemblies and a selection of textiles.

indoor-sky.com CIRCLE 113



Kitchen Transition 2.0

This dual-height, sliding window-and-door system features a load-bearing, upper-running carriage that removes the need for a floor track. Each panel opens and operates independently, with additional options including fully open corners, hidden pocketed panels, EPDM weather stripping, and brush seals between panels and frames. nanawall.com CIRCLE 114



5500 MRL

With its lightweight suspension traction media delivering a smoother and more vibration-free ride than conventional steel ropes, this passenger elevator for mid-rise buildings travels at 200–500' per minute. Its Power Factor 1 Regenerative Drive returns 30% of the unit's energy to the building's power grid, while its destination dispatch system achieves 30%–40% greater operating efficiency than that of a traditional model.

us.schindler.com CIRCLE 115

“Despite its sleek profile, the Entice Entry System offers the performance of a heavy, full-frame system.”

Stephan Jaklitsch



Contemporary Clad Folding Doors

With slender 2¹⁵/₁₆" stile and rail profiles, these doors don't skimp on performance. Features include aluminum exteriors and wood interiors, square or sculpted profiles, and 2¹/₄"-thick panels; sizes range from 60" x 108" for multislide options to 39" x 108" for folding and swing doors. The system also adheres to the California Energy Commission's Title 24 standards.

lacantinadoors.com CIRCLE 116

Verdura

A collaboration between manufacturer Rocky Mountain Hardware and HOK's product design team, this stylish antimicrobial interior door and cabinet hardware is intended for health-care facilities, wellness centers, and educational institutions. The hand-cast fittings are made of CuVerro, an EPA-registered bactericidal copper said to kill 99.9% of infectious bacteria within two hours. Available in matte finishes or three brushed-bronze options.

rockymountainhardware.com CIRCLE 117



Hawa-Junior 80/B

A top-fixed suspension system for low-headroom applications, this hardware for sliding wooden doors weighing up to 176 pounds is easy to install and adjust. It allows for a minimal .04" gap between the top track and door, as well as for a door to be recessed into the ceiling. Junior 80/B can also be combined with a soft-closing mechanism. hawa.com CIRCLE 118



Editors' Choice



THEIA Performance Shading

This tolerance specification and ensuing product reflect Lutron's discovery that transmittance value (Tv) significantly affects a shading textile's ability to achieve target comfort levels and energy savings. Because no industry standard guaranteeing shading's solar performance existed, Lutron established THEIA, which monitors Tv and weave openness. Partnering with Mermet, the company introduced the first THEIA-compliant fabrics in the spring and has set up a Performance Shading Advisor section on its website to assist specifiers. lutron.com CIRCLE 119

Lighting & Electrical

Contract | Commercial | Residential | Outdoor

Stellina Indirect

This incredibly slim 1½" high by 4" wide LED pendant casts light upward, delivering an efficient 133 lumens per watt at 5–10W per foot. Softly curved in shape, the aluminum fixture is available in 56" or 104" lengths, endcaps included. The Stellina mounts with aircraft cable and can be ganged to accommodate countless configurations. It also comes with a variety of dimming and daylight controls. amerlux.com CIRCLE 120

Best in Category

Magneto

What makes Foscarini's new reading lamp a standout? The ease with which its wand-like ABS diffuser can be raised, lowered, and focused in any direction. (A magnetic spherical joint connecting the diffuser to its support rod creates that 360° flexibility.) Available in floor and table versions, Magneto features integrated LED lighting and a body made from epoxy powder-coated steel.

foscarini.com CIRCLE 121

Fraxion

This extremely shallow family of fixed, adjustable, and wall-wash downlights illustrates Lucifer's penchant for detail. With recess depths of 3.8" for fixed models and 4.3" for full-tilt applications, this fixture, with a 4" aperture, comes in trimless or .3" MicroFlange versions with integrated mounting systems for rapid installation; 80+ or 95+ CRI lamps deliver up to 3,000 lumens, with beam spreads from 10° to 60°. Multiple finishes and color temperatures are available.

luciferlighting.com CIRCLE 122

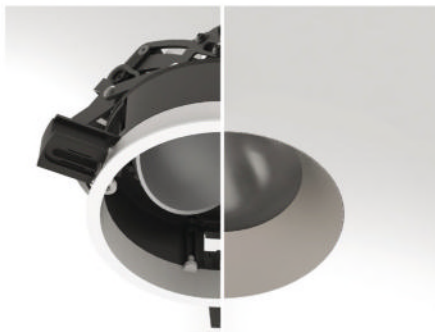
Rincon

Powered with an LED light engine from CREE, this 117" tall x 4½" square fixture adds the missing component to Forms+ Surface's existing Rincon line of bollards and pathway lighting. As with its family members, this latest model is notable for its precise stainless-steel construction and minimalist styling.

forms-surfaces.com CIRCLE 123

FloatPlane LED

With a performance of 129 lumens per watt, the 1.2" high x 8" wide LED linear fixture from Philips Ledalite offers plenty of flexibility. It comes in 4', 6', and 8' lengths and in suspended or wall-mount versions. Available with curved or squared edge caps, it is available in standard matte-white, black, and titanium-silver colors or in custom Pacific Aqua and Surf hues. lightingproducts.philips.com CIRCLE 124





Sail Mirror LED

A frosted-glass insert backlit by dimmable 2,700K LEDs borders this surface-mounted mirror. An even glow and 92+ CRI make Sail an ideal complement for bath and makeup vanities. edgelighting.com CIRCLE 125

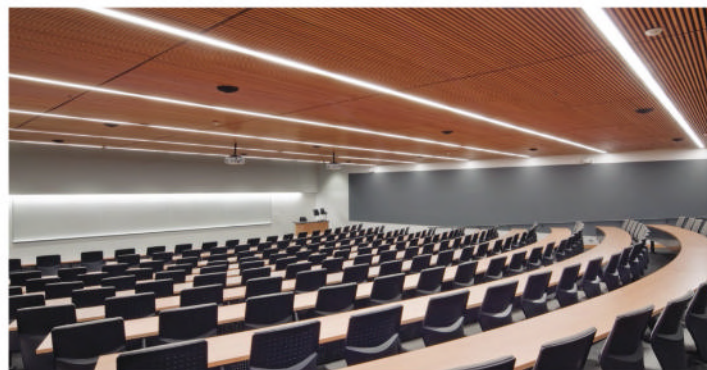
“A new profile in linear LED indirect lighting, Stellina has a rounded half-oval shape and can seamlessly integrate daylight control sensors.”

Charlie Dumais



Quantum LP

At $\frac{3}{4}$ " square, this tiny fixture by MINIMIS may be the smallest architectural luminaire in the world. Manufactured in Texas out of Grade 5 titanium—and featuring a custom-crafted, sharp-cutoff metallic reflector and 9mm aperture—Quantum can be installed in a variety of materials, including drywall, wood, glass, tile, stone, concrete, and steel. This accent and decorative lighting suits indoor or outdoor settings, including marine and IP67 harsh environments. minim.is CIRCLE 126



Neo-Ray Define Series

Available in 1", 2", 3", 4", and 5" widths, this linear recessed LED luminaire integrates into a wide variety of ceiling systems and vertical installations. Lengths can be specified to the nearest inch; other options include integrated motion and daylight sensors, high or low lumen packages, and a selection of color temperatures up to 90 CRI. The fixture also boasts a patent-pending lens clip—for flush, regress, or drop lenses—which prevents light leaks as well as bug and dust infiltration. eaton.com CIRCLE 128



Bahia Mini Wall

Consisting of an asymmetrical layering of two matte-white egg-shaped plates, this luminaire radiates a warm LED glow. The $2\frac{1}{8}$ " round by $2\frac{1}{2}$ " deep fixture, which is made of injection-molded polycarbonate, adds texture and interest to walls and ceilings in commercial and hospitality settings. foscarini.com CIRCLE 127



Murro LED Wall Wash

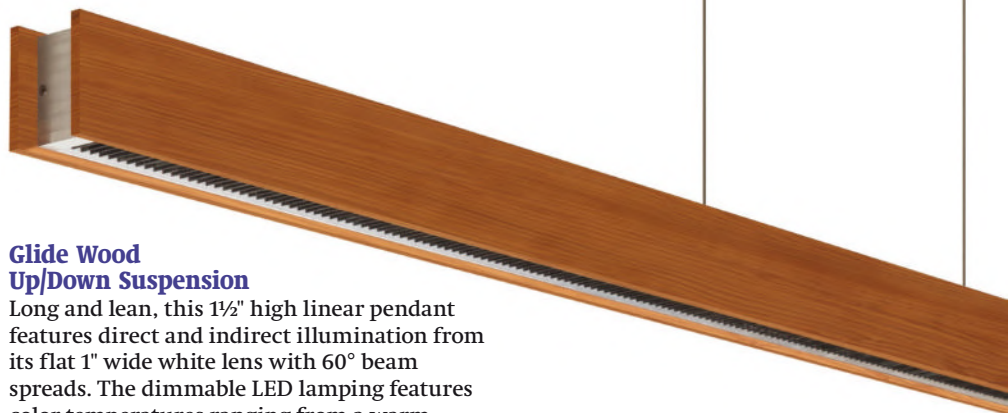
This compact and passively cooled track-mounted fixture delivers up to 2,000 or 3,000 lumens at 91.1 lumens per watt. A 2:1 spacing ratio provides more light on the wall with fewer of the $4\frac{13}{16}$ " wide x $3\frac{1}{16}$ " fixtures. Dimmable to less than 5%, the Murro LED wall wash features Crisp White technology and offers 2,700K and 3,000K color temperatures at 97 CRI.

amerlux.com CIRCLE 129



Stadium Pro

Featuring polycarbonate lenses and a die- and gravity-cast aluminum body, this LED heavy hitter meets the demands of outdoor professional sports venues, providing a 115,000-lumen output per fixture and a 75% energy savings over traditional alternatives. State-of-the-art features include color tuning and flicker-free operation optimized for HDTV broadcasts and slow-motion replays. It also offers glare-minimizing optics and the ability to control special effects in each quadrant. ephesuslighting.com CIRCLE 131



Glide Wood Up/Down Suspension

Long and lean, this 1½" high linear pendant features direct and indirect illumination from its flat 1" wide white lens with 60° beam spreads. The dimmable LED lamping features color temperatures ranging from a warm 2,700K to a cool 5,700K at 85+ or 92+ CRI. Options include 36" to 120" fixture lengths, one or two square canopies, black or white louvers, and a choice of five wood finishes. edgelighting.com CIRCLE 130



Lumec Classic Style & Sleek Vision

This series of retro (shown left) and contemporary post tops features ClearGuide Technology, a state-of-the-art vertically oriented light engine that appears transparent during the day but provides full illumination at night—minus the glare typical in similar LED street lighting. Each post-top series delivers 3,813 to 8,152 lumens, or up to 114 lumens per watt. The bollards provide 495 to 1,915 lumens, or up to 83 lumens per watt. lightingproducts.philips.com CIRCLE 132



Editors' Choice

Revelation Skyceiling

Designed to transform large internal spaces into restorative lighted environments, this modular system works with or without a ceiling grid. It offers standard image panels up to 4' square, with larger custom sizes available for its mega-format, high-resolution digital images. The company's slim, LED edge-lit lighting system provides daylight-quality illumination, enhancing the illusion of a skylight where there is none. skyfactory.com CIRCLE 133



Trac-Master T272L Arc I LED Series

This versatile track fixture works in retail, commercial, and residential settings. Measuring 8¾" high x 5" wide x 2½" deep, the T272L delivers up to 1,648 lumens of brilliant white light from 15W, with efficacies reaching 110 lumens per watt. Designed with a subtle high-tech styling, it is available in white, black, and silver finishes. junolighting.com CIRCLE 134



Pilkington **OptiView™**



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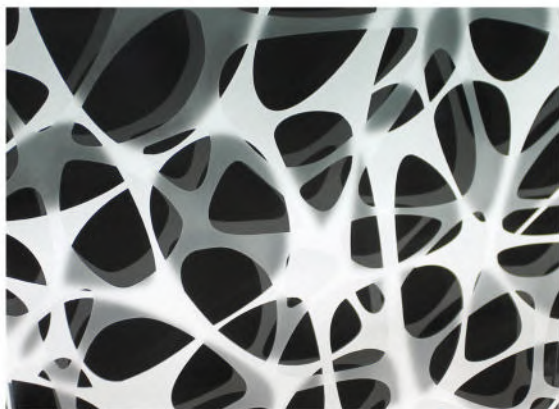
Pilkington **OptiView™** has low-reflective and UV blocking properties which make it perfect for any display, showroom or storefront applications. Pilkington **OptiView™** also minimizes visible light reflectance to less than two percent.

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Oberon Etched Glass

The 3-D patterns gracing both sides of this low-iron architectural glass add a sense of depth to interior partitions and building facades. Available in stock, tempered, or annealed glass, Oberon diffuses light, reduces glare, and offers a degree of privacy. It is ½" thick and may be specified in sizes up to 90" x 124". bendheim.com CIRCLE 135

Best in
Category



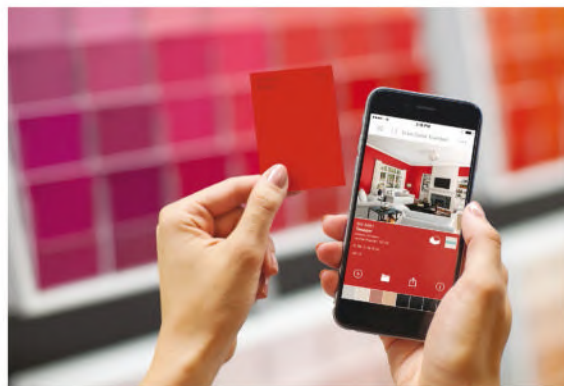
Tavola Divergent

This line of nonparallel, diverging beams and baffles creates texture in interior and exterior spaces. GREENGUARD Gold Certified and Class A fire-rated, the system comes in six configurations and dozens of finishes, including real-wood veneers and Woodwright wood-look powder coat; all elements hang off an aluminum ceiling track available in profile dimensions up to 12' long. Tavola is also compatible with industry standard lighting, HVAC, speaker, fire safety, and security services. hunterdouglascontract.com CIRCLE 136



Zoom Images & Zoom Digital Darkroom

The Zoom Digital Darkroom on the Forms+Surfaces website gives users access to the Zoom image library of large-scale, super-high-resolution images; it also provides the tools to create custom architectural glass designs. Zoom images serve as the graphic interlayers for laminated glass. They can be specified in sizes up to 60" x 120" for partitions, room dividers, and other applications. forms-surfaces.com CIRCLE 137



ColorSnap

This paint-color selection system from Sherwin-Williams comprises an in-store display that groups color by family; a mobile app for iOS and Android devices; and take-home materials such as color chips and inspiration postcards. ColorSnap Visualizer, included in the app, also allows users to match any hue in an image to one of the company's offerings. colorsnap.com CIRCLE 138



BuzziFalls

These 31½" wide multipurpose panels can serve as decorative room dividers or dimensional wallpaper with sound-absorbing properties. Offered in seven CNC-cut motifs, they are comprised of BuzziFelt, a washable eco-felt made of 100% recycled PET. They come with hanging hardware in a choice of two lengths: 87" and 98".

buzzi.space CIRCLE 139



Equal Measure

Three different textures work together in this carpet-tile collection: a carved, irregular pattern that recalls well-worn cobblestones; a simple low-profile pile; and a transition design that bridges the two styles. Made with 100% recycled nylon, part of which is from reclaimed fishing nets, this plank-shaped flooring works end-to-end and side-to-side to create a variety of installations.

interface.com
CIRCLE 140

Lustre

Suited for heavy commercial use, these high-tech vinyl carpet tiles can change appearance based on the viewer's angle. The visually trickery, inspired by how light bounces off crystals, is the result of the way the tiles' woven, asymmetric pattern is fit. Available in over two dozen styles, Lustre is also water- and slip-resistant.

ernestnyc.net CIRCLE 142

**"Zoom Images/
Digital Darkroom
allows you to
easily create a
sense of place
and emotion. It's
a fantastic option
when digital
media aren't
possible."**

Brett Andersen



Industrial Park

Inspired by terrazzo and concrete, this porcelain tile is the first to benefit from Daltile's StepWise Technology. The patent-pending process combines superior slip-resistance with easy maintenance, making Industrial Park a good choice for heavy commercial and mixed-use applications, including interior ramps. The tile is available in three sizes and four colors.

daltile.com CIRCLE 141





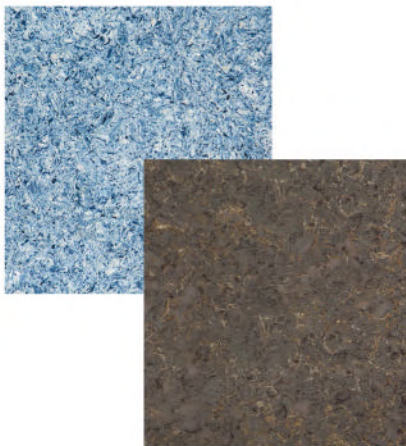
Blendart

Though it may look like reclaimed barn wood, this flooring is actually porcelain tile. Available in 24" squares and 6" by 47¼" planks of custom thicknesses, Blendart comes in five colors. It's suitable for residential and commercial spaces, including those with heavy pedestrian traffic. walkerzanger.com CIRCLE 144



Optical Woods

Utilize a new dual-sided printing technique with four high-res wood patterns and you have 3form's latest line of Varia Ecoresin panels. Optical Woods comes in seven standard hues, five gauges, and two sizes (48" x 96" and 48" x 120"), with custom options available. Each panel contains 40% pre-consumer-recycled content. 3-form.com CIRCLE 143



Silestone Influencer Series

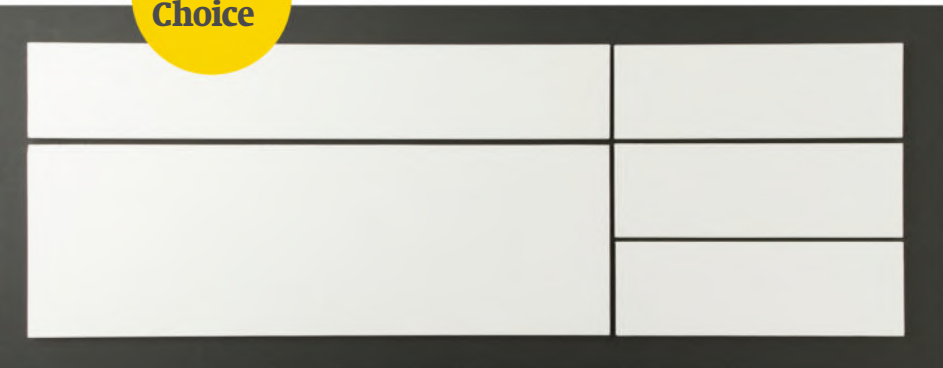
The palette for this line of natural quartz surfacing was developed through Silestone's first-ever color collaboration with interior designers. Reflecting regional trends, the five hues and patterns include Albedo, a swirling deep blue inspired by clouds; Olivia, a warm caper green; Copper Mist, a mixture of earth tones and metallic accents; Nymbus, a soft gray; and Lusso, a white marble with gold veining. silestoneusa.com CIRCLE 145



Axiom Glazing Channel

Designed for use with ¾" and ½" thick glass partition walls, this recessed extruded-aluminum trim offers fully concealed integration into any Armstrong acoustical or drywall suspension system. Five profiles are available, with the end result a clean visual in which the glass disappears into the ceiling plenum. armstrong.com/axiom CIRCLE 146

Editors' Choice



EDGE Tile

This collection of handmade ceramic tiles installs with a mere ¼" grout spacing, creating a polished look for walls, floors, or countertops. Made of 70% recycled clay, EDGE comes in 12 matte colors and three modular sizes: 3" x 9", 3" x 18", and 6" x 18". It is suitable for residential and commercial applications, with its lead-free glazed surface an easy-to-clean option for high-traffic areas. fireclaytile.com CIRCLE 147



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Lampshower by Nendo

Ideal for hospitality and residential clients, this high-performance solid-brass showerhead designed by Nendo's Oki Sato for Axor is a playful take on a lampshade. The wall- or ceiling-mounted fixture has an integrated LED globe at its crown and 120 no-clog spray channels producing a rain-type spray from a disc around its base. The finish is classic chrome. hansgrohe-usa.com CIRCLE 149

Best in Category

OpenSpace B

This ingenious shower unit designed by EOOS for Duravit opens tight bathrooms, with shower doors that can be tucked away when not in use. Available with transparent or mirrored glass doors, OpenSpace B is available in four sizes—from 35" square to 39" x 35"—and can be installed on a tile floor or combined with any Duravit shower tray. duravit.us CIRCLE 148



Raven Studio Sprinkler

A flush profile and 3" wide, paint-in-place escutcheon make this discreet sprinkler ideal for most any application. The UL- and C-UL-listed fixture features a 1½" diameter sprinkler head that provides a minimum of 26 gallons of water per minute. Standard or extended coverage is available for pendant and sidewall configurations. tyco-fire.com CIRCLE 150



SensoWash Slim

Designed to integrate with seven of Duravit's toilets, this slim-profile, high-efficiency seat, which doubles as a bidet, is controlled with a remote device that allows users to select from three personal wash cycles. The Slim is available in two sizes and features a child-safety lock, night-light, and soft-close lid. duravit.us CIRCLE 152



Blu-Stone Shower Base

Made of 80% quartzite and 20% resin, this shower base has an extremely thin 1¼" high threshold that can be recessed for universal design applications. Suitable for residential and commercial use, the durable one-piece unit comes in a slip-resistant matte-white finish. Sizes range from 31½"-35½" wide and 31½"-98½" long. blubathworks.com CIRCLE 151



ShowerSelect Trims

These ADA-compliant thermostatic trims have legible, easy-to-operate push buttons that allow users to turn the shower on and off and, in the two-function models, also switch between hand shower and showerhead modes. The chrome control has a tactile anti-scald 100° safety stop and comes with a square or round plate.

hansgrohe-usa.com CIRCLE 153



Gas Slide-In Range

LG Studio consulted with interior designer Nate Berkus on this five-burner stainless-steel slide-in range sized to align with most kitchen counters. Features include cast-iron grates, robust metal knobs, a canted control panel with digital display, and a 6.4-cubic-foot convection oven with EasyClean technology, a 20-minute low-heat way for the oven to clean itself.

lgstudio.com CIRCLE 154

“A great solution for showers in limited spaces, OpenSpace B has ingenious details, such as a door that doubles as a mirror.”

Vivian Lee



Electronica Vision Wheel

Looking a lot like a music device from a certain California-based tech company, this thermostatic digital shower control features easy menu navigation, three customizable presets, and an LCD screen showing water use and temperature.

