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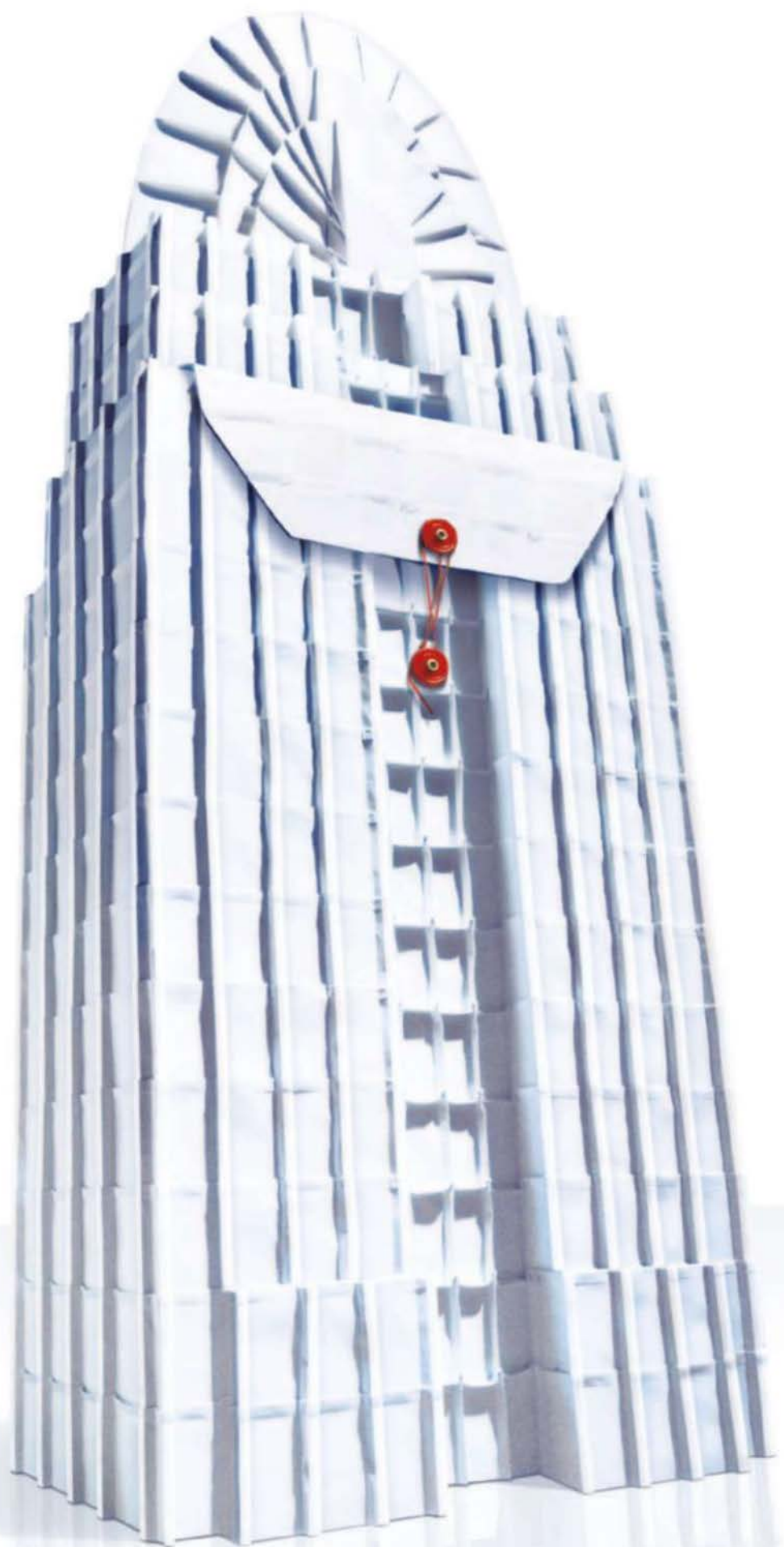