Available in high-gloss black or white with a polished chrome control, Vision Wheel can be operated via an iPhone or iPad app—offering an ingenious way to warm the shower water from bed. blubathworks.com

CIRCLE 155

Editors' Choice



Hybrid Urinal

Water-free urinals are an increasingly popular option for public facilities, though improper or infrequent maintenance of these fixtures can lead to odor and clogs. This model, with Jetrinse Solution Technology, automatically purges its housing and pipes every 72 hours—using only 1 gallon of water in the process. An infrared switch located under the fixture allows maintenance personnel to manually operate the system during cartridge changes.

sloanvalve.com CIRCLE 157



24" Refrigerator Drawers

U-Line's dual-zone, under-counter refrigerator drawer unit (Model 3024DWR) features two independent compartments with individual temperature controls. Users can tailor each drawer's temperature to its content's needs, with choices ranging from 34° to 70°F. The unit comes in stainless steel or ready for custom panels. u-line.com CIRCLE 156

Furnishings

Furniture | Upholstery | Accessories

BuzziHub Open

These cocoon-like seating areas provide islands of privacy within open-plan environments, yet if the user leans forward, into one of the side cutaways, she can engage with others outside the space. Made of recycled wood and aluminum, and then covered in acoustic foam and a choice of fabrics, each unit measures 48" x 79" x 75". BuzziHub may be used alone or grouped in pairs to form a temporary conference area. buzzi.space CIRCLE 158



Zenhit

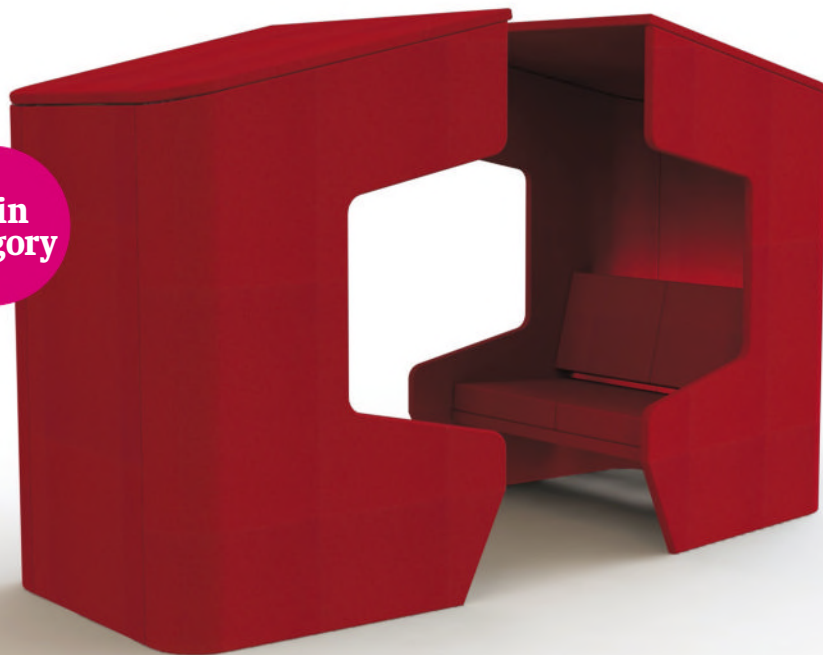
With their elegant, curved frames made of weather-resistant teak, the 13 pieces in this outdoor-seating collection merge form and function. The mix-and-match offerings, which can suit large spaces and small, range from a simple armchair to a daybed to a three-seat sectional. Upholstery options include water- and UV-resistant acrylic fiber or Royal Botania's proprietary RainStop PVC-coated acrylic. royalbotania.com CIRCLE 159



Hex Table

Twenty-six hexagonal cells collide at three levels to form this textured 64" coffee table by Erin Sullivan. Inserts of polished brass and quartz crystal dot its lacquered honeycombs, while clear Lucite legs support its span. esobjects.com CIRCLE 161

Best in
Category



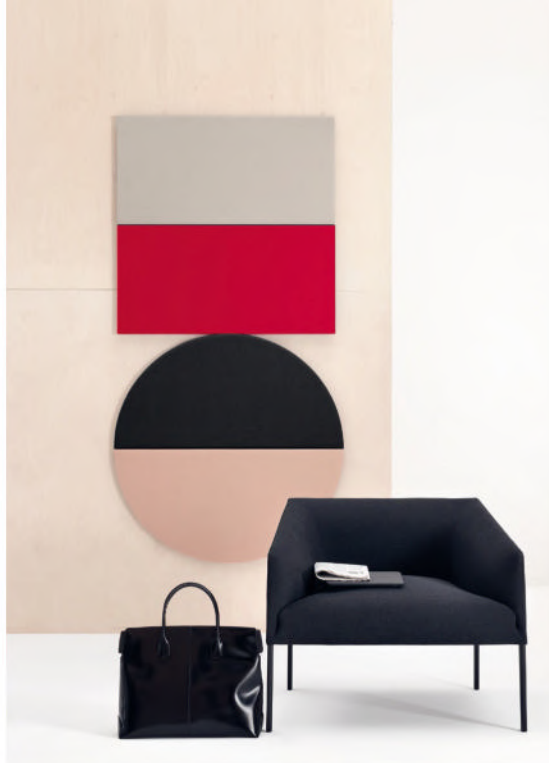
Cubo

This reissue of Harry Probbler's iconic 1972 sofa system exemplifies why the designer is considered the grandfather of modular seating. The 32" components—available as squares, quadrants, and circular-format ottoman pieces—are endlessly reconfigurable. Custom upholstery, multiple wood finishes, and various foot styles are available. m2l.com CIRCLE 160



Agordo

Filling the hole in the market for eclectic, contract-grade furniture, Agordo offers a curvaceous form, rounded legs, and a seat upholstered in fabric or butter-soft leather. The legs come in a choice of five hardwoods and 20 lacquer finishes; they also may be covered in leather. casaintl.com CIRCLE 162



Parentesit

Available as ovals, squares, or circles, these wall panels—rated Absorption Class A—make a strong graphic statement while improving acoustics. Carded-upholstery options include dozens of fabric collections by the likes of Maharam and kvadrat. Parentesit also may be customized with ambient LEDs and Bluetooth-speaker connectivity for a multi-sensory experience. arper.com CIRCLE 163

“Architectural but sculptural, Prism can make a statement in hospitality and corporate environments.”
Sara Agrest



Prism

The first soft-seating collection by architect David Adjaye plays with geometric shapes and geological forms. Comprising a club chair that swivels, an ottoman, and a marble-topped side table, the pieces engage from all sides, making them ideal for open-plan hospitality, office, and residential spaces. knoll.com CIRCLE 166

Havana

Made of 100% IFR Xorel, this textile with a large-scale repeat features diaphanous horizontal stripes that evoke brushstrokes on a canvas. It is suitable for use as a wallcovering or upholstery. Cradle-to-Cradle certified silver, it comes in five colorways. carnegie.com CIRCLE 164



Kinesit

Eschewing cockpit-like adjustment controls, this lightweight task chair uses a weight-responsive seating mechanism to automatically accommodate the user's body. The backrest offers three reclining positions, as well as an adjustable lumbar support. Kinesit is available with armrests, numerous bases, and a choice of three seatback heights. arper.com CIRCLE 165

Editors' Choice



Brody WorkLounge

Brody is a self-contained personal work and study space designed to maximize interior real estate. At its heart is an upholstered seat with upper and lower back support, around which are multiple work surfaces, integrated power outlets, adjustable task lighting, and a storage cubby. The unit's modular nature means it can be configured to fit wherever needed. Its raft of options—including privacy screens and customizable finishes—guarantee that it looks good while doing so. steelcase.com CIRCLE 167

HVAC

Heating | Ventilation | Cooling



Best in Category

Air Pear 25-EC

This destratification fan balances air temperature in facilities with ceiling heights of 8' to 25'. Aside from an energy-efficient EC motor, the unit has an optional 0-10VDC module that allows the fan to be programmed into a building's control system. Standard and short models with 120 or 230 voltage are available; so is a 2' square lay-in to incorporate the fan into acoustic-tile ceilings. airiusfans.com CIRCLE 168

"The Mitsubishi L-Gen Air Source is small, quiet, and made from 89% recycled materials and refrigerant. Its zinc coating also improves its lifespan."

Sara Agrest



Whisper Fit EZ

Suitable for remodeling and new construction, this retrofit fan kit enables utilization of existing ventilation ducts. The package comprises a ventilation bracket with articulating joints, a built-in speed selector that can customize air flow to 80 or 110 CFM, and a galvanized steel fan in one of three styles: lighted, non-lighted, and non-lighted with motion sensor. business.panasonic.com CIRCLE 171



Screen Barrier with Glass Bracket Insert

To meet new industry codes requiring an exterior barrier around fireplace glass, Ortal designed an aluminum-and-steel-mesh screen. To maintain the screen's tautness around multi-sided units, the company devised these virtually invisible tempered-glass brackets with metal sockets. At a mere 7mm thick, they do their job without obscuring views of the flames. ortal-heat-usa.com CIRCLE 169



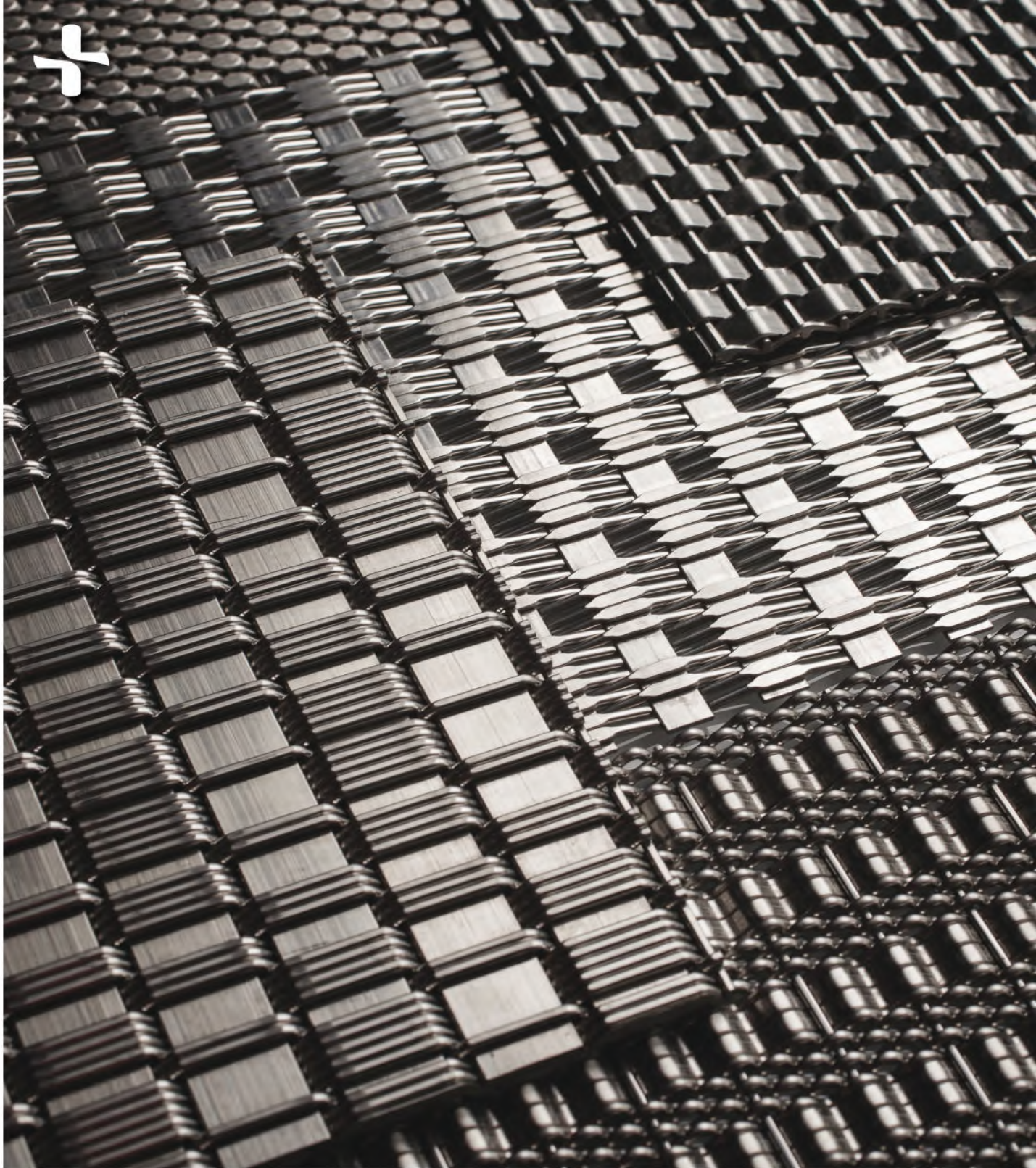
Exterios E

Energy Star-certified, this wall-mounted heat pump provides powerful, low-ambient operation in all weather conditions. Its 23 SEER system constantly adjusts the compressor rotation speed, allowing the unit to operate with minimum power once the desired room temperature has been reached. Plus its ECONAVI human-detection technology senses people in the space and automatically adjusts heating and cooling levels. business.panasonic.com CIRCLE 170



L-Generation Air Source VRF Outdoor Units

Utilizing both Mitsubishi's proprietary HexiCoil heat-transferring technology and an optimized refrigerant circuit, the Air Source VRF offers superior efficiency and water-shedding capabilities. Its footprint is 30% smaller than previous models, and its makeup—89% recyclable materials and R410A refrigerant—make it suitable for LEED and net zero projects. mehvac.com CIRCLE 172



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BuzziShed

An alternative to disposable temporary constructions, this reusable steel-and-metal structure can serve as a booth, reception space, or shaded work area. When covered in Sunbrella fabric, it is also ready for outdoor use, providing protection against wind, temperature extremes, and glare. [buzzi.space](#) CIRCLE 173



Zidiz

To produce this line of outdoor chairs and loungers, Royal Botania first laser-cuts and presses a plate of aluminum, and then bends it into three parts, making it one continuous flow from backrest to seat edge. Then it adds a second piece of aluminum to conceal a structural teak bar in the seat's rear, in the process enhancing the chair's curve. Accompanying tables topped in travertine complete the collection. [royalbotania.com](#) CIRCLE 174

Osprey

With a form like a bird ready to take off in flight, Osprey comprises a cantilevered steel frame covered in an upswept HDPE-knitted canopy held in place by Type 316L tensioning hardware. The canopy shades 66–97% of sun, depending on the fabric's color (19 hues are available). The structure is offered in a regular and extra-strong version that can withstand wind gusts up to 115mph and 165mph, respectively. [tensileshadeproducts.com](#) CIRCLE 175



"I can imagine BuzziShed being used for purposes beyond just the workspace, such as for temporary outdoor exhibitions, kiosks, or emergency shelters."

Anne Schiffmann



Nolita

An economy of materials marks this steel outdoor chair, elegant in its simplicity and lines. Stackable and available in eight colors, it also comes in two seat-back heights and with or without armrests. An optional seat cushion may be added. [ernestny.com](#) CIRCLE 176

Twist Bike Rack

A playful take on the double helix, Twist comprises a single solid-aluminum casting with a durable powder-coat finish. It works with standard U-locks, supports most bikes in two places, and offers multiple locking points. It also complies with the guidelines set by the Association of Pedestrian and Bicycle Professionals. [forms-surfaces.com](#) CIRCLE 177



Vector Seating System

Users can customize this outdoor system with bench and planter modules, numerous finishes, and add-ons such as seat backs and LED accent lighting. Benches can be specified with FSC Jatoba hardwood or powder-coated aluminum seats, while side panels may be made of stainless steel or the company's proprietary VividGlass. [forms-surfaces.com](#) CIRCLE 178



Editors'
Choice

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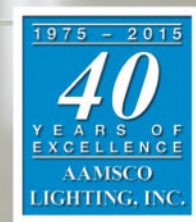
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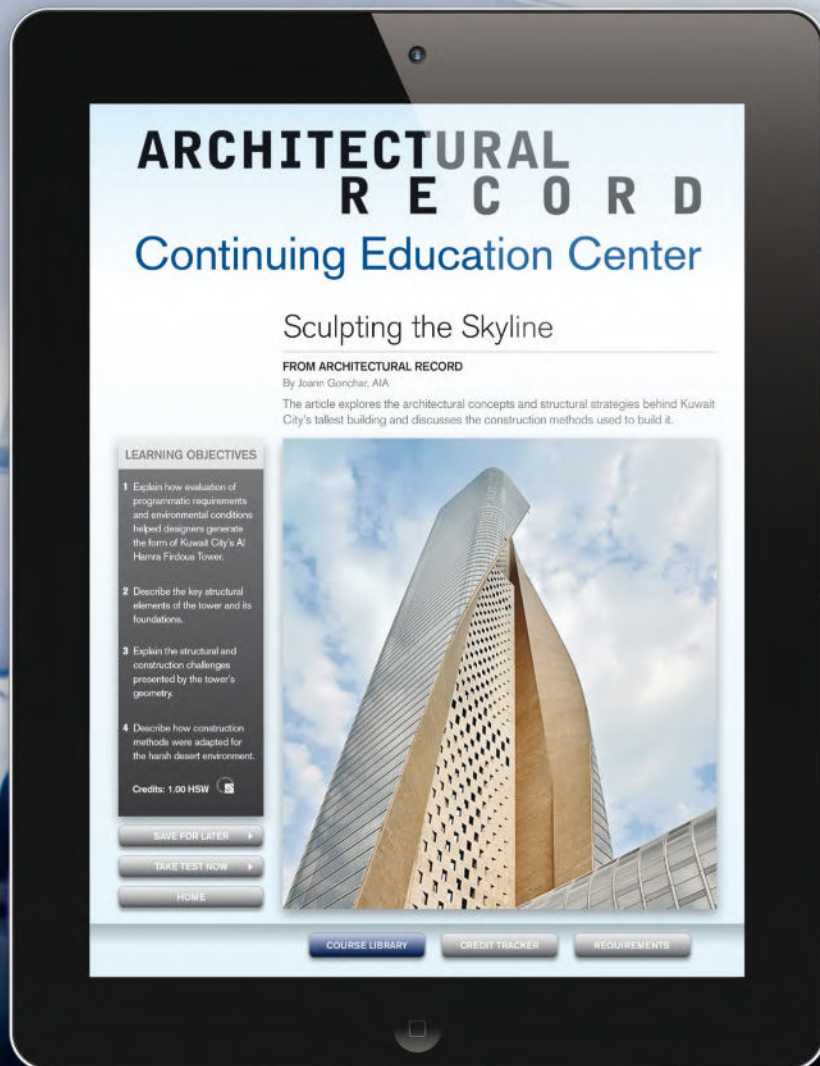


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Code Compliant Exterior Systems for Wood-Framed Building Envelopes

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p143

Photo: Mithun Architects Inc., WG Clark Construction



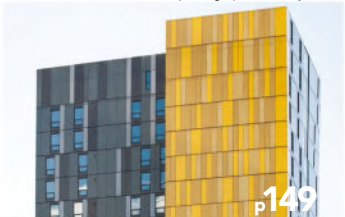
Designing for Durability

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reThink Wood

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Beyond Airtightness: Factors to Consider When Selecting an Air Barrier

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Photo courtesy of Jenn-Air; credit: The IWS Lake Forest Showhouse



The Intersection of Universal Design and Sustainable Living

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Photo courtesy of Eldorado Stone



No Rain In the Plane: Detailing Manufactured Stone

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Photo courtesy of Duro-Last, Inc.



Cool Roofs for a Hot Planet

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Photo courtesy of Build LLC



Crafting the Intersection Between Indoors and Outdoors

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The Health and Design Benefits of Accessing Daylight and Views with Dynamic Glass

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Photo courtesy of Holcim Foundation



Sustainability, Modular Design, and BIM

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Photo courtesy of K.R. Moeller Associates Ltd.



Sound Masking 101

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Breaking Old Rules for Air-Barrier Installation

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p182

— CATEGORIES —

AC	ACOUSTICS	PM	PRODUCTS AND MATERIALS
ACC	ACCESSIBILITY	PMD	PRACTICE, MANAGEMENT, DIGITAL TECHNOLOGY
BE	BUILDING ENVELOPE DESIGN	RE	RESIDENTIAL
EM	ELECTRICAL AND MECHANICAL	ST	STRUCTURAL
IN	INTERIORS	SU	SUSTAINABILITY
LS	LIFE SAFETY AND CODES		

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Code Compliant Exterior Systems for Wood-Framed Building Envelopes

Building codes and energy codes put more emphasis on performance

Sponsored by Huber Engineered Woods LLC | By Peter J. Arsenault, FAIA, NCARB, LEED AP

Evolving codes increasingly emphasize building envelope performance. Structural products offering integrated layers of protection against moisture, air leakage, and thermal bridging are now available to add quality control on-site, while meeting multiple requirements.

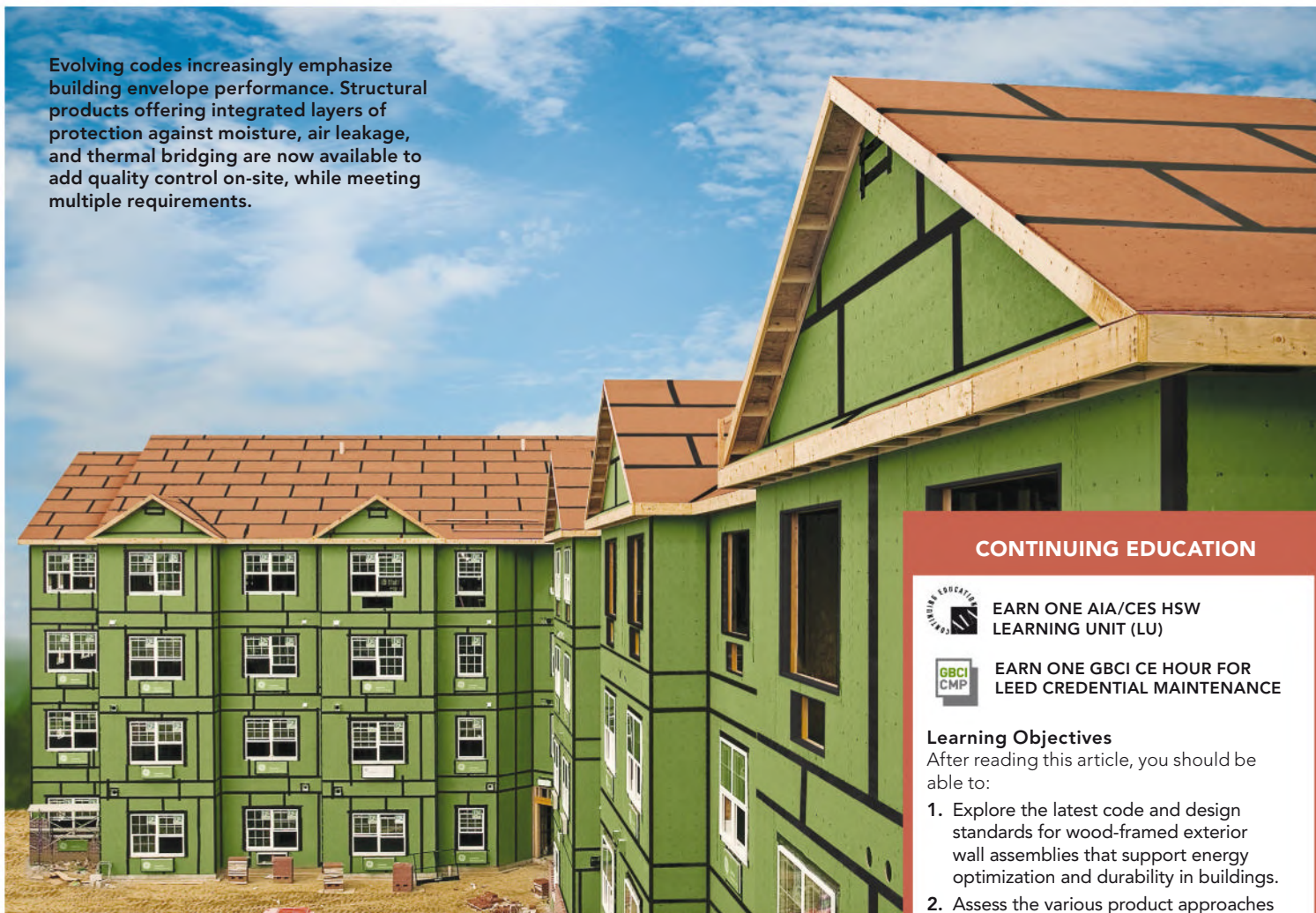


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Wood-framed construction has been, and continues to be, a very popular construction choice for single-family residential, multi-family residential, and light commercial buildings. Building codes and energy codes recognize this popularity and have incorporated requirements that apply specifically to wood-framed buildings. These codes have evolved in recent years with an increasing emphasis on building envelope performance related to five key areas—namely structural integrity, water resistance, air tightness, vapor control, and thermal resistance. The common design and construction response

has been to find available products and materials that can address each of these five needs independently. This approach requires multiple layers of materials acquired from different manufacturers with separate installation steps for each. However, manufacturers have also begun to offer products that can combine multiple performance requirements into a single manufactured product or system. Design and construction professionals have come to understand that these integrated products can provide greater on-site quality control while providing a faster, more labor-efficient means to meet code requirements.

CONTINUING EDUCATION



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Learning Objectives

After reading this article, you should be able to:

1. Explore the latest code and design standards for wood-framed exterior wall assemblies that support energy optimization and durability in buildings.
2. Assess the various product approaches to meet air barrier and water-resistive barriers (WRBs) on the market today for green and sustainable buildings.
3. Analyze the differences between multi-product solutions and single-product solutions to wall sheathing for a total approach to green building design.
4. Investigate the benefits of continuous insulation added to exterior sheathing as a means to optimize energy performance in wood-framed buildings.

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Wood-framed construction has been and continues to be a popular construction choice for single-family, multi-family and light commercial buildings. Codes continue to evolve to address structural performance, moisture, air, and thermal management in the critical exterior wall assembly area.

APPLICABLE CODES

Historically, as is true today, the applicability of a particular code or specific requirements starts first with a determination of the basic building type. This is essentially determined by the way the building is used or occupied and to some extent on the size or construction type. Residential buildings are treated differently than commercial buildings under the codes, and high-rise buildings are treated differently than low-rise buildings. While the categories of code requirements are similar between these different types (i.e., fire safety, light and ventilation, energy usage, etc.), differences exist in the minimum or threshold levels of performance among the different building possibilities.

The International Code Council (ICC) is an association of government, corporate, and individual members who together form the largest building and safety code organization dedicated to protecting the property, health, and safety of people worldwide. It is dedicated to developing model codes and standards used in the design, build, and compliance process to construct safe, sustainable, affordable, and resilient structures.

Most U.S. communities and many global ones have adopted some or all of the family of International Codes (I-Codes) published by ICC. These I-Codes are a complete set of comprehensive, coordinated codes that address general building construction, fire safety, mechanical systems, electrical work, energy

efficiency, and related issues. Together, they provide a common platform and format for a coordinated approach to create regulatory requirements for the construction and maintenance of buildings. Because of their widespread use, I-Codes will be the basis for the discussions in this article, recognizing that application of these codes vary across the county due to publication year and adoption rates. Further, specific building types will be linked to specific codes as follows.

One- and Two-Family Homes

Single-family or duplex homes, whether free-standing or attached as townhouses no more than three stories above grade, are specifically covered under the International Residential Code (IRC) for One- and Two-Family Dwellings. This category of buildings is fairly easy to define, and the distinctions between them and other types of buildings are reasonably well understood, so it is not surprising that there is a separate treatment for energy efficiency in one- and two-family homes compared to other buildings. The International Energy Conservation Code (IECC) is the document that addresses such energy efficiency with two separate and distinct parts—one for commercial construction and one for residential construction.

Other Residential Units

Since people can occupy residential living units that are not one- and two-family dwellings, those occupancies are treated under the more general

International Building Code (IBC). Specifically, the IBC identifies four categories of Residential Occupancies in Section 310: R-1 for transient residents (hotels, boarding houses, etc.); R-2 for permanent residents (apartments, dormitories, vacation properties, etc.); R-4 for between five and 16 permanent residents in a supervised residential environment; and R-3 for building conditions not otherwise meeting the definition of R-1, R-2, or R-4. One thing to be attentive to: while all of these building types are commonly considered commercial buildings for residential use, the IECC doesn't make distinctions the same way. Rather, for purposes of the IECC, a residential building includes not only detached one- and two-family dwellings (including townhouses), but also any Group R-2, R-3, or R-4 building that is three stories or less above grade. The significance of this distinction is that the residential provisions of the IECC are more stringent than the commercial ones in terms of the building envelope. Hence, while all R-1 buildings and any R-2, R-3, or R-4 buildings over three stories can use the commercial portions of the IECC, those other than R-1 at three stories or below need to comply with the residential portions of the IECC.

Non-residential Buildings

All buildings that don't fall into the scope of the IRC come under the provisions of the IBC for new construction. Existing buildings that are being repaired, altered, or added on may be subject to the International Existing Building Code (IEBC), which allows for some accommodation of existing conditions provided all new work complies with the IBC. Both of these codes require compliance with the commercial portions of the IECC, and both indicate when wood-frame (Type 5) construction is allowed or not.

With an understanding of the differing applicability of the I-Codes on various building types that can use wood-framed building envelopes, let's turn our focus to five specific characteristics required by the provisions of these applicable codes.

STRUCTURAL FRAMING AND SHEATHING

The first and most common purpose of wood framing is to provide the structural support for the building. Several chapters in the IRC have very specific tables and charts indicating the required sizes of framing members for floors, walls, and roof-ceiling construction. These tables break down the allowable spans for different types of wood species at different spacings (16 inches, 24 inches on center, etc.). While this information is important and valuable for both the engineering of a wood-framed structure and identifying code compliance, there is more to the structural requirements than the framing.

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The applicability of a code or its specific requirements starts first with a determination of the building type based on the way the building is used, its occupancy, size, or construction type.



Structural engineering principles and the IRC recognize that if a wood-framed wall is not properly braced, it will move, warp, and potentially fail. This is true not only of a particular wall, but of the entire building as well. Dramatic failures of this type can be found in news coverage of storms or floods, where a wood-framed residence is seen slanted to one side or even collapsed with a pitched roof still intact above. The wall bracing in these cases was subjected to wind or other forces that exceeded the capacity of the bracing. As such, the IRC and the IBC require that exterior walls be designed not only to provide for the direct vertical loads imposed on them, but also for the other horizontal or shear loads that can be imposed by outside forces.

There are multiple methods for providing the needed wall bracing as recognized and allowed for by the building codes. The historical approach was to use “let-in” corner bracing, which was rather labor intensive and required a series of studs to be notched at an angle to receive a one-by-four member recessed to be flush with the face of the studs. Although the IRC still recognizes that approach, the availability of structural wall

panels made from plywood, structural particle board, oriented strand board (OSB), or other acceptable engineered products are much more popular and common. The reasons are obvious, in that a continuous layer of structural sheathing provides a more consistent, rigid, wall bracing system that is quicker and more economical to install. It also provides a continuous, fairly smooth surface for other layers of material to be applied. Hence, the codes recognize a series of different materials that can be used for continuous or intermittent bracing of exterior wood-framed walls.

Because there are variables between buildings and their locations, the codes call for a bit more detail in the selection of wall bracing material. Specifically, the code identifies zones or locations where bracing is required as a minimum structural requirement. It goes on to identify nailing or fastening patterns and spacings, taking into account the spacing of wood framing members. It further indicates the minimum thickness of selected materials since more thickness essentially equates to more strength. There are also tables and criteria for addressing seismic and wind loads

of different degrees, which directly impact the structural requirements of structural sheathing that acts as bracing.

Roof construction follows a similar set of requirements. The IRC identifies allowable spans for rafters based on varying structural criteria and also recognizes the use of pre-engineered roof trusses. But, it also goes on to identify the minimum requirements for wood structural panel sheathing used over the rafters or roof trusses. Attachment, span, thickness, and other traits of the structural sheathing are all identified based on reference to the appropriate tables. The additional variable is the presence or absence of snow loads to various degrees, which must be taken into account for the sheathing, just as it is for the framing members. Hence, the sheathing thickness comes into play based on the anticipated loading and the spacing of the framing beneath it.

Whether used for wall or roof construction, it is important to recognize that there is a wide variety in available sheathing products, and not all of them carry sufficient structural strength to be used everywhere. Inadequate strength may not lead to dramatic and sudden failure, but it

could likely lead to sagging and deterioration not only of the structure, but of other building components and systems as well. The American Plywood Association (APA) has published a voluntary product standard known as PS 2-10: Performance Standard for Wood-Based Structural-Use Panels. This is the document that forms the basis for the definition, testing criteria and certification of different types of wood panels, including sheathing, structural sheathing, and combination subfloor underlayment applications. For sheathing, it defines the general minimum requirements for use in construction applications, such as a covering material for exterior walls and roofs when fastened to supports spaced in accordance with the span rating of the wood panel. It also defines a Structural 1 Sheathing, which must meet all of the requirements for common sheathing plus additional requirements identified in the Performance Standard for “cross-panel strength and stiffness and for racking load performance.” This higher performance has a greater capacity for use in braced shear wall designs, making it appropriate to resist high winds and other forces. Prudent designers will tend to routinely specify Structural 1 panels to eliminate any guesswork for safety and structural integrity. Fortunately, some manufacturers seek that certification as a matter of routine for their products, recognizing that it is a designation that makes for a better product and a better building in the end.

WATER RESISTIVE BARRIER (WRB) AND DRAINAGE

With an appropriate structure in place, the building codes—both the IBC and the IRC—are concerned with the long term durability of that structure. As such, they include requirements related to protection from weather and, specifically, water that can penetrate an assembly and cause deterioration or damage to the wood. In this regard, the codes offer some specific definitions of items that need to be understood: (IBC 202, IRC R202)

- **Water-Resistive Barrier (WRB):** A material behind an exterior wall covering that is intended to resist liquid water that has penetrated behind the exterior covering from further intruding into the exterior wall assembly.
- **Exterior Wall Covering:** A material or assembly of materials applied on the exterior side of exterior walls for the purpose of providing a weather-resisting barrier, insulation, or for aesthetics, including, but not limited to, veneers, siding, exterior insulation and finish



Inadequate strength may not lead to dramatic failure, but it could lead to a compromised structure. There is more to structural requirements than framing.

systems, architectural trim, and embellishments such as cornices, soffits, and fascias.

- **Exterior Wall Envelope:** A system or assembly of exterior wall components, including exterior wall finish materials, that provides protection of the building structural members, including framing and sheathing materials, and conditioned interior space, from the detrimental effects of the exterior environment.

Chapter 14 of the IBC describes the particulars for exterior walls, including mandatory performance requirements (IBC 1403). Chapter 7 of the IRC has similar requirements (IRC R703.1.1). In clear and certain terms, the codes state that “[e]xterior walls shall provide the building with a weather-resistant exterior wall envelope.” It goes on to require that “[t]he exterior wall envelope shall include flashing...(and) shall be designed and constructed in such a manner as to prevent the accumulation of water within the wall assembly by providing a water-resistive barrier behind the exterior veneer...and a means for draining water that enters the assembly to the exterior.” Keeping in mind that this is all about the general integrity of the exterior wall, the clear intent is to avoid damage to the wall from water and weather by requiring the use of flashing,

a water-resistive barrier, and drainage for any water that does penetrate.

The IBC and IRC identify two options for WRB materials, first stating: “A minimum of one layer of No.15 asphalt felt, complying with ASTM D 226 for Type 1 felt...” (IBC 1404.2, IRC R703.2). Asphalt felt has certainly been a traditional material for many thermal envelope installations, including walls and roofs; however, it is seen as a rather obsolete material compared to other modern alternatives. Fortunately, the second IBC and IRC option is to allow “other approved materials,” which refers to “materials that are acceptable to the building official or authority having jurisdiction” rather than a long list of alternatives.

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Designing for Durability

Strategies for achieving maximum durability with wood-frame construction

Sponsored by reThink Wood

Architects specify wood for many reasons, including cost, ease and efficiency of construction, design versatility, and sustainability—as well as its beauty and the innate appeal of nature and natural materials. Innovative new technologies and building systems are also leading to the increased use of wood as a structural material, not only in houses, schools, and other traditional applications, but in larger, taller, and more visionary wood buildings. But even as the use of wood is expanding, one significant characteristic of wood buildings is often underestimated: their durability. Misperceptions still exist that buildings made of materials such as concrete or steel last longer than buildings made of wood. Although this connection between materials and building

longevity is often assumed, it is not borne out in fact, as will be discussed in this course.

Examples of wood buildings that have stood for centuries exist all over the world, including the Horyu-ji temple in Ikaruga, Japan, built in the eighth century, stave churches in Norway,

including one in Urnes built in 1150, and many more. Today, wood is being used in a wider range of buildings than would have been possible even 20 years ago.

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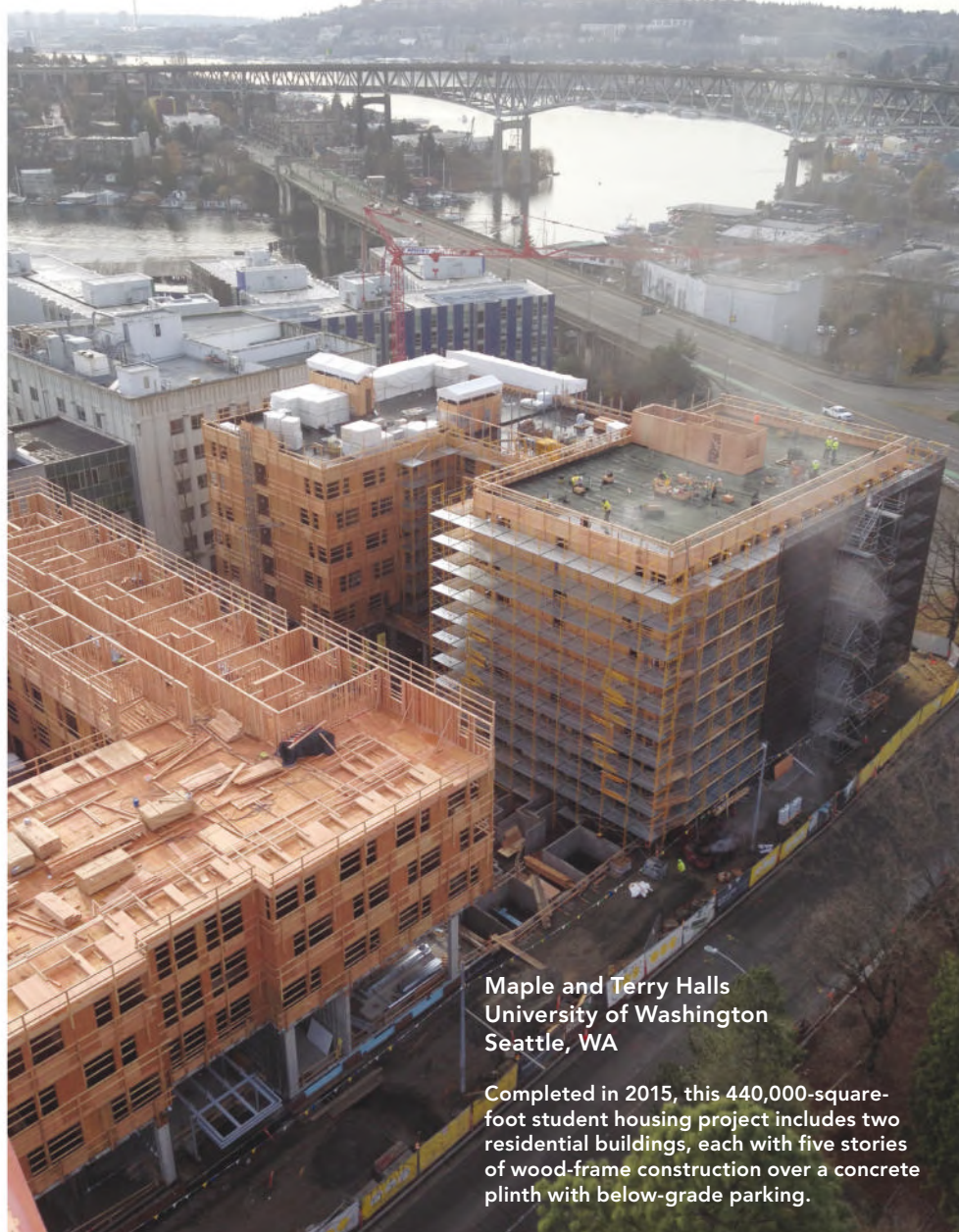
Learning Objectives

After reading this article, you should be able to:

1. Analyze factors contributing to the long-term durability of wood buildings.
2. Implement effective design strategies for controlling moisture in wood buildings.
3. Discuss comprehensive approaches for protecting wood buildings from insect damage.
4. Determine effective quality control measures that will have significant positive long-term impact on building durability.

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Maple and Terry Halls
University of Washington
Seattle, WA

Completed in 2015, this 440,000-square-foot student housing project includes two residential buildings, each with five stories of wood-frame construction over a concrete plinth with below-grade parking.

Photo: Mithun Architects Inc., WG Clark Construction



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Beyond Airtightness: Factors to Consider When Selecting an Air Barrier

Code compliance, performance, and compatibility

Sponsored by Dow Corning High Performance Building Solutions | *By Stanley Yee, LEED AP*



The value of a product or application stems from not only its technical appropriateness, but also its ease of use and the confidence it instills in those who specify and those who do the actual application.

Not surprisingly, following a prescriptive path for compliance with energy code requirements in climate zones that necessitate a split-insulation strategy—a wall assembly with both cavity-filled insulation and continuous exterior insulation (CI)—will reveal vapor-permeable capabilities are key for wall assembly breathability and, by implication, for long-term durability.

In these climate zones, geographic regions often are encountered that have already become (or are now becoming) aware, through codification, of the need to include thermal control—particularly at interface locations—in addition to ensuring continuity of the air and water control layers. For years, the market has offered solutions limited to addressing a specific condition: typically a clear field, linear or single-point condition.

CONTINUING EDUCATION



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Learning Objectives

After reading this article, you should be able to:

1. Define the basic requirements that air barriers must meet.
2. Describe the different types of air barriers on the market and their key differences.
3. Identify key areas within a wall system where detailing is important to system success.
4. Describe the different solutions currently on the market for sealing penetrations and transitions to create a complete air-barrier system.

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AIA/CES #K1512T

These individualistic solutions address specific performance or characteristic requirements for a particular interface or transition condition. When it comes to transitions and maintaining continuity of those same characteristics, there often are instances of incompatibility when material and component selection is not fully considered.

With the wide variety of air-barrier materials on the market, it is important to have an understanding of the available options and their general performance attributes and specific challenges, as well as to maintain a holistic perspective of how these materials will be anticipated to work together and perform.

SHEET- VERSUS LIQUID-APPLIED BARRIERS

In the air-barrier arena, there have been longstanding discussions and philosophies regarding whether a fluid-applied barrier should be selected over a sheet-applied material. The options in both categories are numerous and diverse, as are the rationales for making such a decision.

Sheet-Applied Barriers

Choices in the sheet-applied category can be divided into two basic subcategories: mechanically attached or self-adhering. The challenges associated with mechanically attaching an air barrier include impact on performance and the ease of installation, which ultimately affects long-term durability.

Mechanical attachments—and the holes made in the air barrier during their installation process—represent a potential path for uncontrolled air and water infiltration. To function as a continuous air barrier (a requirement for optimal air-barrier performance and long-term durability), the lapped joints at the sheet material's edges should be sealed—either taped or affixed with some form of a self-adhering backing. In both instances, one can readily imagine the challenges that either of those operations face on a breezy day. The self-adhered

Photo courtesy of Dow Corning Corporation



Self-adhered membrane installation at window opening—multiple layers and sequencing implications.



Liquid flashing installation at window opening—single material and installation operation.

variety of air-barrier materials often comes in the form of an asphaltic-based sheet laminated to a high-density polyethylene (HDPE) or metalized liner. Typically, these materials require a primer to provide long-term adhesion, which adds labor, time and materials.

This is not to say installation of either type of the sheet-applied system cannot be done satisfactorily. However, they typically require more attention to detail and advanced knowledge and coordination of how the interface/transition conditions to adjacent systems (e.g., fenestration) will be managed. These transitions often require another suite of materials, which raises concerns related to sequencing, compatibility, adhesion, and movement capacity.

Fluid-Applied Barriers

Providing more flexibility in the types of substrates to which they can be applied, fluid-applied air barriers simplify installation on more complicated construction projects. For instance, a fluid-applied barrier would be ideal for a wall that transitions from a concrete knee-wall to a framed wall that then transitions (laterally) to a concrete masonry unit (CMU) wall—a combination readily found in commercial construction where the interior usage and associated wall types vary along a given elevation. In addition to the benefit of substrate compatibility, silicone liquid-applied air barriers—particularly those that are water-based—offer primerless adhesion to most construction substrates, minimizing labor and additional product costs within a low-volatile-organic-compound (low-VOC) formulation.

Liquid-applied barriers typically are segregated by thickness of application. Thick-mil systems use more material and have lower yields per gallon of material purchased—and hence are typically more expensive on a per-square-foot-installed basis. Moreover, achieving the required thickness is challenging, as the material can begin to slough during application if upper-end thickness is not monitored. Conversely, thin-mil systems leave little margin of error for the applicator and make it difficult to ensure sufficient material on the wall to provide long-term performance. Liquid-applied membranes in the range of 15-mil dry-film thickness (DFT) optimally provide sufficient material for uniform coverage and performance, while not risking sloughing of material due to high buildup during installation.

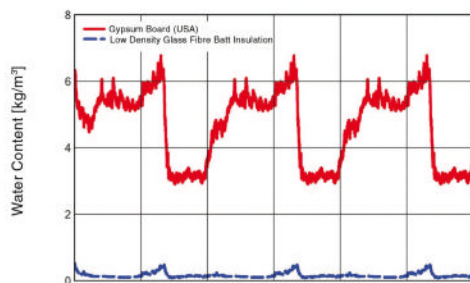
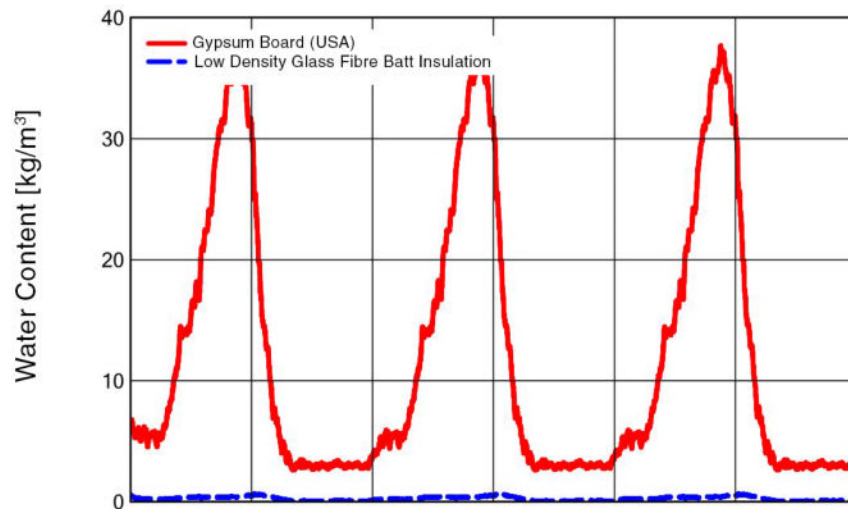
Additionally, some barrier products are marketed as having self-sealing properties, but without full consideration of fastener size, those claims may likely—and justifiably—be received with some doubt. A conversation with the air-barrier system manufacturer about the extent of fastener testing and studies would be advantageous.

ENERGY CODES AND AIR-BARRIER PERMEABILITY

If the exterior wall design calls for a fully continuous exterior insulated wall, the often-referred-to “perfect wall” provides an easy answer.¹ However, the potential for higher costs associated with engineered solutions to provide both the necessary depth to accommodate

Photo courtesy of Simpson Gumpertz & Heger

Images courtesy of Dow Corning Corporation



(Top) Water content in exterior sheathing with nonpermeable air barrier—Chicago (CZ5). (Left) Moisture content of exterior sheathing with permeable air barrier—Chicago(CZ5).

insulation requirements and a robust secondary support system for the cladding to cover the insulation poses challenges to some projects.

Both the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) 90.1-2013²: Energy Standard for Buildings Except Low-Rise Residential Buildings, and the International Energy Conservation Code (IECC)³ mandate inclusion of continuous insulation. In these cases, the default choice becomes a design that includes stud-cavity-filled insulation along with the minimum-required CI. In these situations, air-barrier permeability (to ensure wall assembly breathability) and long-term durability are especially important considerations.

MODELING OF AIR-BARRIER PERMEABILITY REVEALS PERFORMANCE EFFECTS

Three diverse climate zones were examined to study the impact of air-barrier permeability on the whole wall assembly, factoring in the implications of energy code requirements on the wall assembly makeup and design. Individual climate zones and the prescriptively required CI for each of the selected climate zones are those defined in ASHRAE 90.1-2013. The study included locations in Miami, Florida; Seattle, Washington; and Chicago, Illinois—climate zones 1, 4, and 5, respectively.

Using WUFI® Pro 5.34 to conduct the hygrothermal analysis, a typical commercial building was modeled under typical (default) interior environmental conditions. The typical exterior wall assembly construction is as follows:

- Brick veneer with a 25 mm (1 inch) air cavity;
- Fiberglass-faced exterior gypsum sheathing;
- 150 mm (6 inch) steel studs with fiberglass insulation in the cavity;
- Interior gypsum board; and
- Acrylic paint interior finish.

For each of the respective climate zones, the air (or air-vapor control layer) was placed on the exterior surface of the exterior sheathing. For the purposes of this discussion, the air control layer is a vapor-permeable 100 percent silicone water-based fluid-applied product with a dry-/wet-cup United States perm rating of 10.1/26.6; the air-vapor control layer is a generic membrane with a U.S. perm rating of less than 1. Continuous exterior insulation, where required prescriptively by code, was modeled with the insulation placed over the air/air-vapor control layer.

In climate zones where a minimum provision of continuous exterior insulation is required for code compliance, hygrothermal analysis showed the breathability of wall assemblies—enabled by a vapor-permeable air barrier—helped reduce the moisture content level in the exterior sheathing over a three-year period. This is compared to the same simulation conducted substituting the

permeable air barrier for a nonpermeable one. This phenomenon was observed to be more pronounced in those climate zones that required more continuous exterior insulation—in this case, Seattle (CZ4) and Chicago (CZ5).

All three climate-zone scenarios with the vapor-permeable air barrier showed a general drying trend of the wall assembly over the three-year simulation period. However, when the air barrier was replaced with the nonpermeable product, the wall's drying potential appeared to diminish in all modeled climate zones. This trend was observed to be more pronounced progressing toward colder climate zones and as CI requirements also increased.

In the simulation for Miami (CZ1), there is no requirement for continuous exterior insulation, so the impact of a permeable or a nonpermeable air barrier is more subtle. For the most part, the condensation point (which is not the same as the dewpoint) occurs outside of the wall assembly and away from interior materials that may experience the deleterious effects of uncontrolled moisture (vapor) migration. Models did show a vapor-permeable solution allowed for more drying of the wall assembly over time. Given the warm, humid nature of the Miami environment, priority consideration for ensuring a quality installation for continuity throughout—particularly at wall penetrations and transition conditions—would be more beneficial.

Seattle (CZ4), being a more temperate location but seeing a higher level of precipitation in the winter, showed the permeable air-barrier solution being more favorable. Using the analogy of a high-performance rain jacket—one allowing the body to perspire and the moisture associated with the perspiration to exit through the jacket for improved comfort—the permeable air barrier permitted the bi-directional transmission of vapor (in both winter and summer conditions) and allowed the wall assembly to dry out and mitigate the accumulation of moisture content that might result in undesirable condensation within the wall assembly.

Modeling a prescriptively compliant wall assembly for permeable and nonpermeable barriers, the simulation showed an initial drying trend for both. However, over the following three winter cycles, the nonpermeable air-barrier assembly saw increased moisture content in the exterior gypsum sheathing and higher risk of condensation development at that same location. The permeable condition did not indicate an increase in moisture content.

The simulation results for Chicago (CZ5) were clearer in terms of the advantages of using

a permeable air-barrier solution. When using the nonpermeable air barrier under winter boundary conditions, the simulation showed the split-insulated wall configuration did not provide sufficient thermal insulation to push the condensation point of the wall assembly to the exterior side of the air-vapor barrier. The results show after an initial drying period within the first few months of the simulation, the moisture content in the exterior sheathing saw a sixfold increase in moisture content in the winter months. This phenomenon repeated every winter over the three-year simulation period.

In each of the aforementioned simulations, air-barrier breathability was found to be a factor in the increased long-term durability of the wall assembly. In simulations where the minimum-energy-code-required wall assembly (the hybrid insulated wall) was modeled, the use of a nonpermeable air barrier was shown to increase the risk of condensation development in the wall cavity. This potential can not only diminish the real performance of the wall, but it also may have significant impacts on the long-term durability of wall materials themselves.