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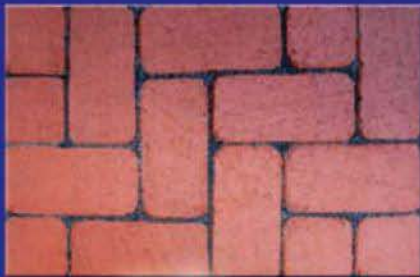
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## 11 2010

### NEWS

- 31 High hopes in Hong Kong
- 32 Pelli wins Iowa job
- 36 Balmond quits Arup
- 40 Turning point for ABI

### DEPARTMENTS

- 18 Reader's Gallery
- 23 Editorial: **Staying on Board in 2011**
- 24 Letters
- 47 The Emerging Architect
- 51 **Encounter: There Goes the Neighborhood**
- 53 **Books: Reading Space**
- 56 **Product Focus: Sustainable Solutions**  
By Rita Catinella Orrell
- 58 **Products in Brief**
- 171 **Dates & Events**
- 200 **Snapshot: Natural History** By Laura Raskin

### FEATURES

- 69 **America's Best Architecture Schools**  
Top ratings from *DesignIntelligence's* 2011 survey of firm principals, students, and deans.  
By James P. Cramer

### PROJECTS

- 79 **Where the Work Is**  
By Suzanne Stephens
- 80 **Israel Museum, Jerusalem**  
JAMES CARPENTER DESIGN ASSOCIATES  
By Michael Z. Wise
- 90 **King Abdullah University of Science and Technology, Thuwal, Saudi Arabia**  
HOK By Josephine Minutillo
- 102 **Vakko Fashion and Power Media Center, Istanbul, Turkey**  
REX By Fred A. Bernstein

### BUILDING TYPES STUDY 906 COLLEGES AND UNIVERSITIES

- 115 **Media Production Center, Columbia College Chicago, Chicago**  
STUDIO GANG ARCHITECTS By Joann Gonchar, AIA

- 120 **Peter Buck Center for Health and Fitness, Bowdoin College, Maine**  
CAMBRIDGE SEVEN ASSOCIATES By Suzanne Stephens
- 124 **William L. Clay Education Center, St. Louis**  
LUCHINIAD By Josephine Minutillo
- 126 **10 Akron Street, Massachusetts**  
KYU SUNG WOO ARCHITECTS By Jane F. Kolleeny

### LIGHTING

- 131 **Harvard Digital Images and Slide Collection, Cambridge, Massachusetts**  
DALY GENIK By Laura Raskin
- 134 **Bradley & Diegel Salon, Boston**  
STUDIO LUZ ARCHITECTS By Linda C. Lentz
- 137 **K20 Art Collection, Düsseldorf**  
DISSING+WEITLING ARCHITECTURE By Tracy Metz
- 141 **Lighting Products**

- 192 **Reader Service**

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ON THE COVER: Vakko Fashion and Power Media Center, by REX. Photograph © Iwan Baan.

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## BUILDING TYPES STUDY

View profiles of 10 university projects and browse our newly redesigned archive.

## VIDEO: KYU SUNG WOO

The Cambridge, Mass.-based architect shows us his graduate student housing for Harvard.