Simulations show a vapor-permeable air barrier is the most technically flexible option.

BEYOND THE MATERIAL: A SYSTEM APPROACH

Taking a more holistic approach to wall assembly design and material selection brings into consideration other factors in the air-barrier system selection. Like water penetration resistance and thermal resistance, airtightness is only as good as the weakest link in the entire wall assembly. The migration of moisture vapor into a wall cavity is more evasive and damaging (by an order of magnitude) when accommodating full movement capacity than the effect of diffusion alone. The airtightness at these transitions often is more important than the airtightness and actual permeability of the air barrier itself.

By using a system-based air-barrier solution, many of these concerns can be addressed. Liquid-applied silicone air-barrier systems typically are easy to apply and come with a suite of compatible silicone-based accessories. Specifically, use of a compatible liquid flashing mitigates the infamous “origami” of sheet-based systems at window rough openings. Liquid flashing—particularly when used in situations permitting primerless installation—also represents a significant time-savings component in comparison to sheet-applied materials and even other liquid flashing materials that require an embedded mesh for reinforcement.

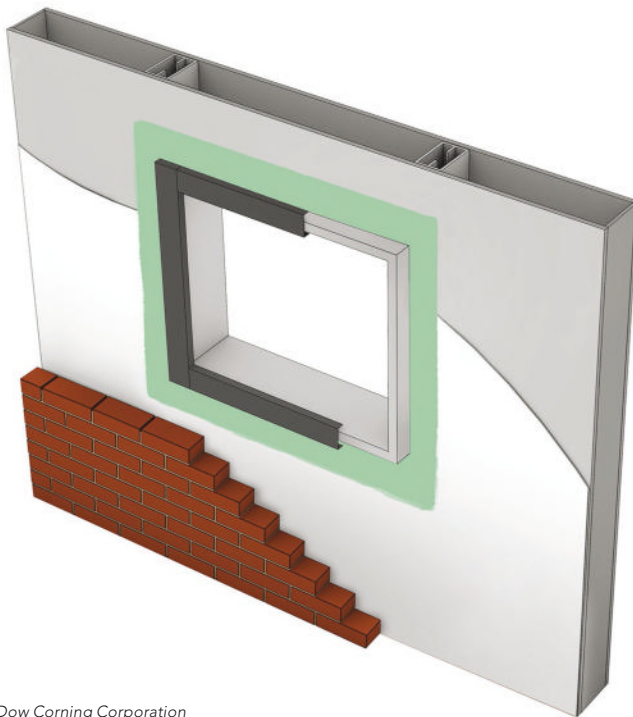


Image courtesy of Dow Corning Corporation

Further, silicone transitions are readily available and do not have the concerns associated with acrylic- or asphaltic-based materials.

Additionally, system-based air-barrier solutions deliver simplicity for specifiers and project managers, easing the decision-making process. With the benefit of a single manufacturer of the barrier components, designers can be confident the system will collectively work for the wall assembly design without compatibility concerns, enabling flexibility in project sequencing. Moreover, availability of supplemental, fully compatible accessory materials adds additional flexibility.

CONCLUSION

Controlling air leakage—whether from the outside in or from the inside out—is critical for building-enclosure performance and long-term durability. Selecting the correct air-barrier system for a given project is a decision that should be based on a number of factors, including permeability, component compatibility, performance and ease of application.

Ideally, one should specify a vapor-permeable, liquid-applied air-barrier system that:

- Provides primerless adhesion to common building substrates;
- Has a 100 percent water base for lower VOC content; and
- Is simple, functional, and backed by a trusted manufacturer.

ENDNOTES

¹BSI-001: The Perfect Wall, Building Insights, Joseph Lstiburek, Building Science Corporation, buildingscience.com/documents/insights/bsi-001-the-perfect-wall

²ASHRAE – American Society of Heating, Refrigerating and Air-Conditioning Engineers, ashrae.org

³IECC – International Energy Conservation Code, iccsafe.org

⁴WUFI® Pro 5.3, Fraunhofer Institute for Building Physics (IBP), wufi.de/en/software/wufi-pro/

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Stanley Yee, a LEED Accredited Professional, is a facade design and construction specialist for Dow Corning having nearly 20 years of experience in the building enclosure industry.

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Universal design and sustainable living come together most notably in the design of efficient, accessible kitchens.

The Intersection of Universal Design and Sustainable Living

Accessibility and sustainability come together in kitchen and laundry spaces that combine established design principles with proper appliance selection

Sponsored by Whirlpool Corporation | By Peter J. Arsenault, FAIA, NCARB, LEED AP

New and renovated residential buildings, among other things, need to be designed to meet current standards or code requirements for handicapped accessibility and energy use. Specifically, multi-family buildings are required to meet code requirements for at least a portion of units to be handicapped accessible following national standards while energy codes and standards, require energy conservation in buildings overall and in equipment and appliances in particular. Increasingly, however, single-family homes and multi-family units

are also being voluntarily designed to think beyond code minimums and achieve a higher level of design. Living units often follow the approach of universal design, meaning that the living spaces are universally accessible by all people. Buildings and appliances that carry certification labels reflecting sustainability, such as ENERGY STAR® and LEED, have become not only a marketing edge, but a mainstream expectation. Both of these areas of sustainability and universal design have become quite well-developed and sophisticated in recent years, with many professional and

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Learning Objectives

After reading this article, you should be able to:

1. Identify and recognize the ways that universal design is important and needed in residential design.
2. Distinguish between the various components of sustainability in building design.
3. Explore the ways to design kitchens to achieve successful integration of universal design and sustainability.
4. Demonstrate the ways that kitchens, laundry rooms, and appliances can be accessible to all users while using water and energy efficiently.

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GBCI COURSE #0920006229

trade resources available. A key consideration is that design professionals can incorporate both of these design areas in ways that work together with each other, creating the best outcomes for the users or residents of the building. The techniques to do this have also advanced to the point where aesthetics and overall design do not need to be compromised by either one. All of the sustainability and accessibility approaches affect the design of a total living unit, but perhaps most notably in kitchen areas and related laundry areas. Accordingly, this article will look at the ways the general principles of universal design and sustainability can work together in residential buildings, and focus on some specific ways to apply them in the design of kitchen and laundry areas.

UNIVERSAL DESIGN

Everyone involved in the design of buildings is certainly aware of the national standard for accessibility, namely, ICC A117.1: Accessible and Usable Buildings and Facilities. The latest version of this standard is included by reference in the family of building codes produced by the International Code Council and adopted in various forms around the country. Originally only a publication of the American National Standards Institute, it has since been fully codified and is generally in agreement with the building provisions of the landmark Americans with Disabilities Act enacted in 1990. Fundamentally, these all prescribe specific requirements to accommodate people with physical disabilities.

Universal design, by contrast, involves designing spaces holistically so they can be used by a full range of people with many different capabilities. Universal design looks beyond code and regulatory requirements for accessibility by recognizing that there is a wide spectrum of human abilities either between different people or between different periods in someone's life. Everyone, whether able-bodied or not, experiences childhood restrictions, adult capabilities, periods of temporary illness, physical injury, and limitations of old age. The differences at these different periods can be found in physical, perceptual, and cognitive abilities, as well as different body sizes and shapes. By recognizing this diversity of experiences that affect all people, environments can be designed that are easier for all people to use. A good example can be found in curb cuts at sidewalks that were initially designed and constructed primarily for people who use wheelchairs. It didn't take long to recognize that they could also be used by pedestrians with strollers or rolling luggage, thus adding functionality and convenience to everyone as part of a universal population.

Photo courtesy of Jenn-Air; credit: The IWS Lake Forest Showhouse



Universal design promotes layouts that are easy to maneuver and pass through, as well as aspects of functionality and convenience.

Photo courtesy of NKBA; design by Jennifer L. Gilmore, CKD



Sustainability can be achieved throughout a residential unit, but there are aspects of kitchens that warrant particular attention.

In addition to convenience, health and wellness in general are common topics of concern by many individuals, organizations, and institutions. It is commonly understood by most of them that preventive, pro-active measures are preferable to treating symptoms and conditions after the fact. Mary Jo Peterson, a nationally known expert on universal kitchen and bath design, has noted that universal design has been emerging as just such a proactive approach to supporting health and wellness. She has observed that “by allowing people to function in their own home environment, they can remain more independent, avoid unnecessary healthcare stays, and help promote their own longevity”.

As part of this health and wellness perspective, there are several groups of people in particular that have given rise to the popularity of universal design. The first is the approximately 75 million baby boomers who are approaching or entering retirement age. With a keen interest in staying active and independent, the concept of “aging in place” has

become a strong design interest. This approach is intended to allow people to remain in their own homes as their physical capabilities change over time. Typically, people in this group have sought a housing design that suits a current active lifestyle but readily accommodates anticipated future restrictions in mobility or capabilities. Another group of people with a similar but inverted order of needs is returning war veterans who are undergoing rehabilitation with the anticipation of improving capabilities. In this case, they seek a housing design that can accommodate their current compromised capabilities now, while still allowing for them to remain in the house when capabilities increase. Then there is the case of an increased number of multi-generational households, where family members or others of different capabilities are living in a household all at the same time. This multi-generational group seeks a housing solution that can accommodate all of their different needs simultaneously.

Incorporating universal design approaches in a residential design allow for the various needs

of all different types of residents to be met. It also allows for the building to have a longer period of usefulness to the owner, reducing the need to move or relocate due to changing capabilities. This is one way that universal design is also more sustainable.

SUSTAINABLE LIVING AND UNIVERSAL DESIGN

It is well understood that the design of sustainable residential units requires attention to a variety of issues. Energy efficiency is appropriately the first one that commonly comes to mind and is the most heavily weighted in green building rating systems, such as LEED, and the primary focus of the ENERGY STAR® program. However, most of us are aware that other issues are important, too. Water conservation is becoming as important as energy savings, particularly in many areas of the country where water shortages are becoming critical. As part of a healthy indoor environment, indoor air quality is a concern particularly in regard to the chemical make-

up of many building materials and products used in buildings. But an indoor environment is also affected by other things too, such as the acoustics and noise generation in a space or the ability to incorporate daylight and views from all areas.

Many of these sustainability attributes are also consistent with universal design attributes, meaning designing buildings to incorporate both does not mean that they need to be thought of as exclusive and separate things, particularly in terms of overall health and wellness of occupants. Turning again to Peterson, we can learn that “universal design has always had a focus on the health of the environment, including healthy air, elimination of allergens, and the way the quality, direction, and amount of light affect the occupants of a space. The same is true of sound quality and the control of noise in the home.” This connection between universal design and sustainable design is fairly obvious in that both are concerned with the ultimate health and wellness of the occupants as much as they are with the physical design of the spaces.

Looking at the bigger picture, if an entire home or a kitchen is created to be flexible and to respond to the differences in the people who will use it, then the home will last longer and be inherently more sustainable. Taking that a step further, if we use the best products and materials we can afford—those that will last the longest—then we can have the least potential long-term impact on the environment. Peterson sums it up nicely: “For a living space to be sustainable, it needs to be usable equally by all inhabitants, and this is what the combination of sustainability and universal design is all about.”

INTEGRATED KITCHEN DESIGN

With an understanding of the principles of integrating universal design and sustainable design, let's focus on what is arguably the most complex room of a living unit to design, namely the kitchen. The National Kitchen & Bath Association (NKBA) is a great resource and the recognized trade association for developing planning and design guidelines for residential kitchens and bathrooms. In 2012, it worked with John Wiley and Sons to publish *Kitchen Planning Guidelines with Access Standards* to provide designers with good planning practices that consider the needs of a wide range of users. For general issues, these standards reference the 2012 International Residential Code (IRC) and the International Plumbing Code, while for accessibility the reference is ICC A117.1-2009 Accessible and Usable Buildings and



The National Kitchen and Bath Association (NKBA) has authored a set of design guidelines for kitchens and bathrooms with accessibility standards included. A new, second edition is expected in January of 2016 published by John Wiley & Sons. Graphic images in the rest of this article are excerpted from the NKBA Kitchen & Bathroom Planning Guidelines with Access Standards published by John Wiley & Sons. Copyright 2012: National Kitchen & Bath Association. This material is reproduced with the permission of the NKBA.

Facilities. This publication offers 31 different kitchen planning guidelines that address kitchen layouts, circulation, reaching distances, work areas, and many other details of creating a good, accessible, kitchen design. More importantly, it epitomizes the concept of universal design in that it shows how to design for all people.

From a sustainability standpoint, there are many great resources to draw from including LEED for Homes or ENERGY STAR®. Essentially, however, kitchens need to meet the same general criteria as the rest of the building in terms of healthy, appropriate construction that allows for light, fresh air, and energy-efficient thermal comfort. But there are some things specific to kitchens to focus on as well. Notably, the appliances in the kitchen require energy and in some cases water that should be used efficiently or only as needed. Appliances can also contribute to unwanted noise when

they are running if not acoustically controlled. Additionally, the kitchen is a common place to provide trash receptacles, which means that from a sustainability view, receptacles for recycling are also needed. Some of these sustainable design elements will affect the amount of space required, and some will affect the selection of materials and equipment.

Pulling this all together, a kitchen that is truly sustainable and universally accessible is also efficient in its use of space, such that it doesn't make the living unit bigger than really needed in the first place. Single-floor living is the usual overall starting point, suggesting that the kitchen is integrated into the main living level. Access into the kitchen from other areas will require an accessible path not only through adjacent spaces, but also leading from a garage or entry door following level floors or acceptably sloped surfaces at 1:12. The circulation and flow into and through the kitchen also needs to avoid interfering with the functionality and flow of the kitchen. It also needs access paths that can accommodate people walking, using wheelchairs, or both.

The functionality of a kitchen is commonly broken down into five explicit zones for storage, preparation, cooking, serving/eating, and clean-up. Each of these zones need to be addressed as an integrated part of an overall kitchen design that allows for accessibility and sustainability. We can look at these five zones in more detail as follows.

Storage Zone

One of the primary functions of a kitchen is to keep or store food, cooking implements, dishes, and other related items. The universal design key, of course, is that everything being stored is easily placed and reachable by everyone. The trend in kitchen storage design is evolving notably to do exactly that. Upper wall cabinets are being used less frequently since they are difficult to reach by many average-height standing adults and even more so by anyone sitting, as in a wheelchair. Hence, a trend has been observed that these cabinets are being replaced with lower-height, open-front shelves that provide ready access and display of things like dishes, glassware, etc.

Continues at ce.architecturalrecord.com

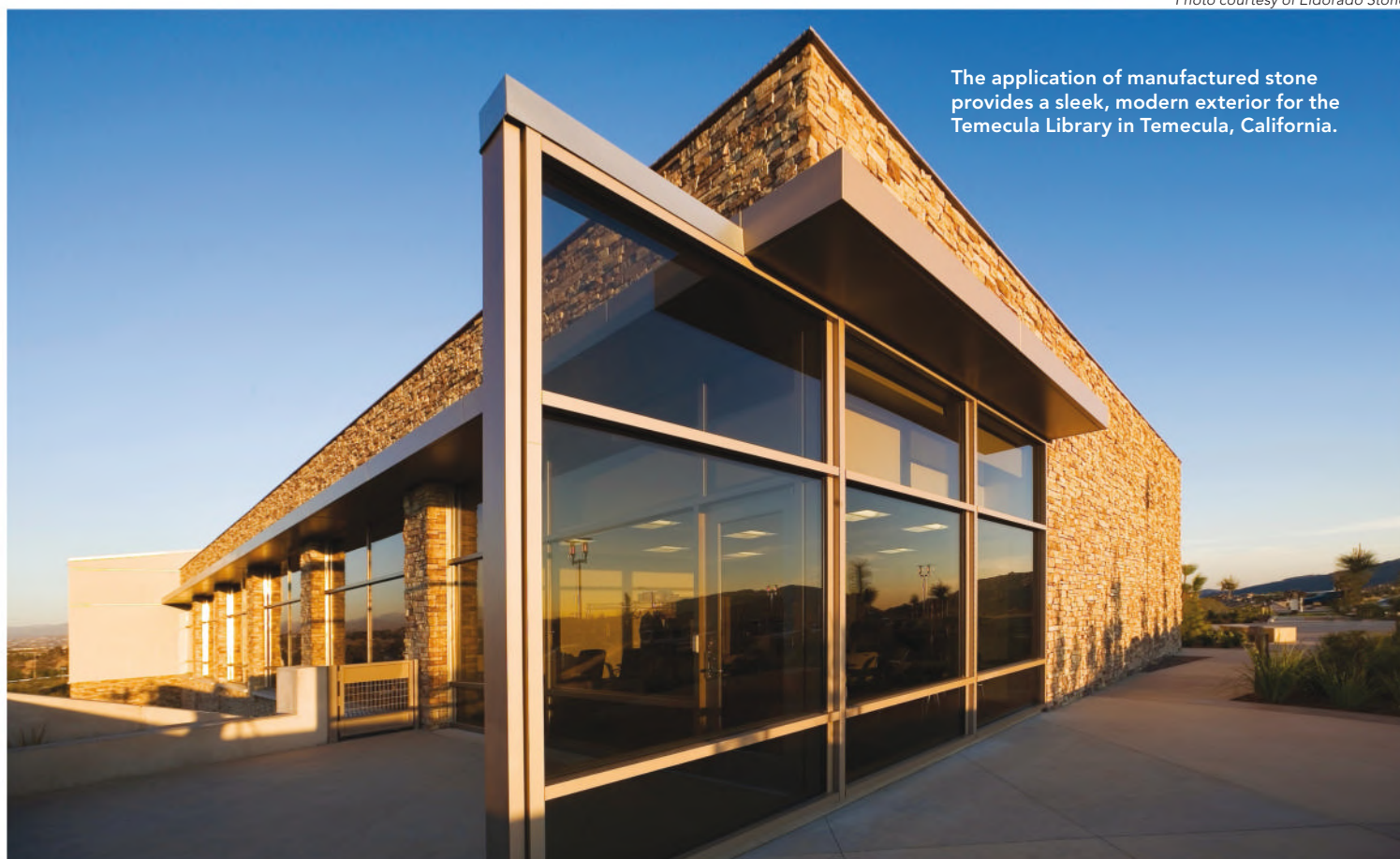
Peter J. Arsenault, FAIA, NCARB, LEED AP is an architect and green building consultant who has authored more than 120 continuing education and technical publications as part of a nationwide practice. www.linkedin.com/in/pjaarch



Whirlpool Corporation is the number one major appliance manufacturer in the world, with approximately \$20 billion in annual sales, 100,000 employees and 70 manufacturing and technology research centers throughout the world in 2014. The company markets Whirlpool, KitchenAid, Maytag, Consul, Brastemp, Amana, Bauknecht, Jenn-Air, Indesit and other major brand names in more than 170 countries. Additional information about the company can be found at WhirlpoolCorp.com.

Photo courtesy of Eldorado Stone

The application of manufactured stone provides a sleek, modern exterior for the Temecula Library in Temecula, California.



No Rain In the Plane: Detailing Manufactured Stone

With careful detailing, durable, lightweight manufactured stone adds value to sustainable projects for architects who employ modern as well as traditional design aesthetics

Sponsored by Eldorado Stone | *By Celeste Allen Novak FAIA, LEED AP BD+C*

When the phone rings, the call from the client to the architect for a new building often begins with a list of contradictory requirements. The client wants to own a building that conveys quality, permanence, and strength. This particular client likes the look of natural stone, but the architect knows that it does not meet the company's ROI and is not in its budget. Natural stone is mined and sourced from specific quarries and has unique markings. However, this client needs a stone that can be reproducible for the 80 or more stores they plan to brand and build across the country. In addition, the client wants a building that meets green standards, one that is energy efficient, uses recycled materials, is

economic to build, and easy to maintain. Given this list of criteria, some designers are choosing high-quality manufactured stone veneer as a successful alternative to natural stone. They are specifying manufactured stone veneer whether the design is rustic, traditional, contemporary, or modern.

Twenty-first century manufactured stone can mimic the permanence and beauty of natural stone while providing economic and green design benefits. With careful attention to details, the illusion of natural stone can be maintained using this handcrafted and hand-placed material. By understanding successful building transitions, quality moisture protection and construction specifications,

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Learning Objectives

After reading this article, you should be able to:

1. Discuss the advantages of using manufactured stone versus natural stone in buildings that reduce their impact on the environment.
2. Specify details and building sections that prevent water damage at building transitions.
3. Describe the difference between a rainscreen and a weep screed, and the principles of drainage planes.
4. Review building safety codes, height restrictions, and mortar selections that lead to aesthetically and economically successful projects using manufactured stone.

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Photo courtesy of Crabtree, Rohrbaugh & Associates



VibraLife is an all-new, 48-bed, state-of-the-art facility designed by Crabtree, Rohrbaugh & Associates that incorporated manufactured stone veneer as an exterior as well as an interior finish.

design professionals can successfully meet client expectations for quality buildings with a natural finish.

For many years, this product has been used primarily to replicate rustic or historic designs. A recent trend includes the use of manufactured stone in contemporary buildings. Modernists are choosing monochromatic stone finishes in palettes of primarily grey, white, cream, and black. They are choosing stones that replicate split-face and saw-cut limestone and ledgestone, tightly stacked with minimal or no grout lines to create a sleek, modern appearance.

Quality manufactured stone veneers are created using concrete in a molding process that reconstructs the actual finishes of natural stone. Some manufacturers are carefully researching natural stone palettes to replicate both the colors and textures of a true natural stone product. Unlike the natural stone, these finishes can be replicated for use in buildings that are multiplied in many regions and climate zones. This means that a designer can control the material aesthetics while maintaining the consistency of the finishes to reinforce a client “brand.”

Manufactured stones are molded into individual stone units and installed using traditional masonry construction. They can be specified with recycled content to meet green standards. They are available locally and provide the aesthetics of permanence and nature that is found by using natural stone with the benefit of one-half the weight of natural stone. This material allows you to “lightweight” the building structure, cutting transportation and labor costs. Using manufactured stone

EXPOSURE TO NATURE: VIBRALIFE REHABILITATION CENTER AND SENIOR LIVING COMMUNITY

VibraLife is an all-new, 48-bed, state-of-the-art facility designed by Crabtree, Rohrbaugh & Associates. Located in Mechanicsburg, Pennsylvania, this firm has focused on providing a client-oriented approach to architecture for more than 30 years. The Vibra Rehabilitation Center and Senior Living Community provides rehabilitation and personal care accommodations. It is designed to address comprehensive care and living needs. The facility provides assistance with its residents’ activities of daily living, rehabilitation, and healthcare supervision. VibraLife includes a secure, 10-bed Memory Care Unit.

The design of the VibraLife facility reflects some of the latest research in health care that encourages an approach that exposes patients to nature. Evidence-based research encourages designers to use natural materials in health-care settings. The incorporation of natural light and the introduction of a variety of natural materials can promote healing. Wayfinding, particularly where there are memory challenges, can be enhanced with the incorporation of texture, color, and multiple finishes.

Manufactured stone was chosen for a finish material both on the exterior and the interior to add value and character to this project. The stone creates a natural setting that is calming

Photo courtesy of Crabtree, Rohrbaugh & Associates

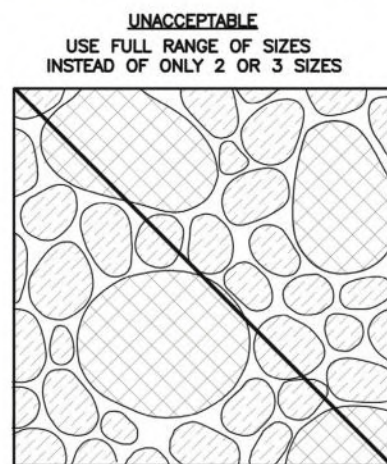
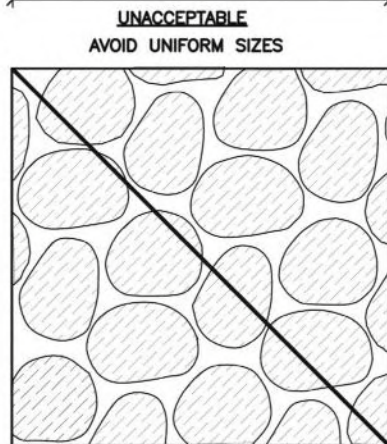
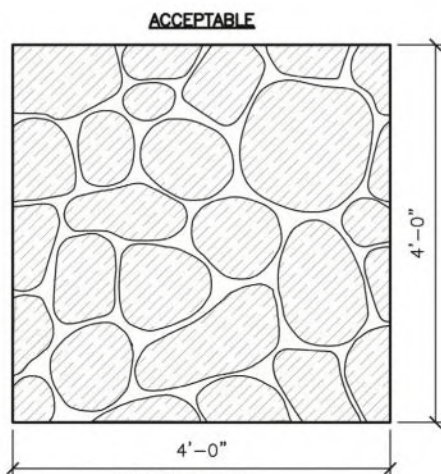


The living area of the VibraLife facility demonstrates that the use of natural materials can provide an elegant and welcoming center in a health care setting.

for the patient and residents along with their families. This approach is developed on the exterior of the building and then transitioned to the interior; integrating the key living and common spaces with the exterior environment. The manufactured stone selected became the generator for the rest of the interior and exterior finish palette. The warm earth tones of the stone are reflected in the flooring, paint, and furniture selected for the project. The result is a homogeneous design that has a hospitality experience rather than a health-care feel. Using manufactured stone, the architects created a place that is durable, economic, and comfortable.