## FEATURED HOUSES

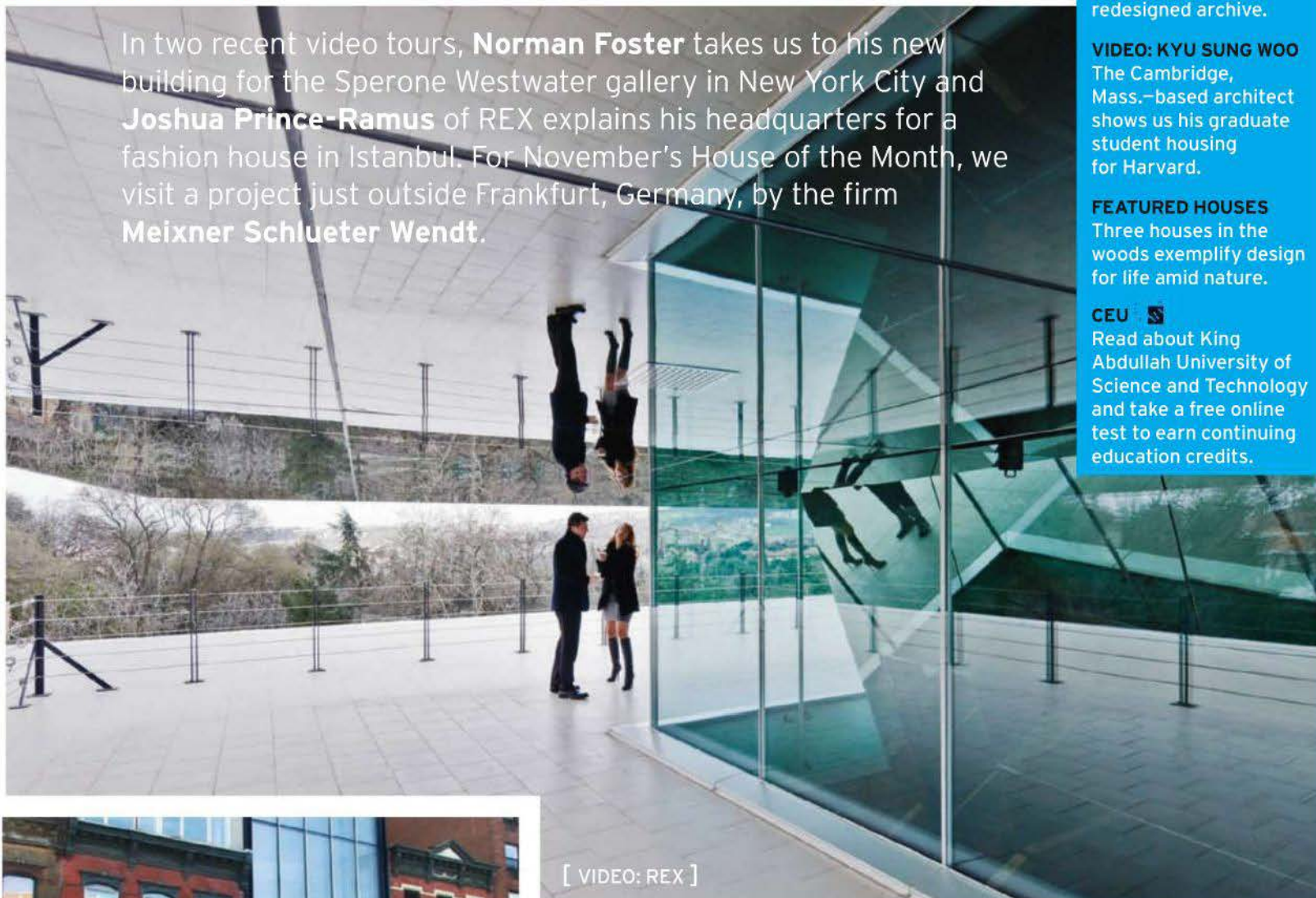
Three houses in the woods exemplify design for life amid nature.

## CEU

Read about King Abdullah University of Science and Technology and take a free online test to earn continuing education credits.

## NEW THIS MONTH

In two recent video tours, **Norman Foster** takes us to his new building for the Sperone Westwater gallery in New York City and **Joshua Prince-Ramus** of REX explains his headquarters for a fashion house in Istanbul. For November's House of the Month, we visit a project just outside Frankfurt, Germany, by the firm **Meixner Schlueter Wendt**.



[ VIDEO: REX ]



[ VIDEO: NORMAN FOSTER ]



[ HOUSE OF THE MONTH ]



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CONTRIBUTIONS  
TO THE SITE FROM  
THE PREVIOUS  
MONTH.



[RIGHT] Staatsgalerie |  
Designed by James Stirling |  
Stuttgart, Germany | Photo  
submitted by "sinisa.ppic."