Image courtesy of Eldorado Stone

Examples of acceptable stone masonry placement.



NOTES:

1. ALL SIMULATED STONES SHALL PROJECT APPROXIMATELY 1-1/2" TO 2" FROM MORTAR JOINT.
2. AVOID LAYING SIMULATED STONES IN HORIZONTAL ROWS.
3. MINIMUM JOINT THICKNESS IS 3/8".
4. 95% OF ALL JOINTS SHALL BE ONE FINGER WIDE OR APPROXIMATELY 1/2" TO 3/4". ON RARE OCCASIONS THE JOINTS MAY BE SLIGHTLY SMALLER OR LARGER.
5. SPECIAL CARE MUST BE TAKEN TO FIT THE PROPER SHAPED SIMULATED STONE TO MINIMIZE THE MORTAR JT. SIZE & AVOID LARGER MORTAR FIELDS @ THE STONE INTERSECTIONS.
6. REFER TO THE SIMULATED STONE MASONRY SPECIFICATIONS FOR ADDITIONAL DETAILED NOTES FOR SETTING STONE.

as an alternative to natural stone can provide great benefits. However, in order to successfully provide the illusion of natural stone, careful attention to details and the construction process is necessary.

Whether manufactured stone is used on the interior or exterior of a building, this product can create the appearance and the dimension of natural stone with the advantages of several economic and environmental benefits.

MAXIMIZING THE ILLUSION

Architect J. Brian Haines AIA, LEED AP, director and senior project manager at Crabtree, Rohrbaugh & Associates, has used manufactured stone for many years. He believes that there are several principles to follow in order to emphasize the illusion of natural stone and to make the use of a manufactured stone product believable. The first is to select a product that is molded to replicate the shape, texture, and color palette of natural stone. Just as one would select a color palette for a natural stone product, he carefully selects the stones and their placement on each of his projects. The following are a few guidelines that Haines recommends to maximize a trompe-l'oeil illusion when using manufactured stone.

Color Selection

Manufactured stones are delivered on pallets and hand placed in the field by a mason. The architect should carefully select the type of stone finish, and also assure that the product is placed to maximize variations in color and size. Because they are molded to mimic actual stone

types, these units arrive in a variety of colors and sizes. Haines uses a mock-up to demonstrate to the masons his preferred stone placement. He recommends paying close attention at corners to assure that they do not appear vertically stacked. The mason should vary stones of different colors and values, and make sure that there is no marring on the stone surfaces.

Masons using manufactured stones will cut stones during installations, which can expose the concrete aggregate. The aggregate should be disguised by hiding the cuts at transitions, cutting thinner stones to cover thicker stones, or touching up the concrete aggregate with color kits.

Broken stones should not be used to fill voids, and all large spaces should be resolved as part of a horizontal plane. Combining ledgerstone—that which is longer and more horizontal along with a larger stone—creates a successful natural feel to the wall area. Designers can combine individual color palettes on the project site to create unique colors. The design professional should select a color that is believable and replicates that of natural stone.

Transitions

One of the advantages of manufactured stones is the illusion that a building facade, wall, or interior chimney has been constructed from full-depth natural stones. Manufactured stones are concrete products that can be specified with thicknesses that range from 0.5-inch to 1.6-inch average, depending on the profile. Transitions at corners, doors, windows, foundations, and

Photo courtesy of Eldorado Stone



Installation of a manufactured stone system requires the choice of a believable color palette and careful placement of masonry units on exterior walls and building facades to maximize the illusion of natural stone.

Photo courtesy of Eldorado Stone



Wall transition using manufactured stone corner pieces.

rooftops require careful consideration and coordination by the architect, mason, and contractor. Using corner stones provided by the manufacturer rather than wrapping the corner with a flat stone will add to the air of authenticity. The observer sees a dimension and a depth to the wall surface that otherwise is not apparent. Highlighting windows and archways with the right architectural accents can make the stone installation appear seamless. Sill pieces, window surrounds, and traditional accents should be researched and detailed to assure stylistic conformity.

Careful attention to transitions at grade is important. Neither natural or manufactured stone cannot be installed at or below grade. By code, manufactured stone must be a minimum of 4 inches from grade and 2 inches above pavement. These code requirements allow free drainage from the wall cavity and prevent water back flow and insect ingress. There are several solutions to mask the appearance of a “floating” stone wall. For example, a bed of stones can be placed adjacent to the wall along with a landscape area beyond that can screen the transition. Another technique is to paint or select a foundation block that blends with the color of the stone.

Continues at ce.architecturalrecord.com

Celeste Allen Novak FAIA, LEED AP BD+C specializes in sustainable design and planning in Ann Arbor, Michigan. She is the author of *Designing Rainwater Harvesting Systems: Integrating Rainwater Into Building Systems*.

Photo courtesy of Eldorado Stone



Foundation treatments that obscure the required termination of manufactured stone above grade can include a bed of stones placed adjacent to the wall along with a landscape area beyond that can screen the transition.



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COLOR: SANDERLING

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Photo courtesy of Duro-Last, Inc.



As the planet heats and cities heat even further, cool roofing systems are an effective method to keep buildings cool, protect insulation and substrates, and deflect solar energy back into the atmosphere and beyond.

Cool Roofs for a Hot Planet

Today's cool roofing systems are a significant platform for urban building sustainability

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Learning Objectives

After reading this article, you should be able to:

1. Discuss the science and background of cool roofing systems.
2. Describe the basics of thermoplastic single-ply roofing.
3. Identify myths and realities of PVC cool roofing.
4. Describe the role cool vinyl roofing plays in sustainable building design.
5. Identify key criteria for roof selection.

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Many scientists agree that the planet is warming quicker than the natural forces of nature have ever brought about, and those scientists maintain that such quickening is caused in large part by human activity.

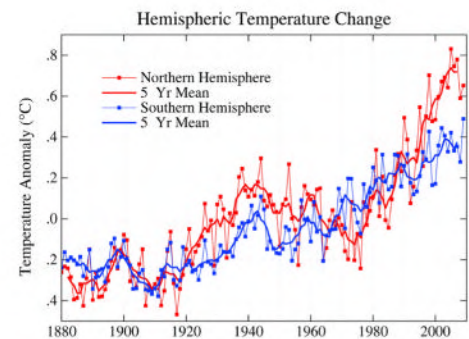
As the planet warms, the world's population continues to move into urban areas that are heating up at twice the rate of global warming due to human activity, lack of vegetation, and the use of dark roofing and paving materials.

This article discusses the role of cool, reflective roofing, and specifically the role of PVC roofing as a way to decrease energy use and thereby decrease emissions. PVC single-ply roofing deflects heat from buildings, decreases energy use, mitigates urban heat islands, and serves as a durable platform for photovoltaic systems and vegetative roofs.

WHAT IS A HOT PLANET?

We have always lived in a greenhouse of sorts. The atmosphere traps the heat of the sun, which allows living beings to live and thrive.

Image courtesy of NASA



According to NASA, January 2000 to December 2009 was the warmest decade on record.

Many scientists maintain the expansion of that greenhouse effect, via gases that block solar heat from escaping back out of the atmosphere, causes the planet to heat up at a rate too quickly for nature to adapt. The U.S. Dept. of Defense considers climate change "an urgent and growing threat to our national security".

According to NASA, the world's leading climate research agency: "Multiple studies published in peer-reviewed scientific journals show that 97 percent or more of actively publishing climate scientists agree: Climate-warming trends over the past century are very

likely due to human activities. In addition, most of the leading scientific organizations worldwide have issued public statements endorsing this position.”

Those issuing statements regarding climate include: the American Chemical Society, the American Medical Association, U.S. National Academy of Sciences, American Geophysical Union, American Meteorological Society, and the Intergovernmental Panel on Climate Change.

Additionally, cities are growing at an incredible rate worldwide—and they are heating up at a faster rate than global averages. They are particularly vulnerable to heat-related issues like air quality and health issues from heat. While most people don’t think about roofs, they can be 25 percent to 30 percent of total city area, making them a significant platform for urban sustainability that most people never have to interact with or notice. But roofs can be a part of the solution of hot cities. Roofs tend to be replaced more frequently than a building is retrofitted, so the rate of change (and rate of results) can be relatively quick. In short, smart roof usage is a climate strategy because it is immediately effective across a broad spectrum of benefits, and can be rolled out relatively quickly with good policy and good business decisions.

Photo courtesy of Duro-Last, Inc.



Cool roofs deflect solar energy away from a building and back to the atmosphere and beyond.

CURRENT COOL ROOF REFLECTANCE STANDARDS		
Reference Standard	Minimum Roof Reflectance	
	Initial	Aged
International Energy Conservation Code (2012)	0.70	0.55
ASHRAE 90.1 Energy Standard for Buildings (2011)	0.70	0.55
Energy Star for Roofs (U.S. EPA, 2012)	0.65	0.50
California Title 23 Energy Standard (2012)	N/A	0.63

WHAT ARE COOL ROOFS?

Among the solutions to decrease energy use and thus decrease emissions from burning fossil fuels are cool roofing systems. Cool roofs use a highly reflective surface to direct a significant portion of solar heat from the sun away from the building. Unlike a dark or non-reflective roof surface that absorbs and transfers solar heat into the building and the surrounding neighborhood, a light-colored, reflective roof surface reflects and drives solar heat away from the building and into

the atmosphere or beyond. Reflecting the sun’s energy to keep cool is an ancient strategy that has been made modern with science and innovation. Cool roofs have been widely available in the U.S. marketplace for more than 25 years.

Cool roofs can be achieved using a wide variety of roofing technologies, including single-ply membranes, cool-surfaced modified asphalt systems, and metal roofing panels. A wide variety of roof coatings may be applied to many different roofing surfaces. For any of these roofing products to be “cool” by today’s standards, the minimum percentage of solar heat reflected away from the building typically falls within a range of 0.50 (50 percent) to 0.70 (70 percent), depending on the particular standard being applied and the aging of the sample tested. The table to the left shows the most-recognized building codes and standards.

BENEFITS OF COOL ROOFS

The cheapest roof is rarely the least expensive. While the upfront cost of the cheapest roof possible may appeal to an owner, the long-term benefits that will be sacrificed makes it a very bad bargain. While budget may seem like the overriding concern, the primary goal should be to design and construct a watertight roofing system as well as a superior building that will not only create a healthier and more comfortable environment for occupants, but will save the owner or operator money and trouble in the long run. In many cases, educating the owner is necessary so that the best decision for long-term benefits can be made.

There are compelling “talking points” that explain the real costs and benefits of a cool roof:

- **Insulation is from 25 to 50 percent more effective.** When insulation gets hot, it is less effective at doing what it is supposed to do—slow heat movement through the surface. The science shows that extremely high temperatures reduce the effective R-value of the most widely used types of insulation (Leonard & Leonard, 2005).
- **Improved HVAC efficiency.** Inlet air temperature can be 5 degrees to 15 degrees cooler 30 inches above the roof surface. Most HVAC units are designed with efficiency ratings evaluated at 95 degrees (York International, 2005).
- **Reduced heat flux.** Studies from Princeton University show with modeling and field tests that reflectivity noticeably reduces heat flux on roofs with as much as R-48 insulation. The authors conclude that cool roofs make sense because they save in the summer and don’t really affect winter heating, especially in roofs with high levels of insulation.

Photo courtesy of Duro-Last, Inc.

Rooftop HVAC equipment has been shown to work more efficiently in combination with a cool roof.



- **Ambient interior temperatures can be 15 to 20 degrees cooler than outside with a cool roof.** According to a report by the Lawrence Berkeley National Laboratory and other researchers: “In many commercial buildings, thermal conditions are not controlled well due to insufficient cooling or heating capacity, high internal or external loads, large thermal zones, improper control-system design or operation, or other factors.” The results of the study on worker productivity show that performance increases with temperature up to 70 to 71 degrees Fahrenheit, and decreases with temperature above 73 to 74 degrees Fahrenheit. The highest productivity is a temperature of around 71 to 72 degrees Fahrenheit. For example, at the temperature of 86 degrees Fahrenheit the performance is only 91.1 percent of the maximum, with the reduction in performance of 8.9 percent. In short, cool roofs can contribute to lowering the interior temperature and maintaining comfort levels for the occupants.

Reducing Peak Demand

Analysis of energy bills shows that peak demand charges accounts for a significant portion of monthly electric bills across the United States and that cool roofs provide an equally significant opportunity to reduce these charges when installed on air-conditioned buildings.

A sharp peak in electrical demand can be observed in buildings during the busiest hours of the day. Although a share of this peak may be attributed to equipment use in the building, a significant portion is caused by increased

demand for air-conditioning in the heat of the afternoon. This peak in demand requires additional power plant capacity, leads to a greater chance of brownouts and blackouts, and may result in increased air pollution.

But most importantly for your client, the building owner, peak demand may result in monthly charges many times higher than the base electrical rates. One of the best approaches to shrink peak demand is to reduce the heat load on a building, especially the solar load that drives the need for air-conditioning. Few heat-reduction strategies can match the energy-saving potential of modern cool roofing technology.

Cool Roofs and Urban Heat Islands

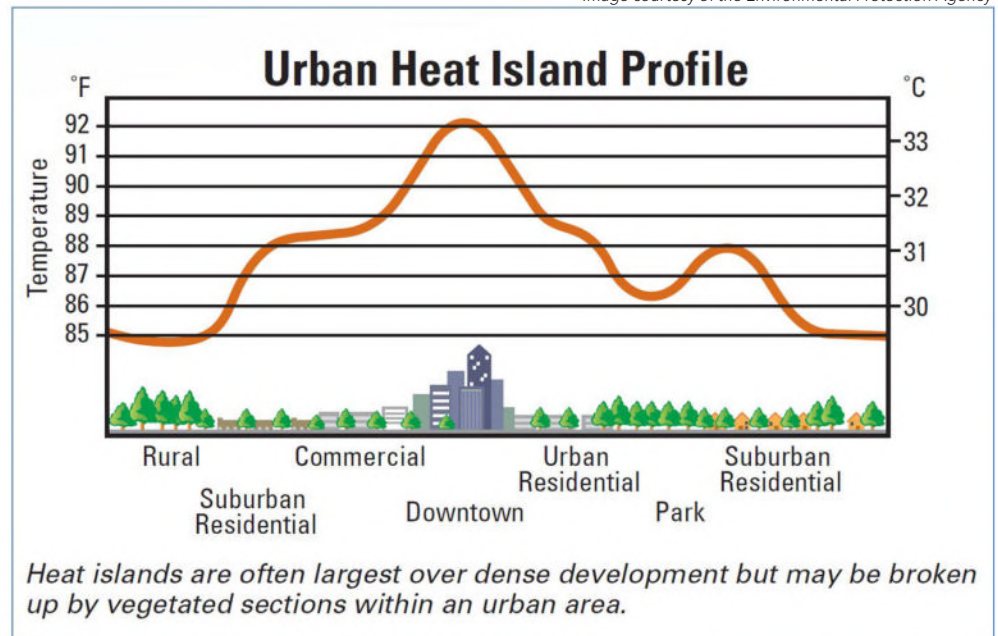
Heat islands are those urban areas where the temperatures will be hotter than the surrounding areas. Lawrence Berkeley National Laboratory (LBNL) has been the main research agency and proponent of heat island mitigation activities.

As the chart below shows, on average the difference in afternoon temperatures between rural and urban land is 7 degrees Fahrenheit. In some areas, the difference is as much as 10 degrees Fahrenheit. This difference can increase during extended heat waves.

Three key factors make up the overwhelming majority of the 7-degree heat island difference:

- 1) Fifty-six percent of the effect is due to less vegetation in the urban land compared to rural land (about 4 degrees).

Image courtesy of the Environmental Protection Agency



This chart shows that on average the difference between rural and urban areas is 7 degrees Fahrenheit, with some areas as much as 10 degrees hotter. This difference can increase during extended heat waves.

- 2) Dark paving causes 6 percent of the difference (less than ½ degree).
- 3) Thirty-eight percent is directly attributed to dark roofing (almost 3 degrees).

Let's consider the possible solutions to heat islands. Adding vegetation will certainly help. However, it is a long-term improvement, requiring 10, 20, even 50 years to reap full benefits of, for instance, mature leafy trees. Such a remedy is constantly in a catch-up mode because construction and expansion continually removes vegetation.

Replacing dark pavement with lighter-colored paving could also have a positive effect. Indeed, technology to make lighter pavement exists. But this is also a long-term solution and requires significant capital outlays for somewhat minimal benefit.

However, replacing dark roofing with light, reflective cool roofing provides the biggest bang for the buck. By raising reflectivity, we can offset the warming impact. Relative to other possible mitigations measures, it is easy to accomplish, relatively inexpensive, and provides immediate benefits to lessen the impacts of heat islands on a heating planet.

How Cool Roofing Systems Are Rated

Following the long trend toward verifiable results that has arisen in the sustainable building industry, the Cool Roof Rating Council (CRRC) was created in 1998 "to develop accurate and credible methods for evaluating and labeling the solar reflectance and thermal emittance (radiative properties) of roofing products and to disseminate the information to all interested parties."

To become certified by CRRC, manufacturers must have their products tested and rated. The U.S. Department of Energy's ENERGY STAR® program also offers a certification process for cool, reflective roofing.

BRIEF HISTORY OF MODERN ROOFING

For many decades, traditional asphalt roofing construction was the norm. Asphalt roofs experience little expansion or contraction, which means there were no thermal shock issues to consider. There was little concern for insulation and heat loss. Air-conditioning use was minimal or was not very costly. Therefore, summer heat retention was of not much concern.

Single-ply membrane products appeared in the early 1970s. Over the past few decades, scientists and product manufacturers developed better knowledge of chemical interactions and have introduced plasticizers



and stabilizers into single-ply membranes, which prolong material life. At this point, the single-ply roofing industry has a proven performance record of more than 30 years.

As with any product, the quality of the components affects overall performance.

TYPES OF MEMBRANE ROOFING

There are more types of membrane roofing than many architects realize. Modified bitumen, for example, is asphalt-based and blended with styrene-butadiene-styrene or atactic polypropylene. This product is a hybrid of traditional BUR (built-up roofing).

Thermoset membranes are "vulcanized," which means the molecules are cross-linked, making polymers elastic. However, these materials become "set" so they are difficult to bond to each other. That means they cannot be softened and bonded by heat. Therefore, seaming requires adhesives. These include EDPM, Neoprene, and CSPE (Hypalon).

Thermoplastics will "flow" when heated because the molecules are not cross-linked. That means the seams can be heat welded or solvent

welded. Ingredients used in compounding can include PVC resin, plasticizers, stabilizers, pigments, and fillers. These materials are represented by a somewhat bewildering array of abbreviations: PVC, CPA, EIP, NBP, CPE, PIB, and TPO.

The big players of thermoplastics, however, are TPO (thermoplastic polyolefin) and PVC (polyvinylchloride).

TPOs are relatively new in the field, with most having been installed in the past 15 years. The ASTM standard for TPO is ASTM D 6878-03 for TPO Based Sheet Roofing.

PVC MEMBRANES

PVC roofing membranes have a much longer history than TPO roofing. PVC's were introduced in Europe in the early 1960s and a decade later in the United States. PVC roofing systems can be installed on virtually any type of structure in any geographic location. Installations may be on dead flat, low-slope or sloped applications.

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Multi-panel door systems eliminate barriers between interior and exterior spaces, creating a natural and open flow. Aluminum thermally broken folding doors showcase the beauty of surrounding landscaping at this home.

Crafting the Intersection Between Indoors and Outdoors

An in-depth look at multi-panel door systems

Sponsored by LaCantina Doors | *By Amanda Voss, MPP*

An architect puts pen to paper, dreaming up an initial sketch that melds a building seamlessly with its environment, complementing topography, and surroundings. The ability to bring the outdoors in, and for a building to reflect its surroundings, is a hallmark of modern design. Outdoor rooms that flow naturally into interior spaces not only enhance a structure's footprint, they also provide ventilation, fresh air, and daylight, and connect occupants to nature.

Facilitating the fusion between the interior and the outside is the job of multi-panel door systems. A multi-panel door system is a door or window system with multiple operable panels that open sequentially to create a large opening. Reaching beyond the capability of a traditional hinged door, multi-panel systems don't just transition between indoors and out. Instead, the wide and seamless opening they furnish

blends nature into a room or series of rooms, eliminating the perceived divide.

Not only do multi-panel door systems improve important health metrics, like indoor air quality, as enhancements in manufacturing and technology have augmented door efficiency, these systems can occupy a greater area in the building envelope without compromising overall performance.

MEET THE FAMILY: AN INTRODUCTION TO TYPES OF MULTI-PANEL DOOR SYSTEMS

Multi-panel door systems are, as the name describes, composed of multiple panels. The ways in which these panels operate defines the type of system. The most common types of multi-panel door systems are folding and multi-slide. Multi-slide doors may be further separated into stacking multi-slide or pocketing multi-slide.

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Learning Objectives

After reading this article, you should be able to:

1. Examine the types of multi-panel systems available and their most appropriate applications, both aesthetically and from an energy performance standpoint.
2. Describe the range of material and threshold options, and their critical energy performance and sustainability impacts on the building envelope.
3. Identify the key specifying considerations for multi-panel door systems.
4. Discuss essential manufacturing core competencies when considering multi-panel systems providers, including necessary energy performance testing, sustainability considerations, and certifications.

To receive AIA/CES credit, you are required to read the entire article and pass the test. Go to ce.architecturalrecord.com for complete text and to take the test for free.

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Multi-Slide Doors

In a multi-slide door, panels stack within the opening.

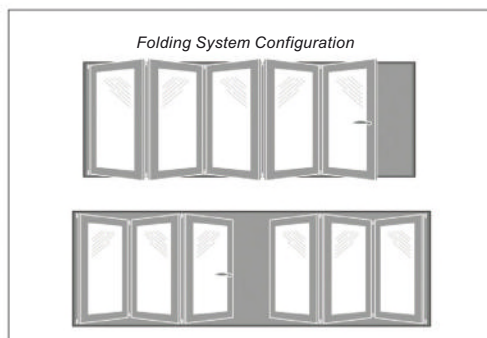
Multi-slide glass doors are generally used to create large openings in walls or to take the place of an exterior wall altogether. The size of the panels and the total door unit can vary and may be custom fabricated to suit a particular building project. Usually, it is the glass itself that imposes limits on the size of each individual multi-slide panel. Most single pieces of glass are limited to 60 square feet in size, with a typical maximum height of 12 feet and a width of 8 feet. The number of individual panels can be varied to meet the desired opening dimensions.

The configuration of multi-slide door panels can be designed so that all panels stack behind each other on one side of the opening, or so that panels are split to stack on both sides of the opening. There are two basic options for how the individual panels appear when stacked. The first option is to keep one glass panel fixed, or stationary, and to slide all adjacent panels to stack evenly behind this stationary panel. In using this option, when fully stacked, some manufactured designs appear as a single panel when viewed from the inside or outside. The second option is to conceal the sliding panels in a wall pocket when open. In this style, the sliding panels disappear altogether, giving the appearance of a full opening in an otherwise solid wall area.

Multi-slide doors do not need to be limited to a single wall plane. Manufacturers have developed methods to allow doors to meet at a corner location, eliminating the need for a post or frame element. When open, the corner virtually disappears, allowing a full visual and physical three-dimensional connection between outdoors and inside. When fully closed, the door panels come together to form the corner.

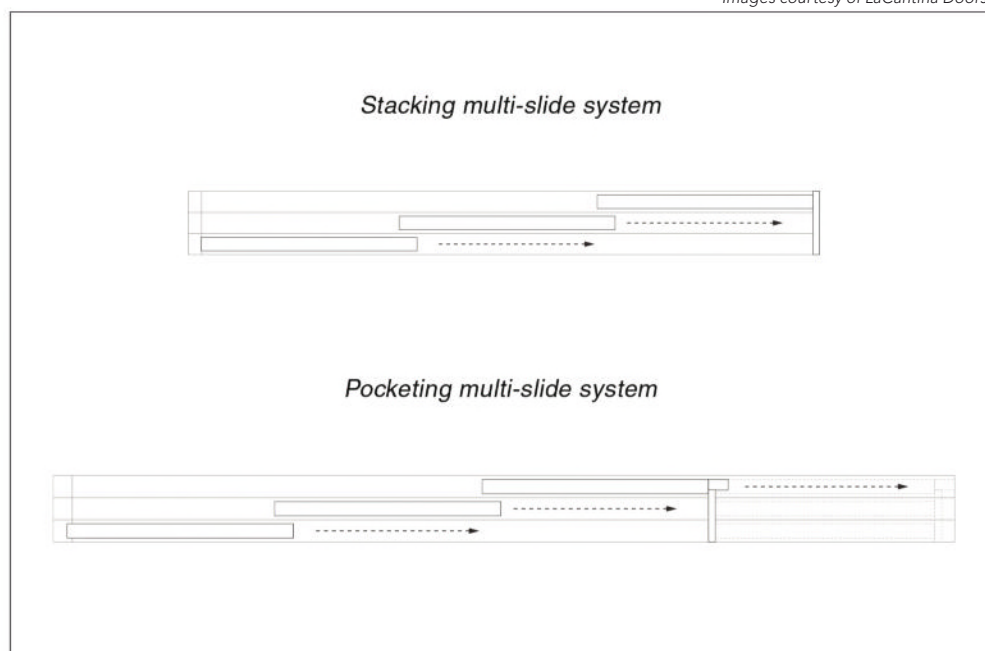
Folding Doors

In a folding multi-panel door system, panels stack perpendicular to the opening when fully opened. As with multi-slide systems, in folding systems, doors may stack to one side when open, or can



Daily access door on any configuration that includes an odd number of panels.

Images courtesy of LaCantina Doors



Multi-slide doors are classified by their different operation methods: stacking multi-slide doors and pocketing multi-slide doors.

divide and stack to both sides of the opening. The folding action mimics the expansion and contraction of an accordion. The panels may be inswing or outswing, depending on design preference and use. Because of the weight of the system, individual folding door panels are typically limited to 39 inches in width; standard heights may be 7 to 8 feet tall or can be made to measure up to 10 feet tall. Despite those limitations, openings for a full system of folding doors can reach up to a staggering 65 feet wide.

Folding glass doors may either be floor-mounted or top-hung, with top-hung systems the predominant method. In a top hung folding door system, the top track carries the weight of the doors and the floor track serves as a guide. Precision bearings and rolling hardware are used to operate the door. Top-hung systems allow for effortless and smoother operation and longer lifespans. The frame must be secured to an adequate header that does not deflect downward when the doors are installed. The structural support required and header size depends both on the weight of the doors and the surrounding structural conditions.

BRINGING MORE GREEN TO YOUR BUILDING: SUSTAINABILITY AND ENVIRONMENTAL BENEFITS

Multi-panel door systems not only open up design opportunities by erasing the border between inside and out, they also enhance the sustainability of a structure. The benefits of a multi-panel system are not confined just to their operation—a thoughtfully selected product has environmental advantages inherent in the very materials it uses.

Natural Daylighting: Allowing for more glass and light, multi-panel door systems can be a good passive heat source and minimize use of electricity for daytime lighting.

Energy Efficient: Most multi-panel door systems offer dual-paned tempered glass, creating an insulating barrier between the inside and out. Manufacturers may offer advanced low-e glass options to help reduce cooling costs in the summer and heating costs in the winter. Overall U-factors (insulating factors) in the door panels can be achieved at or near the common fenestration target of 0.30 or better depending on specific glazing selections made for low-e or other coatings. While no piece of fenestration can match the insulating performance of a wall, having the highest-performing glass and door systems installed in designated openings supports the overall performance goals of the project.

Fresh-Air Ventilation: A critical aspect of green design evaluates the indoor air quality for healthy living environments. Indoor air quality (IAQ) refers to the air quality within and around buildings and structures, especially as it relates to the health and comfort of building occupants. Common pollutants can occur and build up indoors, creating the risk of indoor health concerns. Using multi-panel systems opens up areas typically blocked by walls and aids in whole house air circulation, bringing clean and fresh air into any structure and replacing existing, stale air.

Local Manufacturing: Finding a domestic or local manufacturer contributes to green design by minimizing fuel and transportation costs normally associated by importing products from areas outside of the United States.

Photo courtesy of LaCantina Doors



Multi-panel door systems capture energy efficiency, natural daylighting, and boost indoor air quality. The multi-slide doors open this home dramatically to its environment.

Recycled Packaging and Materials: Certain manufacturers pack and ship systems using recycled materials, providing safe transport and smart use of renewable resources.

LEED Projects: Multi-panel door systems can help to earn a LEED designation for projects. Architects and project owners can submit many of these characteristics for point consideration within their project. Please note that as LEED v4 becomes fully enforced, points may be categorized differently.

Possible LEED v3 points opportunities:

- Energy & Atmosphere Prerequisite 2
- Energy & Atmosphere Credit 1
- Materials & Resources credit 2
- Indoor Environment Quality Credit 4.4
- Indoor Environment Quality 6.2
- Indoor Environment Quality 8.1
- Indoor Environment Quality 8.2

Responsible Materials: If wood or clad multi-panel door systems are under consideration, certain manufacturers offer FSC-certified wood. The Forest Stewardship Council (FSC) sets forth principles, criteria, and standards to guide forest management and practices toward sustainable forestry worldwide. FSC certifiers verify that companies claiming to sell FSC-certified products have

tracked their supply back to FSC-certified sources. This chain of custody certification assures that consumers can trust the FSC label.

NFRC, THE MEANING OF GREEN, AND MULTI-PANEL DOOR SYSTEMS

Classifying and labeling the real thermal performance of door and window systems is the focus of The National Fenestration Rating Council (NFRC), a not-for-profit trade association. In 1993, NFRC developed the first consensus method for evaluating the thermal transmission of windows. Today, NFRC 100: Procedures for Determining Fenestration Product U-factors is the accepted standard for rating windows, doors, and skylights for U-factor. A U-factor is typically rated between 0.20 and 1.20. This standard establishes standardized environmental conditions, product sizes, and testing requirements, so that architects and others can make informed choices fairly and accurately by comparing the performance of different products.

One of the most important improvements that NFRC 100 offered the industry was a determination of heat loss from the entire window unit, rather than heat loss solely from the glass. Under this all-encompassing

evaluation, a multi-panel door system earns credit for all of its energy-efficient features, including energy-efficient glass, thermally improved frames, and even down to such minutiae as the spacers used between layers of insulated glass.

NFRC testing also looks at other overall performance characteristics, including the solar heat gain coefficient (SHGC), which measures how much solar energy passes through a particular glazing, creating heat gains inside a building. A SHGC is expressed as a number between 0 and 1. In areas where heat gains are a concern, coatings are applied to the glass to allow less transference.

NFRC testing also responds to green building standards by assigning a value to the visible light transmittance (VT). Values are between 0 and 1. VT determines the effective light available for daylighting, helping gauge potential offset of electricity costs for lighting a building's interiors.

In addition to thermal performance, codes, and standards, including those of the NFRC, have increasingly recognized air leakage (AL) as a very significant factor in fenestration performance. Today's window and door products must meet minimum standards for

air infiltration and be tested, certified, and labeled for this performance. The total system must be able to withstand wind pressures associated with its geographic location, and air leakage must be controlled not only for energy performance but also for occupant comfort and long-term durability of the fenestration system. NFRC expresses AL as a number ranging between 0.1 and 0.3.

U-factor, SHGC, VT, and AL are all disclosed on an NFRC label for an individual product. The lower the U-factor, the better the insulation level of the unit, meaning less heat loss to the outside or, in cooling dominated climates, less heat gain from the outside. A low SHGC means more solar energy will be blocked, eliminating passive heat gain from outside into the building. The higher the VT, the more natural light is transmitted through a product. A higher AL means greater air infiltration over the life of the product.

Typical high-performance multi-panel doors have U-factors of 0.32 or less and SHGC of 0.30 or less, depending on climate zone. The most suitable AL rating for an energy efficient building will be at or near 0.1; VT is dependent upon climate zone and client preference.

THE NATURAL HABITATS OF MULTI-PANEL DOOR SYSTEMS

The desire for commercial and residential clients alike to experience outdoor living environments and the unique flexibility of the product has resulted in multi-panel door systems being found in a wide variety of buildings.

Residential

Multi-panel door systems offer the ideal avenue to create an outdoor living experience for any home. By eliminating a wall or typical patio doors, these systems remove the distinction between the indoors and outdoors, creating a healthier, more comfortable environment with natural light and open air. Entertainment spaces flow naturally between the patio the living room or kitchen.

Restaurants and Retail Storefronts

Multi-panel door systems provide a unique opportunity for restaurant and retailers to attract customers and maximize valuable and costly commercial space. Whether creating a true al fresco dining experience or capturing a shopper's attention through open-air marketing, multi-panel interior and exterior applications offer a dramatic design element.



Photo courtesy of LaCantina Doors

Multi-panel door systems are a perfect compliment for commercial spaces, offering maximum use and an undivided flow from indoors, out. Aluminum folding system shown.

Resort and Hospitality

Multi-panel door systems create large indoor/outdoor spaces that allow guests to enjoy gorgeous scenery and breathtaking sunsets with unobstructed views. The flexibility of these systems can accommodate guest rooms, suites and villas, outdoor cabanas, and high-rise balconies.

Additional Applications

Multi-panel door systems also can be found making better use of interior spaces or creating large open spaces by connecting the indoor and outdoor areas of schools, libraries, campuses, and museums. Form meets function with an interior or exterior application.

SPECIFYING CONSIDERATIONS FOR MULTI-PANEL SYSTEMS: MATERIAL TYPE

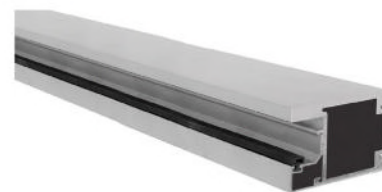
Multi-panel door systems, both folding and multi-slide, are available in a variety of materials. Careful selection of each project's door frame material should consider use, aesthetics, climate zone, and efficiency goals.

Aluminum

Aluminum systems have a clean, modern appeal, with some manufacturers offering a narrow $2\frac{3}{4}$ inch stile and rail profile, allowing for maximum glass and light. Aluminum is suitable for use in exterior applications or as interior space dividers. The basic configuration is an extruded aluminum panel wall thickness of up to $\frac{1}{4}$ inch, and single

panels up to 10 feet tall. A 10-inch-tall bottom rail and low-rise sill meet commercial Americans with Disabilities Act (ADA) requirements. Aluminum panels are offered in several finish options. White paint, clear anodized, and dark bronze anodized aluminum rails and stiles match most commercial aluminum window finishes. Selecting aluminum eliminates the need for finishing and offers low maintenance. Aluminum typically has the highest U-factor and is best suited for use in moderate climates, where heat loss or gain is less of a concern.

Photo courtesy of LaCantina Doors



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Amanda Voss, MPP, is an author, editor, and policy analyst based in Colorado. She serves as the managing editor for Energy Design Update, has taught multiple live AIA CEU classes, and served on the board of Energy Literacy Advocates. She has a background in public policy, residential construction, and custom building.

Photo ©Jeffrey Totaro 2015



The Health and Design Benefits of Accessing Daylight and Views with Dynamic Glass

A closer look at how electrochromic glass provides healthy, productive, and controlled daylight exposure without compromising energy performance

Sponsored by SageGlass | By Jeanette Fitzgerald Pitts

Daylight has a powerful effect on human health. Not only are our bodies designed to synthesize sunlight into vitamin D that aids bone growth and helps fight certain diseases, but important internal systems that regulate our physical, mental, and behavioral well-being are evolutionarily programmed and maintained by exposure to daylight. Disrupting the natural circadian rhythms of the body, which take their primary

cues from the daily cycle of daylight and darkness, has been associated with increased risk for a cardiovascular event, obesity, diabetes, and neurological problems such as depression. Unfortunately, these are prevalent health issues today. Heart disease is the leading cause of death in the United States and diabetes is regularly within the top ten. The Centers for Disease Control and Prevention describe obesity as common, serious, and costly, identifying more

than one-third of United States adults as obese. A study published in the February 2015 issue of the *Journal of Clinical Psychiatry* found that depression in the United States “is the leading cause of disability for people aged 15-44, resulting in almost 400 million disability days per year.”

Here is one more interesting statistic to add to the heap: Americans spend approximately ninety percent of their time indoors. It seems

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Learning Objectives

After reading this article, you should be able to:

1. Describe why access to daylight and views in the built environment positively impact the health and productivity of building occupants, and understand how thermal and visual discomfort from uncontrolled sunlight admission can completely negate those positive benefits.
2. Recognize the challenge that exists between having enough glazed area on the building envelope to achieve sufficient daylight penetration and views for occupants, and not over-lighting or over-heating the space, compromising both human comfort and building energy performance.
3. Understand the performance of electrochromic glass and the ways in which it can offer a solution that enables designers to use more glass in the building envelope to achieve the needed daylight sufficiency and views, without impacting energy efficiency goals, occupant comfort, or architectural design aesthetics.
4. Explain how to use appropriate zoning and control to provide the optimum balance of glare control, daylight admission, good light color rendering, and energy performance.
5. Analyze the cost-benefit of this dynamic sun management solution in terms of up-front costs and payback on human factors, as well as energy.

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Saint-Gobain North America used electrochromic glazing to help achieve points under both the Indoor Environmental Quality (IEQ) and Energy and Atmosphere credits in its quest to achieve LEED Platinum certification in its new headquarters building in Malvern, Pennsylvania. The company's goal was to provide a comfortable, well-day-lit environment to support the health and well-being of its employees without compromising energy performance and in line with its corporate sustainable habitat strategy.

and complexity of the light it provides. Daylight spans an exceptionally broad range of intensities, impacted both by the time of the day and weather conditions, with a color composition that changes regularly throughout a 24-hour cycle.

Dynamic Intensity

Time of day, time of year, and daily weather all affect the intensity of the daylight incident on a window at any given moment, giving the intensity of daylight the characteristic of constant change and a certain degree of unpredictability. Outdoor daylight illuminance can range from 120,000 lux for direct sunlight at noon, which is enough to cause eye pain, to less than 5 lux under thick storm cloud cover. The position of the sun relative to any window changes throughout the day and year as the Earth rotates around its own axis and the sun. Clear or cloudy sky conditions also influence the intensity of available daylight, as can obstructions and reflections in the immediate environment. This variability and unpredictability of solar intensity provides a challenge for the building designer in controlling the amount of the sun's heat and light entering the building.

likely that for most people, in most buildings, time inside is spent under fluorescent lighting with limited access to daylight. Although the topic of incorporating daylight and views into buildings has been gaining momentum for some time, the practice of bringing a considerable amount of daylight into the built environment and managing it effectively is not yet commonplace.

This article will explore the health and productivity benefits of incorporating daylight and views into a building. It will introduce a potent glazing solution that enables architects to design more freely with glass, providing access to daylight and views, while preventing glare and unwanted solar heat gain from entering the space and negatively impacting the comfort and energy performance of the building.

CHARACTERISTICS OF DAYLIGHT

Daylight is a dynamic light source that is unmatched in terms of the power, variability,

Photo courtesy of SageGlass/Phil Daubman Photography



The Dynamic Spectrum of Daylight

Visible light has a wavelength range from 400 to 700nm. Violet, indigo, and blue light exist at wavelengths from 400 to 480nm; green light has a wavelength of around 510nm; and red and orange light have wavelengths from 590 to 700nm. White light is a mixture of all of the colors of the visible spectrum. The color of the light perceived by the human eye depends on the relative intensities of each wavelength seen. Although daylight appears essentially neutral like white light, the balance of color (or spectral power distribution) actually changes as a function of the position of the sun in the sky, on the sky conditions (cloudy sky or cloudless sky). For example, daylight has a higher blue component in the morning and a higher red component as the sun sets.

DAYLIGHT IMPACTS HUMAN HEALTH

Studies now prove that the human body is uniquely attuned to the ever-changing presence, and absence, of daylight, and that daylight exposure at the right time of day, or lack thereof, significantly impacts the functioning of a number of important internal processes called circadian rhythms.

Circadian rhythms play a large part in regulating hormone release and body temperature. They govern sleep/wake cycles and affect the body's blood pressure, mood, metabolism, reproduction, and immune response. Disrupted circadian rhythms can manifest feelings of grogginess and disorientation, and the general state of malaise commonly referred to as jet lag that people experience when traveling across time zones.

CASE STUDY: BUTLER COUNTY HEALTH CARE CENTER, DAVID CITY, NEBRASKA

The design of the Butler County Health Care Center in David City, Nebraska, featured a curved, 22-foot-tall glass curtain wall, totaling more than 3,000 square feet, which flares out at a seven-degree angle in curved pie-shaped forms. The design team at Visions in Architecture knew they needed to manage the potentially harsh daylight exposure that the south-facing facade would experience. They also wanted to fully incorporate daylight and views into the wellness and rehabilitation center in order to offer occupants access to the documented benefits in stress relief, decrease in pain medication dependence, and improved patient outcomes that exposure to abundant natural light can provide.

The architects chose EC glazing because of the elegant solution to the heat and light control it provided and the ability to maintain views of nature that patients in the rehabilitation center could enjoy. Given the outward slope and curvature of the facade, shading this facade using conventional means would have been very difficult. The tinting in the dynamic curtain wall is programmed to follow the solar path, more deeply tinting sections of the glass at the time of the day when they receive direct solar radiation.

With EC glass, it is possible for patients and staff at Butler to enjoy unobstructed outdoor views of the nearby park and golf course from a comfortable environment that maximizes the presence and, hopefully, the restorative effects that natural daylight can provide.

As an added bonus, the center was able to reduce HVAC requirements so effectively that it was able to reduce the size of the heating and air-conditioning unit by one size.

Photo courtesy of SageGlass/Phil Daubman Photography



A large facade incorporating electrochromic glazing at Butler County Healthcare Center in Nebraska. This project features a complex curved facade with an outward slope, which provides panoramic views for the center's patients.

Daylight is a drug that effectively entrains and resets the body's clock to the 24-hour cycle and, as Deborah Burnett, co-founder of the Benya Burnett Consultancy, says, "Nature is the dispensing physician," providing the right type of daylight (color), in the right dose (intensity), at the right time of day.

Circadian rhythms respond primarily to the availability of light and dark in the immediate environment. They are also affected by the changes in the color spectrum of daylight. In fact, the visible light measuring between 460 and 500nm (blue) has been shown to be a powerful regulator of the circadian response in humans and has been termed circadian blue light.

Exposure to morning daylight, which has a higher blue component, increases cortisol levels to combat stress, serotonin levels to provide impulse control, and dopamine levels to increase alertness. The absence of light in the evening encourages the body to produce melatonin to aid sleep, and supports other functions geared toward lowering blood pressure and regulating metabolic and repair processes. Untimely exposure to intense light, especially blue light, in the evening can disturb the body's circadian rhythms and cause important internal processes to be disrupted, which could cause serious health concerns. LCD screens that emit blue light can be especially problematic, and there are now applications (apps) available for phones and laptops to suppress blue light emission in order to reduce the probability of circadian rhythm disruption when these devices are used at night.

THE BENEFITS OF INCORPORATING ACCESS TO DAYLIGHT AND VIEWS INTO THE BUILT ENVIRONMENT

Studies detailing the positive impact of daylight and views in the built environment now abound as the topic continues to gain momentum, making it possible to dissect the benefit of access to daylight and views across specific application types. A 2013 report released by the World Green Building Council (WGBC) titled "Productivity and Health Benefits: The Business Case for Green Building" summarizes study findings that incorporating both daylight and views into schools, office spaces, and healthcare facilities generates real and significant improvements in the function, health, and well-being of the people in the space.

Offices

In office spaces, many studies have shown double-digit improvements in productivity, significant reduction in absenteeism, and improvement in attraction and retention of staff. For example, a 2003 study by the Heschong Mahone Group exploring the impact of daylight on a California call center showed 7-12 percent faster call processing and a 16 percent improvement in cognitive tests for those with a primary view through a window. Workers with a view spent 15 percent more time on their primary task than their peers without a view who spent 15 percent more time talking on the phone or with others.

Demonstrating the positive impact on wellness and absenteeism, a 2013 study conducted by Chueng (et al) found that workers without windows have poorer quality of life scores, vitality, sleep disturbance and efficiency, and daytime dysfunction; whereas, those with windows slept 46 minutes more per night. The 2011 study *Daylighting—Bias and Biophilia: Quantifying the Impact of Daylighting on Occupant Health* by Elzeyadi concluded that employees whose administrative offices incorporated daylight and views took less sick leave when compared with employees whose offices did not offer them access to the outside environment.

Of significant importance to businesses today is the ability to attract and retain talent. As an example of the impact daylight can have, a study of social service groups that moved into day-lit offices found the change resulted in a 200 percent decrease in turnover and a tripling of job applicants.

Healthcare

In healthcare environments, patients with access to daylight and views have demonstrated reduced post-operative recovery times, reduced use of pain medication, and improved outcomes. Other studies point to reduced stress, sick days, and error rates in hospital staff. Given that adverse drug events cost \$2 billion annually, reducing dispensing errors can have a huge impact on medical costs, as well as patient care quality. In the *Economics of Biophilia*, Browning suggests that \$93 million could be saved in healthcare each year alone by giving patients and staff views of nature.

Education

In contrast to the belief widely held in the 1970s that views are distracting to students and disrupt the learning process (a view which led to the construction of many schools devoid of windows), it has now been shown that views and daylight are extremely important to the growth, development, learning rates, and behavior of children. As an example, a 1999 study conducted by Heschong Mahone Group found that students in classrooms illuminated by daylight achieved higher test scores and learned faster than students in settings that had little daylight.

DAYLIGHT AND VIEWS IN GREEN BUILDING

The debate over the contribution that daylight and views make to a healthy interior appear to be over as the inclusion of these elements is encouraged and incentivized by many of the green building rating systems used to define success in green building today. The Leadership in Energy and Environmental Design (LEED) green building rating system, created by the USGBC, is the preeminent green building standard in the United States. This standard has included credits for bringing daylight and views into the interior for years, and in its most current version, LEED v4, more points have been allocated to this area to underscore its importance.

The Daylight credit offers up to three points for achieving a minimum amount of daylight penetration in the interior while not exceeding a maximum intensity. The Quality Views credit awards one point for designs that can provide a quality view (one to two points in LEED Healthcare).

The fact that there is a requirement not to exceed a maximum sunlight exposure limit, and for the use of glare control devices, indicates that USGBC recognizes that controlled exposure to daylight is an incredibly positive and beneficial aspect of the interior environment, but that uncontrolled daylight in the interior can be destructive.

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Jeanette Fitzgerald Pitts has written dozens of continuing education articles for Architectural Record covering a wide range of building products and practices.

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Sustainability, Modular Design, and BIM

Incorporating the most up-to-date thinking into an integrated design and construction process yields exciting projects

Sponsored by Vectorworks, Inc. | *By Peter J. Arsenault, FAIA, NCARB, LEED AP*

The Monte Rosa Hut in Switzerland is an excellent example of the ongoing evolution in the design and construction process. An integrated team used modularized design, sustainability, and building information modeling to achieve outstanding results.

CONTINUING EDUCATION



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Learning Objectives

After reading this article, you should be able to:

1. Compare and contrast traditional design and construction processes with current pre-fabrication and modular design processes.
2. Identify and recognize the trend of integrating together modular prefabrication, sustainability, and building information modeling into building projects.
3. Investigate the innovative design opportunities to create buildings that meet all user and code demands plus sustainability requirements using pre-manufactured components.
4. Assess the functional contributions of using building information modeling to create pre-manufactured buildings while achieving green and sustainable design.

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It is an exciting time to be an architect: We are living and working in a time of a convergence of evolutionary activities that allow those of us engaged in designing, renovating, and operating buildings to push the traditional limits of the architectural profession. This activity is borne in part from the modernization of design and construction processes that help design professionals work more closely with construction teams. It is also being driven by green, sustainable design thinking, which has advanced to become part of the mainstream definition of good design and construction. At the same time, there is an ever-increasing interest in and use of modular, pre-fabricated construction to

achieve better quality control in buildings. Tying all of these trends together, computer aided design (CAD) for buildings is giving way to object-oriented building information modeling (BIM) that can provide a common platform for everyone to engage in the design and construction process. This article not only examines the emergence of these architectural movements, but will also use examples of built projects to highlight how these individual trends come together to produce visionary designs. Architects who recognize these emerging movements and are able to incorporate them into their practice will find benefit to their projects, their clients, and their firms.

Photo courtesy of Holcim Foundation

CASE STUDY: MONTE ROSA HUT

Modular design, sustainability, and BIM come together to create dramatic results in the Swiss Alps.

Project: Monte Rosa Hut: Sustainable Lodging in the Alps

Location: Swiss Alps, Switzerland

Architect: Bearth & Deplazes Architekten AG and ETH Zürich

The Challenge: The Monte Rosa Hut was conceived as one of 50 projects undertaken to commemorate the 150th anniversary of ETH Zürich, the Swiss Federal Institute of Technology (a consistently highly ranked leader in research and education in Switzerland with worldwide influence). In 2003, the Studio Monte Rosa was formed within the ETH Faculty of Architecture to design and build a structure that would replace an original one that was in great need of repair. There are no roads leading to the Monte Rosa Hut site, which sits 2,883 meters above sea level in the Swiss Alps between the Gorner, Monte Rosa, and Grenz glaciers near Zermatt, Switzerland. Hours away from the nearest outpost, the surrounding landscape has a lunar quality—vast, isolated, and eerily quiet. One sees the Matterhorn to the west, dwarfing any sign of human life. The design intent was to continue the centuries-old tradition of providing alpine mountain shelters since most visitors to this location travel by foot over rocky, snow-covered terrain. A traveler can walk two to three hours from the nearest train station in Rotenboden or drop in by helicopter and ski there in the winter. Once the long journey is complete, the desired reward is a new building to serve two important purposes: to provide alpinists and hikers protection from the elements, as well as a comfortable, clean space to eat, rest, and commune with fellow travelers; and to provide ETH Zürich with valuable research on effective sustainable practices. The overriding challenge was to create a building that could be constructed far from public power and water supply grids, yet provide enough energy and water to serve all of its lodgers' needs, while weathering the extreme wind, snow, and earthquakes that plague the area.