[BELOW] Ballard Cut House |  
Designed by PRENTISS  
Architects | Seattle,  
Washington | Photo  
submitted by "nicole."



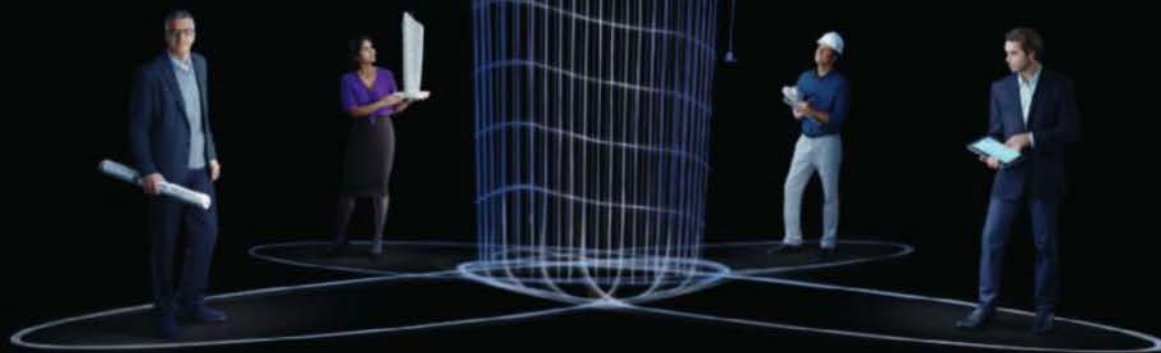
[ COMMENTS ]

“Nice facade design.  
It will be interesting to see if  
N.Y.C. union contracting and  
construction firms actually bid  
on it and build it ... correctly  
... Here’s hoping for common  
sense and sensitivity on BOTH  
sides of this controversial project.  
Best of luck to everyone.”

—Anonymous on an interview with Michel Abboud,  
principal at the firm designing the Park51 Islamic  
Community Center in Lower Manhattan.

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Page 151



### Fiberglass Fenestration Comes into its Own

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Page 157



### Solar Lighting: Making Steps Off-Grid towards a Sustainable Future

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### Building Movement Joints and BIM

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Dancing House by Frank Gehry  
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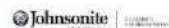
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### The Language of Color

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### Restroom Design: The Water Efficiency Factor

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CIRCLE 47





## Staying on Board in 2011

You only have two issues left, unless you subscribe.

**AS PAINFUL AS** it sounds, this may be one of the last issues of ARCHITECTURAL RECORD you'll receive. If you are an AIA member, you are good to go through December (that's this issue and one more). Then, presto – or the sound of one hand clapping – RECORD will disappear from your mailbox. Help! What is an architect to do?

So we are letting you know. By now, you've received your copy of the printed magazine with the page affixed to the cover fairly shouting at you to subscribe to the publication. You may have received a first-class letter from yours truly, and e-mails, or even a tweet, if you're a Twitterer. They all say essentially the same thing: Your subscription to ARCHITECTURAL RECORD is running out; it's time to subscribe.

If you are one of the 40,000 loyal subscribers who are non-AIA members, you can skip this editorial in its entirety. But those of you who are AIA members may not realize that you paid for RECORD as a portion of your annual dues every year. You were, and are still, a subscriber. As of January 2, 2011, however, AIA has made other arrangements, and no longer will your mailbox contain ARCHITECTURAL RECORD around the first of the month. We still love you, but unless you've signed up, we're dropping you from our rolls like a hot rivet.

Why should I subscribe to a print publication, you ask? Everything seems to be shifting to the Web, anyway. I'll just go online. Our answer would be that of course you can, and almost 200,000 of you visit our Web site from around the world each month, many from small towns and cities with names far different from our own. We encourage you to keep viewing the site, which we enrich with hundreds of videos, community pages that allow you to post your own work, additional source material, and special features that appear nowhere else.

Print, for the time being, allows you choice and time. On an airplane flight and want to dawdle over the Burj Khalifa details (how did they do that, anyway)? Or to poke your head into the lush photography? Or to take your time with a continuing education story? The issue slips right in your briefcase.

To entice you, our circulation gurus have concocted a wealth of offerings that include a discounted price (it's so cheap!); free access to our digital edition, currently offered via Zinio; as well as our iPhone and iPad apps, complete with videos and slide shows. More iPad development is under way here in Gotham and may offer the best alternative to print – so watch for announcements in the coming months.

A special message to employers: Many of you purchased ARCHITECTURAL RECORD, via AIA membership, for your junior employees. Don't forget them. Times are tough, but this is the time to study and prepare for the future. We're making it easy for you.

For 2011, ARCHITECTURAL RECORD is only going to get better. We're beefing up our building-technology coverage, adding more details, sharpening our critical pencils, and planning the revitalization of a real building for you to visit. All will appear here, and nowhere else. You, and your employees, deserve the information and inspiration that are evolving and improving for 2011 in ARCHITECTURAL RECORD.

How can you begin a productive plan for a better year? Keep a positive attitude; don't gnash your teeth. Buy a subscription!



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**Bad stats**

I saw your news item regarding some of the government figures on unemployment numbers for architects and engineers ["Recovery? What Recovery?", October 2010, page 27]. Like many of your readers, I was pretty shocked by the degree to which the state of affairs was being underestimated by the Bureau of Labor Statistics. I would like to make a constructive suggestion to RECORD: Why not put an informal survey on your home page regarding employment of your readers? You can stress that this is a "nonscientific survey" and meant only as a reflection of your online readers' input and their situations.

The following questions could be included:

- Are you currently a full-time employee at an architecture firm?
- Are you employed as a contractor with no benefits?
- Are you employed part-time?
- Are you completely unemployed in the industry; if so, for how long?
- Have you taken a pay cut in the past 24 months? If so, what percentage of your salary did it constitute?
- Are you a recent graduate with no employment prospects?
- Are you considering leaving the architecture profession?

*Keith Carlson  
Laguna Beach, Calif.*

I think you do the profession a huge disservice when you publish an unemployment rate for architects and engineers of 5.9 percent [for the second quarter of 2010, according to the U.S. Bureau of Labor Statistics]. Considering the number of storied firms that have closed during the past two years and the number of large surviving firms that have slashed their workforce anywhere from 30 to 70 percent, the real unemployment rate for architects is without question substantially higher. Publishing such a low statistic minimizes the plight of everyone in this profession.

*Bill Gordon  
Littleton, Colo.*

*Editors' reply:  
We, too, were surprised by the U.S. Department of Labor's 5.9 percent*

*jobless rate. In response, we have produced a follow-up article, "Exactly How Many Architects Are Unemployed?" Look for it in our online news section.*

**Unpaid design competitions**

When I was still a student at UC Berkeley, the late Frank Israel came to speak about his work. At the very end of the lecture, he said that what we do has "value" and that we should never give our work away. Everyone in the entire lecture hall stood up and applauded. I have never forgotten those words. In a profession facing tremendous economic stress, the concept of unpaid design competitions, like that mentioned in Robert Ivy's September editorial ["Competition for Ideas," page 23], runs counter to the viability of this profession. Many firms are stressed to the breaking point, and encouraging a process where we essentially give our ideas away for free is both reckless and irresponsible. Not all of us are independently wealthy or are fortunate enough to subsidize our practice with teaching and/or publishing.

*Chris Apicella  
San Francisco*

**Contradiction and context**

With regard to the Energy Laboratory at the Hawaii Preparatory Academy in Waimea, Hawaii ["Live | Build | Sustain," October 2010, page 110], I take it that the Boston-based Flansburgh Architects did not make any site visits. Robert Venturi's title for his book *Complexity and Contradiction in Architecture* (1966) is starting to make more sense to me.