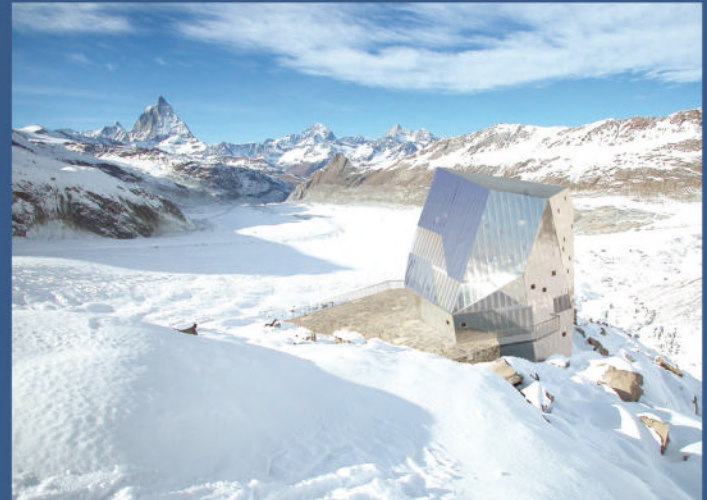
The Design Approach: The design of the Monte Rosa Hut was realized through constant collaboration among ETH students, the Swiss architecture firm Bearth & Deplazes Architekten, and the Studio Monte Rosa faculty. Together, the concept, design, research, and execution phases for the project were carried out to meet the stringent program requirements and established budget. After crafting 12 different proposals for the facility, they honed their ideas down to one groundbreaking design. This final version was based on pre-manufactured components that could be brought to the remote mountain location for assembly. It was also designed to be not only sustainable, but also self-sufficient by generating its own electricity and harvesting its own water. A sustainable hut that produces its own energy represents the next generation of technology and ecofriendly practices, and ensures that the mountains remain pristine for the future. The goal was to construct an unprecedented building that seemed impossible to create. However, all of this became possible because of the collaborative visualization and analysis capabilities of using BIM as the primary design tool.

The final building design is an irregular polygon with 10 interior segments created by radial cross beams. Its five stories are framed by asymmetrical angles. The shape was developed for efficiency, optimizing volume while reducing surface area, thus minimizing the facility's exposure to wind and snow while providing room for 120 guests. It also contains a simple kitchen and dining area

with a large common room for socialization. A ribbon of windows shadows a cascading staircase and echoes the ridges of the famous mountaintops in the distance.

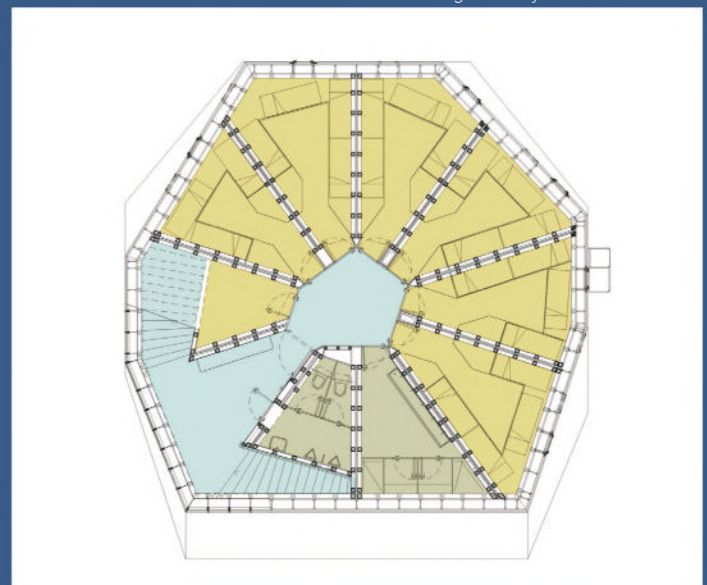
In terms of sustainability, the Studio Monte Rosa and the ETH students designed everything through the lens of self-sufficiency. The building has its own water supply provided by the mountainous terrain. The design called for blasting through granite to create an underground tank to house 200 cubic meters of melt water, located below the permafrost barrier to keep the water from freezing in extreme temperatures. The design also called for a small on-site treatment plant to process wastewater and use grey water for toilets. Photovoltaic solar panels produce electrical power while solar thermal panels collect and distribute heat. Additionally, the large and continuous bands of windows stream sun into the building to provide daylight and passive solar gains. During periods of sustained cloudiness, or when the demand is higher, a cogeneration plant that runs on grapeseed oil, a type of biodiesel, supplies the needed additional energy.

Photo courtesy of Holcim Foundation



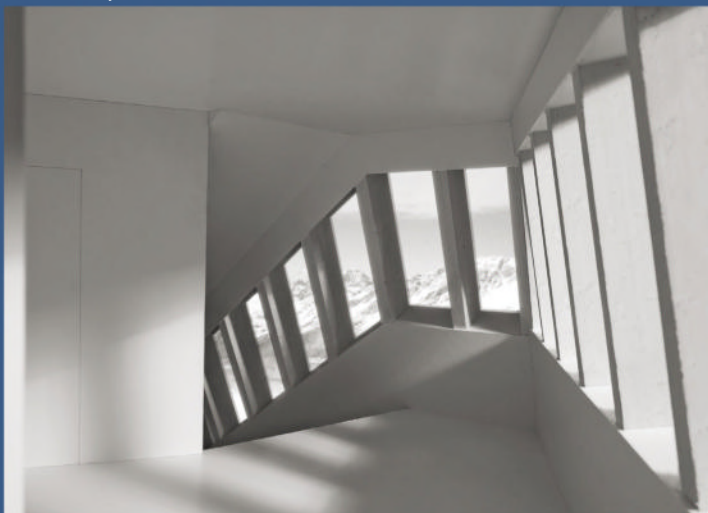
Monte Rosa Hut: Building Exterior

Image courtesy of Holcim Foundation



Monte Rosa Hut: Upper Level Plan

Photo courtesy of Holcim Foundation



Monte Rosa Hut: Interior Circulation Stair

Photo courtesy of Holcim Foundation



Monte Rosa Hut: Interior Dining Area

The Construction Approach: The design team used BIM software to create the complex geometry of the Monte Rosa Hut, identifying 420 different wall and ceiling elements that were able to be prefabricated and pieced together on site. A big task was handling the different geometries while keeping the detailed solutions as similar as possible, as was done with the ribbon glazing/window strip, the timber construction/woodwork, and the furnishing of the bedrooms. Those bedrooms feature trapezoidal mattresses in various sizes made to minimize wasted space by matching the shape of the human body (broader at the top and tapering for the legs). BIM software was used to maximize the placement and number of beds within the given space. By simulating many different scenarios for the beds and other building elements, the team optimized the hut's entire design, which saved a great amount of development time and significantly reduced building costs.

The construction process could not have been accomplished with traditional methods because the location was off the power, water, and transportation grids. This meant many of the prefabricated components needed to be delivered by alternative forms of transportation. Since most of the Monte Rosa Hut is constructed from sections of no more than 400 kilograms in weight, they were transported to the site by a small helicopter, which was the means determined to be most cost effective and environmentally friendly. Throughout the entire construction period, the team used the

helicopter approximately 3,000 times, both to ferry components and as a building crane. Construction started with 10 concrete foundations that root the structure into the mountain's rock and support a star shaped steel "table" with radial cross walls. On top of this table, the prefabricated first floor components were placed and secured into place. Interior sections fabricated to form the concise geometry from the building information model were added to support the second floor as similarly precise exterior panels were placed and connected. The sequence continued until all sections were in place and the building was completely closed in.

For the materials, the team chose to use renewable options as much as possible. After testing several different wall systems, Bearth & Deplazes Architekten determined that a conventional insulation package comprised of aluminum sheeting with mineral wool insulation and three-ply panel spruce would be the most efficient. In a nod to the traditional mountain huts, the architects selected local spruce and fir approved by the Federal Office for the Environment (FOEN) for the interior finish. They wanted to show off all of the construction, so they turned the large, blonde wooden beams around, exposing the mortises and dovetails. Since the joints were exposed, their formation required perfect precision. "Until now, no one has exploited the aesthetic potential of these apparently handmade joints in digital wood construction," noted Andrea Deplazes, the lead architect. The design teams were also careful to select low-pollutant building materials that could eventually be recycled or discarded in the future with little effect on the environment.

In addition to being critical to the design and successful construction of the building, the BIM software also provided the basis for managing many aspects of the project. For example, the team was able to calculate project costs according to Swiss standards directly from the building information model. It also enabled the students to employ a "digital chain" methodology to fine tune the hut's components at each step of the project, moving their data seamlessly from concept to design, to development, to fabrication, and finally to construction. By using the digital chain to address complexities and efficiencies, they were able to reduce the number of building elements by 30 percent and the weight by 40 percent, and also adjust design elements throughout the process.

The Results: The design of the Monte Rosa Hut is nothing short of amazing, especially since it is a 90 percent self-sufficient facility. It has earned recognition from the Swiss Confederation and Swiss Cantons because it provides "high-grade, airtight building envelopes and the continuous renewal of air in the building using an energy-efficient ventilation system." The completed facility houses a state of the art research lab that measures the building's efficiency as a self-sufficient entity. It also has an energy management system so sophisticated it factors in the weather forecast and the number of guests in its calculation of energy usage. BIM software files serve as input and output for the energy design. The ETH Zürich controls this energy management system remotely from Zürich about 260 kilometers away. This constitutes a giant step for the university into a brave new world of technology while providing a sustainable, pre-manufactured, computer-modeled facility for its guests. "I'd even maintain that it is currently the best hut in the Alps," remarks Architect Deplazes. "Not because of its technology or form, but rather because we have succeeded in erecting a building that cannot be split into dichotomies, such as construction and technology, or surface and structure. Things work together. It is impossible to change anything about the building without calling other components into question. It constitutes a balanced whole."

THE RECENT EVOLUTION OF DESIGN AND CONSTRUCTION

Sometimes change is quick and dramatic, and other times it is a slow process over years or decades. In the case of the way buildings are being designed and constructed, it is fair to say that both speeds are at work. For many currently practicing design professionals, their careers began based on very traditional design, drawing, and construction administration practices that were grounded in long-standing manual drafting and documentation procedures. Many have held on to those traditions and continue to practice in the manner that is familiar to them. Other design professionals began their careers with a full complement of computerized informational tools available that allowed them to pursue designs in a style characterized more by experimentation than by tradition. Hence, within a generation or two, the ways of thinking, the tools, and the processes related to design have changed significantly.

It is worth pointing out that traditional 20th-century practices were built on a separation of design from construction. This was formalized by separate contracts between the building owner and the architect and between the owner and the contractor. In this typical design-bid-construct process, everyone had a defined but separate role to play in the interest of producing the best outcome for the building owner. Unfortunately, that also meant that the architect and general contractor didn't commonly meet or communicate until after bids were opened, and then often entered into a relationship that could as easily be adversarial as not. It also typically meant that the design team had little or no communication with subcontractors or suppliers other than preparing specifications for the applicable trades, reviewing their shop drawings and submittals, and occasional presence at job-site meetings.

In the interest of seeking to streamline the construction process, reduce potential delays, control costs better, and improve communications, some building owners have pushed for a more coordinated and integrated process for delivering projects. The American Institute of Architects (AIA) has responded to this need with a formal position on "project delivery," which is fundamentally the process by which a project successfully moves through all aspects of design and construction. This statement reflects the need to cross over traditionally separate roles and responsibilities

and focus on collaboration and sharing of information in the interest of better project outcomes. The statement goes on to say that "The AIA also believes that the architect is most qualified to lead the design of a project and can lead a project team throughout the project delivery process."

SUSTAINABILITY AS PART OF MAINSTREAM DESIGN

Within this context of increased collaboration, green and sustainable building design, construction, and operation has flourished. It wasn't that long ago that sustainable building issues like energy efficiency, indoor air quality, and recycling were specialty concepts that were applicable to a select group of building projects. That has changed notably and has been cited extensively as an enduring change to the way buildings are looked at by virtually everyone, including owners, users, designers, contractors, suppliers, manufacturers, and regulators. The continued rise of building rating systems, such as the LEED program of the U.S. Green Building Council (USGBC), the Green Globes program of the Green Building Initiative, and the ENERGY STAR® program for buildings of the U.S. Environmental Protection Agency (EPA), have certainly contributed significantly to the thinking and perception of building performance. Also, increasingly stringent energy codes have been influenced by the recognition of the numerous negative impacts of buildings that do not use energy effectively. Hence we find ourselves today with a code-required minimum level of sustainable design needed for every project, and in many cases a higher level being sought or required by building owners and users. The media characterizes a notable shift like this as "going mainstream," meaning that it is no longer a special or fringe group that is engaged, but the vast majority of the people.

Creating sustainable designs starts with a philosophy that the definition of a well-designed building automatically includes the attributes that make up sustainability. These include environmentally sensitive site design, water conservation, optimization of energy use, attention to life-cycle assessment of materials, and indoor environmental quality. It also means taking a personal stand that all design work undertaken will meet specific performance standards, particularly in regards to reducing the use of fossil fuels. The not-for-profit organization Architecture 2030 has issued the 2030 Challenge for all architects

to work toward designing new and existing buildings with zero fossil fuel reliance by the year 2030. As a corollary to that, the AIA has invited all architecture and engineering firms to personally commit to the AIA 2030 Challenge, whereby firm principals agree to track and report their progress on all of their projects each year toward meeting the 2030 Challenge goals. These programs have been signed by a substantial number of design firms.

MANUFACTURED CONSTRUCTION COMES OF AGE

In the years following the end of World War II, a surge in the need for housing and other buildings in the United States helped to proliferate construction that was efficiently prefabricated in a factory-like setting and then shipped to a building site. Among them were developments where a limited number of standardized modules were arranged in different formations and finishes to give the appearance of personalization with very little actually existing. While this may still be a pervasive image of modular construction to some people, the reality is that a lot of growth and change has occurred in this arena. In his book *Prefab Architecture: A Guide to Modular Design and Construction* (John Wiley & Sons, Inc. 2010), author Ryan E. Smith chronicles the history of manufactured building from the Industrial Revolution to the present in the context of environment, organization, and technology. He identifies a number of 20th-century examples of work and trends that have contributed to current notions of manufactured construction, and includes dozens of recent examples of prefab projects by contemporary architects and fabricators, including KieranTimberlake, SHoP Architects, Office dA, Michelle Kaufmann, and many others. It becomes abundantly clear that while standardized construction and fabrication is achieved, great design flexibility is also gained.

Continues at ce.architecturalrecord.com

Peter J. Arsenault, FAIA, NCARB, LEED AP is an architect and sustainable building consultant who has authored more than 100 continuing education and technical publications as part of a nationwide practice. www.linkedin.com/in/pjaarch

Sound Masking 101

Understanding and specifying sound masking technology

Sponsored by LogiSon Acoustic Network | By Niklas Moeller

Sound masking systems are a common component of today's interiors, from their original use in commercial offices to relatively newer applications such as patient rooms in hospitals.

This technology uses loudspeakers to distribute an engineered background sound throughout a facility, raising its ambient level in a controlled fashion. The new level obscures noises that are lower in volume and reduces the disruptive impact of those that are higher by minimizing the degree of change perceived by listeners. Similarly, conversations are either entirely covered up or their intelligibility is reduced, improving speech privacy and decreasing the number of disruptions to occupants' concentration.

Most people have experienced this type of effect—for example, when washing dishes at the kitchen sink while trying to talk to someone in the next room. The listener can tell the other person is speaking, but it is difficult to understand exactly what is being said because the running water has raised the ambient level in their area. In fact, everyday examples are virtually endless: the drone of an airplane engine, the murmur of a crowd in a busy restaurant, or even the rustling of leaves in the wind. They all have the potential to mask sounds the listener would otherwise hear.

Of course, when introducing a sound to a workplace or a healthcare facility, it is vital to ensure that it is as comfortable and unobtrusive as possible. Otherwise, it risks becoming a source of irritation and rather than helping to solve an acoustic problem, it becomes one itself—as was the case with the original masking systems developed in the late 1960s, which used white noise generators.

WHITE AND PINK NOISE

Though the term 'white noise' still tends to be used interchangeably with 'sound masking,' it is a very different type of sound from that produced by modern masking technologies.

White noise is a random broadband sound—meaning it includes a wide range of frequencies—that typically spans the audible range of 20 to 20,000 hertz (Hz). Graphical representations of this type of noise vary depending on the horizontal axis. If it shows individual frequencies, volume is constant; however, if the scale is in octaves, each octave's volume increases by three decibels (dB) because each octave contains double the number of frequencies than the one before it, and as a general rule, the combined volume of any two sounds of equal volume is three dB higher. Thus, a graph depicting white noise shows either flat or increasing volume.

CONTINUING EDUCATION



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Learning Objectives

After reading this article, you should be able to:

1. Differentiate between sound masking, white noise, and pink noise.
2. Identify the three main types of masking architecture: centralized, decentralized, networked.
3. Demonstrate the importance of achieving spatial uniformity in the masking sound in order to improve occupant comfort and productivity.
4. Evaluate a specification for sound masking technology

To receive AIA/CES credit, you are required to read the entire article and pass the test. Go to ce.architecturalrecord.com for complete text and to take the test for free.

AIA/CES COURSE #K1512C



Photo courtesy of K.R. Moeller Associates Ltd.

Image courtesy of NRC

Most people describe white noise as ‘static’ with an uncomfortable, hissing quality. Those old enough to remember analog televisions compare it to the ‘snow’ broadcast when the antenna lost the transmission signal and picked up electromagnetic noise instead. It is unsurprising that these early masking systems were typically turned down or off soon after they were installed.

‘Pink noise’ is another term often inaccurately substituted for ‘sound masking.’ It is also a random broadband sound, but instead of being equal in volume at each frequency, volume decreases at a rate of three dB per octave as frequency increases. However, because these decreases are offset by the increases created by the doubling of frequencies in each octave, pink noise is constant in volume per octave. Subjectively speaking, this sound is less hissy than white noise. On the other hand, the relatively louder low frequencies give it a rumbling quality, prompting comparisons to the sound of a waterfall.

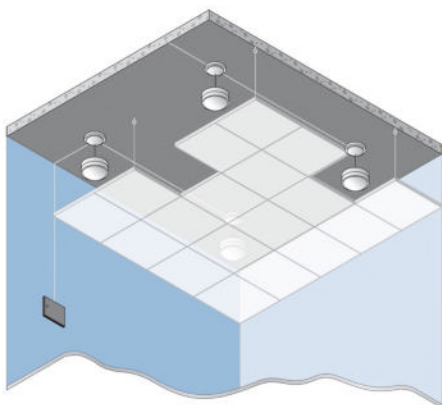
Given these descriptions, it is understandable why modern sound masking systems do not emit white or pink noise, or in fact any of the other colors (e.g. brown, blue or purple).

A SOUND MASKING SPECTRUM

A sound masking spectrum—often called a ‘curve’—is engineered to balance effective acoustic control and comfort. It is usually provided by an acoustician or an independent party, such as the National Research Council (NRC), rather than by the masking vendor.

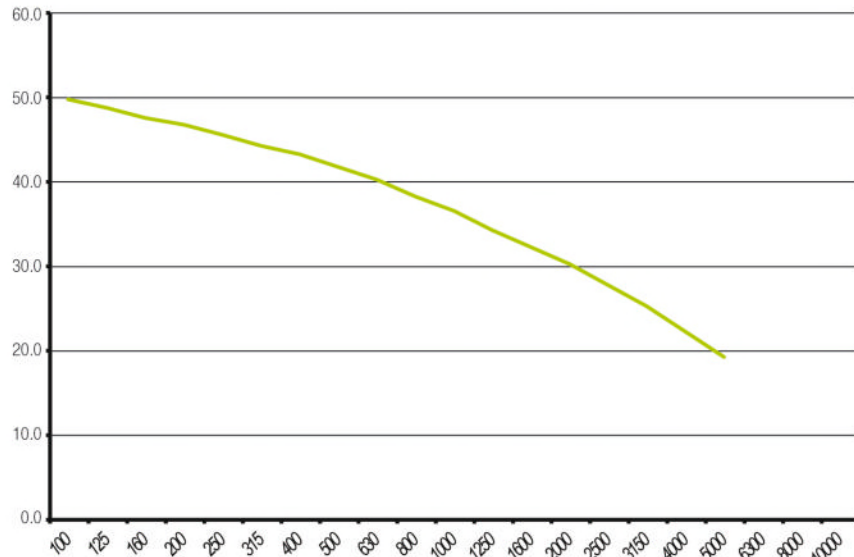
A masking curve includes a wide range of randomly generated frequencies; however, it is narrower than the full audible range—typically from at least 100 to 5,000 Hz, and

Image courtesy of Screen Solutions



A sound masking system consists of a series of loudspeakers, which distribute an engineered background sound throughout a facility. The loudspeakers can be installed above a suspended ceiling (as shown) or in an open ceiling.

NRC Maximum Masking Curve



A sound masking spectrum or ‘curve’ is typically specified by an acoustician or supplied by an independent third party, such as the National Research Council (as shown), rather than by the sound masking system’s vendor.

sometimes as high as 10,000 Hz. Further, the volume of masking frequencies is not equal, nor do they decrease at a constant rate as frequency increases.

It is important to understand that the curve defines what the sound masking system’s measured output should be within the space. Regardless of how the system is designed, its out-of-the-box settings, or the orientation of its loudspeakers (i.e. upward- or downward-facing, sometimes called ‘direct-field’), the sound is influenced as it interacts with various interior elements within the facility, such as the layout and furnishings. If the sound is to meet the specified curve, the system’s volume and frequency settings have to be adjusted in small, localized zones. In other words, it must be tuned for the particular environment in which it is installed.

Tuning is handled by a qualified technician after the ceilings and all furnishings are in place, and with mechanical systems operating at normal daytime levels. Since conversations and activities can prevent accurate measurement, it is done prior to occupation or after hours. Basically, the technician uses a sound level meter to measure the masking sound at ear height. The technician analyzes the results, and adjusts the system’s volume and equalizer controls accordingly. This process is then repeated as often as needed until the desired curve is met at each tuning location.

ACHIEVING SPATIAL UNIFORMITY

Most people compare the sound of a professionally tuned masking system to that of softly blowing air. However, there is much more significance to the tuning process than simply providing a pleasant auditory experience. One must also ensure that the sound performs its intended job.

The effectiveness of the masking sound is directly related to the sound masking system’s ability to closely match the specified curve. Some degree of variation is expected; it is impossible to achieve perfection in every tuning location. However, because variations in the masking sound can profoundly impact performance, the specification should not only provide a target curve, but also a ‘tolerance’ that indicates by how much the sound is allowed to deviate from that curve across the space. Achieving consistency is also important for comfort; a uniform sound fades into the background more easily, and occupants come to consider it a natural part of their space.

Historically, tolerance was often set to ± 2 dBA (i.e. plus or minus two A-weighted decibels), giving an overall range of 4 dBA. However, such wide swings in overall volume across the space can allow occupants to understand up to 43 percent more of a conversation in some areas than they can in others.

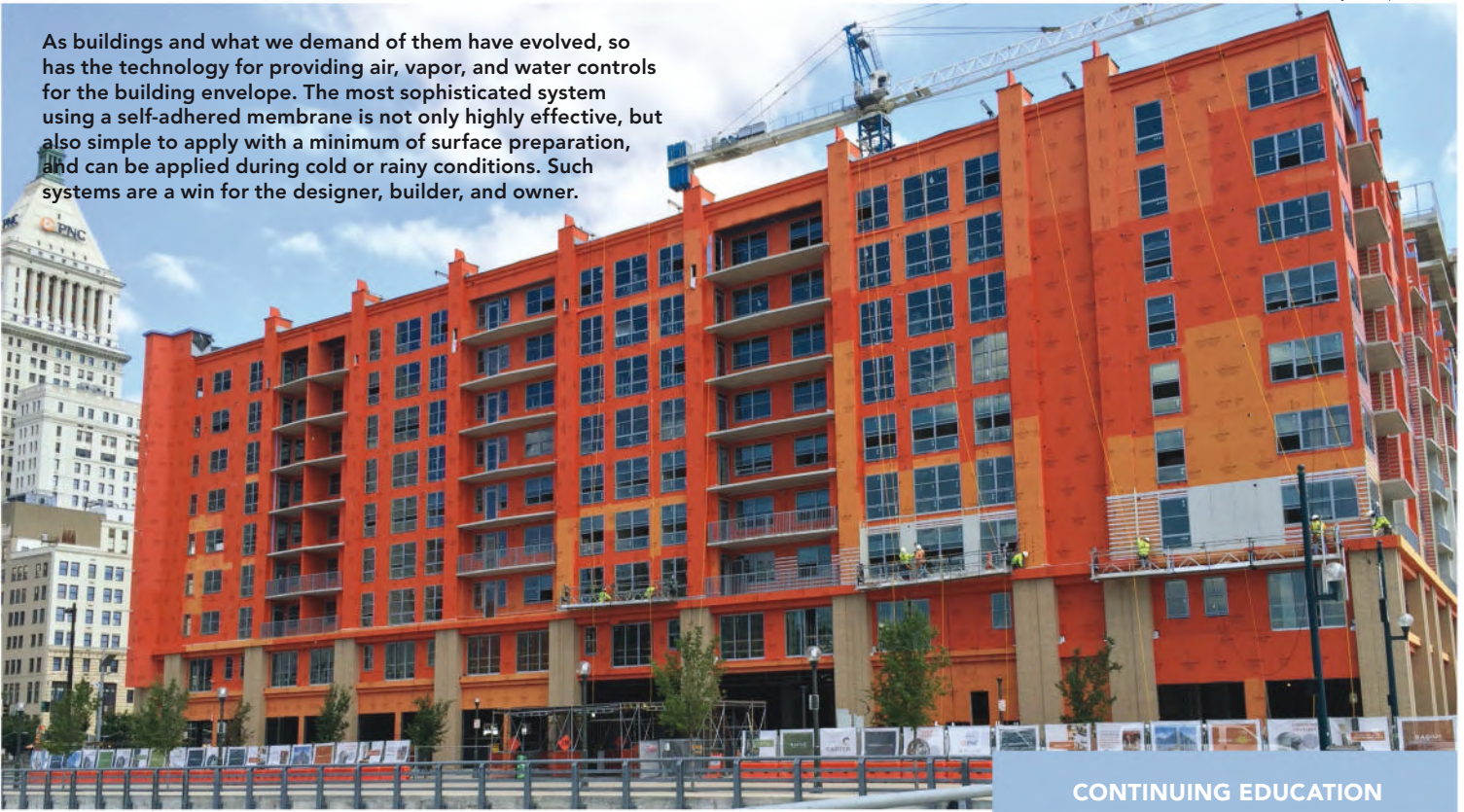
Continues at ce.architecturalrecord.com



Today’s interiors are even more dependent on sound masking for speech privacy and noise control. The LogiSon Acoustic Network is tuned using TARGET, an application that accurately adjusts each small zone to the specified spectrum, maximizing benefits and occupant comfort. Worldwide distributors provide turnkey services and support. www.logison.com

Photo courtesy of VaproShield

As buildings and what we demand of them have evolved, so has the technology for providing air, vapor, and water controls for the building envelope. The most sophisticated system using a self-adhered membrane is not only highly effective, but also simple to apply with a minimum of surface preparation, and can be applied during cold or rainy conditions. Such systems are a win for the designer, builder, and owner.



Breaking Old Rules for Air-Barrier Installation

Innovative, self-adhered, water-resistive, vapor-permeable, air-barrier sheet membrane that increases performance of the building envelope, lowers costs, and speeds up installation

Sponsored by VaproShield

In the beginning, humans were hot or cold, wet or dry, comfortable or miserable, all depending on the weather. As we evolved, comfort became a priority, and then energy savings, and eventually health and durability, and sustainability rose up in our collective concerns. Building paper and weather-resistive barriers (WRBs) have emerged and then evolved to meet our new needs and expectations. Today, the architect or specifier can choose from an astonishing array of weather-resistive/air barriers with various capacities and installation strategies, from those that are tacked, fastened on, glued on, sprayed on, and, ultimately, those membranes that self-adhere.

To clarify the difference between weather-resistive/air-barrier choices, this article is about self-adhered, vapor-permeable WRBs/air barriers, and the role they can play in design

and construction of superior buildings that satisfy owners, serve the needs of occupants, and help shield the architect/owners and general contractors from risk. We start with the basics of heat and energy flow, then review the history of air barriers, discuss the basics of self-adhered products and their installation benefits, and finally look at some case studies where a self-adhered WRB/air barrier was used to further the goals of designing and creating a superior building.

Let's begin with a review of basic building science.

BUILDING SCIENCE: THE MOVEMENT OF AIR, HEAT, AND VAPOR

In the design and construction of buildings, it's important to understand how air, heat, and vapor move into and out of tight structures.

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LEED CREDENTIAL MAINTENANCE

Learning Objectives

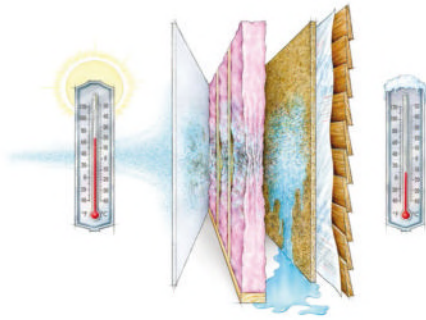
After reading this article, you should be able to:

1. Explain the natural movement of air, heat, and vapor into and out of a building and how that relates to energy savings, occupant health, and durability.
2. Discuss the history of building paper and weather-resistive barriers (WRBs).
3. Identify the performance and testing characteristics of breathable, self-adhering WRBs and air barriers that contribute to a durable and energy-saving building.
4. Describe the different types of air-barrier technology for a durable building envelope.
5. Examine several case studies where an innovative vapor-barrier system sped up construction, lowered costs, increased building envelope quality, and/or contributed to green building certification.

To receive AIA/CES credit, you are required to read the entire article and pass the test. Go to ce.architecturalrecord.com for complete text and to take the test for free.

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Image courtesy of Green Building Advisor Scott Gibson (Aug. 17, 2010)



When the designer and contractor understand how air, heat, and vapor move into and out of buildings, there is a better chance that the structure will be durable, healthy, and energy efficient.

The way air, heat, vapor, and liquid water move in and out of a building is best defined by the second law of thermodynamics. This is the study of heat and energy and how they “move” or transfer.

Air, heat, vapor, and liquid water—driven by the immutable laws of nature—move from more to less when given a chance. That means that higher concentrations move to lower concentrations. Hot moves to cold. Wet moves to dry. Higher pressure moves to lower pressure.

This is easily understood during a northern winter. The cold air outside seems to “want” to come inside, but it’s really the warmth that wants to leave the house. Left uncontrolled, this will occur until the temperature is the same inside and outside.

Insulation and air barriers keep the warm air from escaping in heating climates, predominantly northern states, and keeps the hot air outside in cooling climates, mostly in southern states.

Air Barrier

For insulation to be effective, we need an air barrier to control convective heat transfer. An air barrier is required whether the insulation performs that function or not. This will ensure that connections between the insulation materials as well as penetrations (windows, doors) and transitions from wall-to-wall, wall-to-roof, and wall-to-foundation are properly sealed.

This calls for an air barrier to be installed in the building envelope. When the air pressure is not equal inside and outside (stack effect, wind, or mechanically induced pressure difference), and there is no identified air barrier, the air will move from high to low.

CASE STUDY: BANKS PHASE II

The performance potential of a self-adhered membrane was demonstrated recently in the Banks Phase II project in Cincinnati, Ohio, where the designers changed from a fluid-applied air barrier to a self-adhered, water-resistive, air-barrier sheet membrane.

Located between Paul Brown Stadium and Great American Ballpark in downtown Cincinnati, The Banks project is a multi-stage development featuring retail, office space, hotel rooms, and residential space. The second of three phases is a 291-apartment mixed-use building that also features 20,000 square feet of retail space.

The senior estimator at the time, Josh Turner, explains why his company switched from fluid-applied to self-adhered barrier.

“The major reasons we switched to the sheet-applied were, number one, the temperature at which we were going to begin installing the air-barrier membrane was going to be too cold for fluid-applied,” he says. “And the other thing was that the building was going together in sections, floor-by-floor. And to have a crew to come in and do the fluid-applied would have been 12 to 15 mobilizations on the project. So what we sold the contractor on was that we could do a product that we could install on smaller sections at a time that would be easier without having all the equipment to set up, and that way we could progress as the building went up.”

Turner added that the self-adhered membrane was also better than fluid-applied because of the wind factor.

“In downtown, there is quite a bit of wind,” he notes. “And that was the other thing we were worried about with fluid-applied was overspray on the windows below.” In some parts of the project, the finished portion was below the point where the membrane would be installed. The cost and trouble of masking off the floor below to protect it from the spray above would have been prohibitive.

Vapor Controls

This brings us to the issue of vapor, or water in a gas form. We feel most comfortable when the interior relative humidity ranges from 40 percent to 60 percent. In a hot and humid climate, it needs to be below 50 percent to manage some indoor air-quality issues. However, in the summer in the South, the outside relative humidity is often more than 90 percent.

We use the air-conditioning to lower the temperature and the relative amount of moisture in the air in the form of vapor. The vapor movement from higher to lower concentrations through building materials is typically minor, as well as slow to necessitate additional vapor control over the natural vapor control of the materials used in wall construction.

Continues at ce.architecturalrecord.com

Photo courtesy of VaproShield



There was 150,000 square feet of self-adhered, water-resistive, vapor-permeable air-barrier sheet membrane installed on The Banks Phase II mixed-use building (top). Shims used under horizontal cladding attachment components create a 1/4-inch rainscreen cavity, allowing for unimpeded vertical drainage of moisture away from the building envelope (bottom).



VaproShield designs and manufactures high performance, zero VOC self-adhered and mechanically attached vapor permeable weather resistive barriers (WRB) and air barrier (AB) membranes. The membranes, along with the innovative vapor permeable flashing materials and rain screen design accessories have been rigorously tested together to maximize life-long building envelope performance. Membranes are 100% recyclable and offer a standard 20 year warranty.

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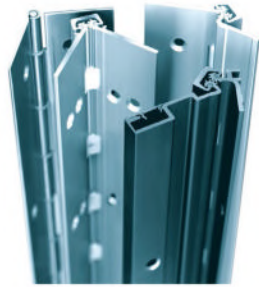
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New and Upcoming Exhibitions

Case Work: Studies in Form, Space & Construction by Brad Cloepfil/Allied Works Architecture

Denver

January 24–April 17, 2016

This is the first comprehensive exhibition to explore artworks created during Allied Works' investigative process, which is at the heart of the firm's practice. *Case Work* displays the artistic explorations of material, form, and spatial experience that have guided the firm's architectural designs over the last 15 years, including both realized buildings and projects that have yet to take shape. At the Denver Art Museum. For more information, visit denverartmuseum.org.

Peter Fischli David Weiss: How to Work Better

New York City

February 5–April 20, 2016

For more than three decades, Peter Fischli (b. 1952) and David Weiss (1946–2012) conspired to realign our view of the world through a combination of humor and banality. This exhibit, at the Guggenheim, will investigate the artists' joint production, revealing the ways they juxtaposed the spectacular and the ordinary to celebrate the sheer triviality of everyday life while staging an interrogation of temporality, visual culture, and the nature of existence. For more information, visit guggenheim.org.

Beauty

New York City

February 12–August 21, 2016

The fifth installment of the Cooper Hewitt, Smithsonian Design Museum's contemporary design exhibition series, *Beauty* will celebrate design as a creative endeavor that engages the mind, body, and senses. With a focus on aesthetic innovation, the exhibition will feature more than 250 works by 62 designers from around the globe, and is organized around seven themes: extravagant, intricate, ethereal, transgressive, emergent, elemental, and transformative. For more information, visit cooperhewitt.org.

Ongoing Exhibitions

David Adjaye: Architecture for Social Change

Chicago

Through January 3, 2016

With more than 50 projects constructed across the world, David Adjaye is rapidly emerging as

a major figure in architecture and design. This first-ever retrospective, at the Art Institute of Chicago, spans from furniture and housing to public buildings and master plans; it features drawings, sketches, models, and building mock-ups. The exhibition also immerses viewers in Adjaye's distinct approach and visual language through a dynamic installation conceived by his eponymous studio. For more information, visit artic.edu.

Provocations: The Architecture and Design of Heatherwick Studio

New York City

Through January 3, 2016

Provocations is the first museum exhibition to introduce the imaginative work of British designer Thomas Heatherwick and his London-based studio to an American audience. Heatherwick is known for his unique design concepts ranging from products, infrastructure, and temporary structures to large-scale architecture projects around the world. Highlights of the work on view include: the Learning Hub at Singapore's Nanyang Technological University; the 2014 Bombay Sapphire Distillery in Laverstoke, England; and the 2012 redesign of London's double-decker buses, known as the New Routemasters. At Cooper Hewitt, Smithsonian Design Museum. For more information, visit cooperhewitt.org.

The Inaugural Chicago Architecture Biennial

Chicago

Through January 3, 2016

The Chicago Architecture Biennial provides a platform for groundbreaking architectural projects and spatial experiments that demonstrate how creativity and innovation can radically transform our lived experience. Through its constellation of exhibitions, full-scale installations, and program of events, it invites the public to engage with and think about architecture in new and unexpected ways and to take part in a global discussion about the future of the field. At five locations in Chicago, including the Chicago Cultural Center. For more information, visit chicagoarchitecturebiennial.org.

Palladian Design: The Good, The Bad, and The Unexpected

London

Through January 9, 2016

Andrea Palladio gave his name to a style that is still in use around the world after nearly 500 years. Using examples from the U.S. Capitol to a 21st-century Somerset cowshed, this exhibition introduces Palladio's design principles and

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explores how they have been interpreted, copied, and re-imagined across time and continents from his death in 1580 to the present day. At the Architecture Gallery. For more information, visit architecture.com.

Une histoire

Paris

Through January 11, 2016

A new presentation of the Centre Pompidou Museum's contemporary collection, *Une histoire* displays more than 400 works dating from the 1980s to the present day. Featuring paintings, sculptures, installations, videos, films, drawings, photographs, and architectural and design models, this exhibit offers a themed circuit through ultracontemporary creation, showcasing the works of nearly 180 artists and some 50 architects and designers from 55 countries. For more information, visit centrepompidou.fr.

Making Music Modern:

Design for Ear and Eye

New York City

Through January 17, 2016

Music and design—art forms that share aesthetics of rhythm, tonality, harmony, interaction, and improvisation—have long had a close affinity, perhaps never more so than during the 20th century. Drawn entirely from the Museum of Modern Art's collection, *Making Music Modern* gathers designs for auditoriums, instruments, and equipment for listening to music, along with posters, record sleeves, sheet music, and animation. For more information, visit moma.org.

Turner Prize 2015

Glasgow

Through January 17, 2016

The Turner Prize is awarded annually to a British artist under 50 for an outstanding exhibition or other presentation of their work in the preceding year. Every other year, the prize leaves Tate Britain and is presented at a venue outside London. This year, that venue is Tramway in Glasgow, an international art space renowned for commissioning, producing, and presenting contemporary arts projects. For more information, visit tate.org.uk.

Chinese Style: Rediscovering the Architecture of Poy Gum Lee, 1923–1968

New York City

Through January 31, 2016

In this survey exhibition at the Museum of Chinese in America, architectural historian Kerri Culhane documents and explores Poy Gum Lee's nearly 50-year-long career in both China and New York and examines



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Lee's modernist influence in New York's Chinatown. This project has resulted in the first-ever comprehensive list of Lee's projects in New York. Lee's hand is visible in the major civic architecture of Chinatown post-1945, which blends Chinese stylistic details with modern technologies and materials. For more information, visit mocanyc.org.

St. Louis Modern

St. Louis

Through January 31, 2016

St. Louis Modern explores a dynamic period (1935–65) when St. Louis-based architects, artists, and designers made innovative contributions to Midcentury Modern design. Commemorating the 50th anniversary of Eero Saarinen's modernist masterpiece, the Gateway Arch, this exhibition features more than 150 modern design objects and artworks drawn from the St. Louis Art Museum's own collection as well as more than 30 museums and private lenders around the country. Many works in the exhibition are being shown for the first time. For more information, visit slam.org.

David Adjaye Selects: Works from the Permanent Collection

New York City

Through February 14, 2016

Architect David Adjaye presents 14 West African and Central African textiles from the Cooper Hewitt museum's permanent collection in the latest installment of the museum's Selects series. On view in the renovated Marks Gallery on the museum's first floor, the exhibition is the 12th in an ongoing series in which prominent designers, artists, and architects are invited to mine and interpret the museum's collection. For more information, visit cooperhewitt.org.

Frank Gehry

Los Angeles

Through March 20, 2016

Frank Gehry's buildings have altered architecture's relationship to the city. This Los Angeles County Museum of Art exhibition is a comprehensive overview of Gehry's work. The show begins in the early 1960s—Gehry established his firm in Los Angeles in 1962—and runs to the present. Many of the 200 drawings have never been seen publicly, and 65 models illuminate the evolution of Gehry's thinking. For more information, visit lacma.org.

Lectures, Conferences, and Symposia

SAH 2016 Annual International Conference

Los Angeles

April 6–10, 2016

The SAH 2016 Annual International Conference will engage participants from around the world with the rich, evolving legacy of the Pasadena/Los Angeles region's built environment. With the scheduled completion of the Metro Expo Light-Rail Line west to Santa Monica in early 2016, Pasadena will be connected to downtown

L.A. and the rest of Los Angeles County. This infrastructure, building on historic rights-of-way, will provide new perspectives on the broad range of the region's architecture and urbanism. At the Pasadena Convention Center. For more information, visit sah.org.

Competitions

Fairy Tales 2016

Registration deadline: December 9, 2015

Fairy Tales is an international ideas competition that challenges creatives from all

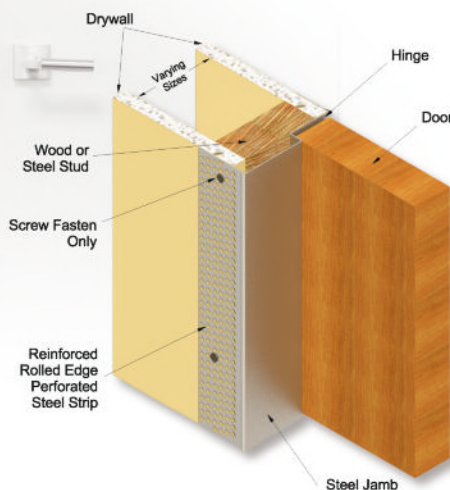
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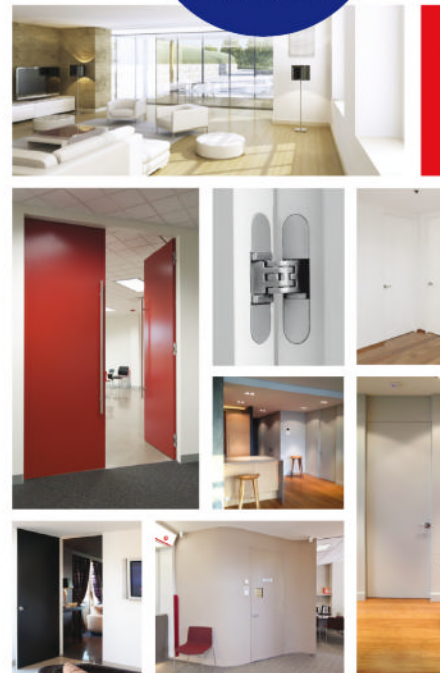
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2015 Build Abroad Travel Scholarship

Submission deadline: December 10, 2015

Build Abroad is offering a travel scholarship that covers a one-week construction program in Costa Rica, Guatemala, or Peru. The organization's mission is to build and repair communities across the world through socially responsible construction volunteering, and to bridge cultures in the process. Scholarship applicants must be current students or recent graduates with degrees in architecture, civil engineering, interior design, or a related field. For more information, visit buildabroad.org.

CITAB-CTBUH China Tall Buildings Awards

Submission deadline: December 14, 2015

The CITAB-CTBUH China Tall Buildings Awards recognize projects and individuals that have made extraordinary contributions to the advancement of sustainable tall buildings in China. The object of this awards program is to provide a more comprehensive and sophisticated view of these important structures while advocating improvements in every aspect of their performance. For more information, visit china-tall-building-awards.com.

My Detroit: Postcard Photo Contest

Submission deadline: December 31, 2015

The curators of the United States Pavilion at the 2016 Venice Architecture Biennale are looking for photographs that capture the essence of the city of Detroit. Photographers of all ages—amateurs and professionals, residents of Detroit, and residents of the world—are invited to enter. Photos can include cityscapes, city scenes, street encounters, accidental revelations, buildings, architectural details, or personal reminiscences: any view of Detroit in the spirit of urban exploration and architectural invention inside the city limits. For more information, visit thearchitecturalimagination.org.

A Museum in the Making: Beirut, Lebanon

Submission deadline: January 4, 2016

The Association for the Promotion and Exhibition of the Arts in Lebanon (APEAL) is launching a design competition for a new modern art museum in the heart of Beirut, Lebanon. The yet-to-be-named museum, set to open in 2020, is envisioned as a multidisciplinary hub of art and design dedicated to showcasing modern and contemporary Lebanese culture. For more information, visit amuseuminthemaking.com.

Taking Buildings Down

Registration deadline: January 12, 2016

In a design culture focused on the superlative (the tallest, the newest, the priciest), in which destruction is often perceived as or produced by an act of violence, the processes of removal appear as secondary concerns or collateral damage. Taking Buildings Down invites proposals for the production of voids; the demolition of buildings, structures, and infrastructures; or the subtraction of objects and/or matter as a creative act. Removal is all that is allowed. For more information, visit storefrontnews.org.

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2016 CALL FOR ENTRIES Record Houses

The editors of **ARCHITECTURAL RECORD** announce the **2016 RECORD HOUSES** awards program. Entry is open to any architect registered in the U.S. or abroad. Of particular interest are projects that incorporate innovation in program, building technology, materials, and form. Projects must be built and inhabited. They may be new construction or renovated and adaptive-reuse projects.

The fee is US\$75 per submission. Download the official entry form at architecturalrecord.com/call4entries. E-mail questions to arcallforentries@bnpmedia.com. Please indicate **Record Houses** as the subject of your e-mail.
SUBMISSION DEADLINE: JANUARY 8, 2016

Good Design Is Good Business

CALL FOR ENTRIES

The editors of **ARCHITECTURAL RECORD** are currently accepting submissions for the **2016 ARCHITECTURAL RECORD GOOD DESIGN IS GOOD BUSINESS** awards program. Good design is a priority for leaders of business and industry looking to boost productivity, rebrand, and attract customers. The Good Design Is Good Business awards honor architects and clients who best utilize design to achieve such strategic objectives. Winners will be published in the June 2016 issue.

The fee is US\$150 per entry and \$50 for each additional project. Download the official entry form at architecturalrecord.com/call4entries. E-mail questions to arcallforentries@bnpmedia.com. Please indicate **GDGB** as the subject of your e-mail. **SUBMISSION DEADLINE: FEBRUARY 1, 2016**





IN THE northern Norwegian village of Birtavarre, the Sabetjohk Pedestrian Bridge spans 147 feet across the 500-foot-deep Gorsa Gorge—northern Europe’s deepest canyon. In less than a year and for just under \$1 million, Oslo-based Ghilardi+Hellsten Arkitekter designed and constructed the lightweight sandblasted aluminum structure, which offers breathtaking views of the waterfall below. Fabricated in Austria, shipped by truck to Norway, and assembled in a nearby lot, the public design-build commission nearly met a dramatic end during installation. The helicopter airlifting the bridge to its site suddenly dropped in altitude, sending the 8,400-pound cargo crashing to the ground, but the crew was able to repair and mount it the next day. The treacherous terrain made anchoring a suspension bridge—the initial design idea—impossible, so the architects chose to construct an equilateral triangle frame along a beam anchored at two foundation points, using the recognizable geometric shape to “enhance the contrast between the landscape and the man-made.” The bridge completes a steep, rocky hiking path around the grounds of an old copper mine and includes a bungee-jumping deck for the most daring visitors. *Miriam Sitz*

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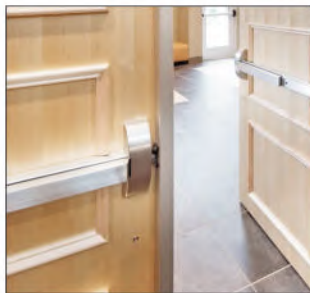
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Service



Premium Access Solutions and Services

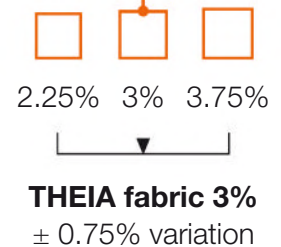
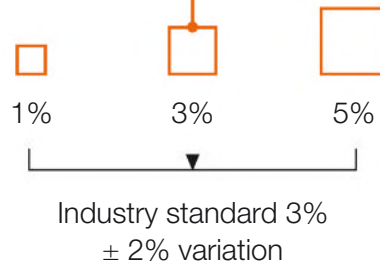
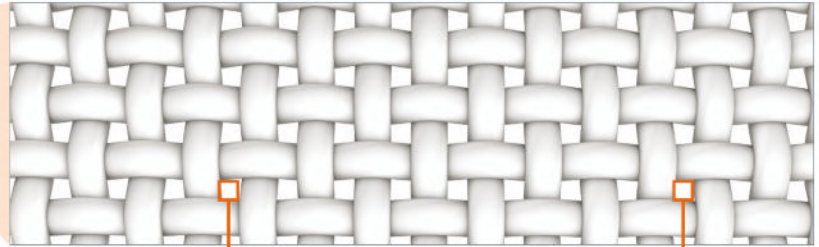
Educational environments need door openings and applications that function seamlessly and also stand up to high traffic and abuse. DORMA is the trusted global partner for stakeholders of any building. **Find your solution at go.dorma.com/edusolutions or 844-SPECNOW.**

Glare is the enemy of comfort and performance

Your glare-free design intent will not be achieved if the shade fabric openness factor is 2% higher than specified.*
Typical industry tolerances today can range over 2% from the specified openness factor.

Lutron has introduced THEIA™ — a new fabric specification requiring the tightest tolerances in the industry ($\pm 0.75\%$ openness factor) with over 60 fabrics to precisely manage glare.

Shade fabric weave openness 



Visit www.performanceshadingadvisor.com to find the THEIA fabric that achieves your design goals.

* Based on 2014 Purdue University study. For more information visit the Lutron Performance Shading Advisor.

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