*Edgar Toms Carr, AIA  
Durham, N.C.*

**Corrections**

The October CEU article "Live | Build | Sustain" [page 110] contained some inaccurate information about a Miller Hull Partnership project, the Cascadia Center for Design + Construction, in Seattle. The piece stated that the project team had already received approval to extend a photovoltaic canopy over a right of way. In fact, the team is in the process of applying for this approval.

*Send letters to [rivy@mcgraw-hill.com](mailto:rivy@mcgraw-hill.com).*



Upper: The Coffou Cottage  
Architect: Brininstool + Lynch

Left: Hudson - Panos House  
Architect: Swatt Architects

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# A WORLD OF REASONS FOR CEDAR



## Winners of the Western Red Cedar Architectural Design Awards show diverse, creative ways to apply timeless cedar to cutting-edge architecture.

When is Western Red Cedar more than a beautiful, natural building material? When it's in the hands of the world's most creative architects.

That was the main finding of three leading architects who served as jury for the 2nd edition of the Western Red Cedar Lumber Association's prestigious awards program. Entries came from hundreds of firms worldwide for projects ranging from sheds and home remodels to hotels and commercial complexes. "I served on the jury two years ago, and this year there was definitely a far greater pool to choose from — so something is going right," says Martin Finio, AIA, LEED AP, a returning juror from Christoff:Finio Architecture.

The Western Red Cedar Architectural Design Awards are sponsored by Western Red Cedar Lumber Association ([www.wrcla.org](http://www.wrcla.org)) "to recognize innovative design using one of the world's most unique building materials, Western Red Cedar." Hundreds of architects entered, submitting impressive photographs, plans, detail drawings and — for renovation projects — images prior to reconstruction.

"The overall quality of submissions was very high, and the varied use of shingles was especially interesting," notes juror Alfred Zollinger of the firm Matter Practice. "One nice surprise was the number of international projects, as was the variety of traditional and modern uses of cedar." Noteworthy past winners included Grimshaw Architects' iconic Experimental Media and Performing Arts Center in Troy, N.Y., as well as Orange Me-

morial Park. This year, the outstanding honorees include AIA Gold Medal recipient Peter Bohlin's Combs Residence and a massive biomedical complex in Barcelona.

"The projects tell a compelling story," says Katherine Chia, a juror from Desai/Chia Studio, "not just about the innovative use of Western Red Cedar but also about innovative architecture in general."

### ABOUT THE JURORS

#### **KATHERINE CHIA**

*Partner, Desai/Chia Studio, New York City*

Since 1994, the firm Desai/Chia has been widely published for its acclaimed residences, landscapes and retail work. Previously, Chia worked with Maya Lin and Prentice & Chan, Olhausen Architects and Planners. She also teaches at Parsons.

#### **MARTIN FINIO**

*Founding Partner, Christoff:Finio Architecture, New York City*

Finio teaches at the Yale University School of Architecture while building an award-winning practice with varied residential and institutional clients. He was editor of the monograph Williams Tsien: Works.

#### **ALFRED ZOLLINGER**

*Principal, Matter Practice, Brooklyn, N.Y.*

Zollinger's firm focuses on architecture and exhibition design. The firm has completed residences, public projects and exhibitions for such clients as the National Building Museum. Zollinger also leads the design-build program at Parsons.



#### PILOT DWELLING HET ENTREEHUIS

Completed in 2009, this dwelling is the first of ten units planned for the Groote Scheere country estate in the Netherlands, set in a picturesque area known for its farmland, village atmosphere and diverse landscape. Named Het Entreehuis or “entrance house” because it stands at the estate’s gateway, the pilot house is built from sustainable and lightweight Western Red Cedar coated with a black oil color — a nod to the barns typical of the region. The façade is made up of a series of shutters: Large vertical shades on one end allow light to enter or function as blinds, while horizontal shutters on the opposite side are reminiscent of slits in the façade of a farm house. A thatched roof without eaves opens up to a wooden terrace lying just above the landscape, making the house appear embedded in the surrounding bucolic scenery.

#### COMBS POINT RESIDENCE

The residence at Combs Point is a sequence of clear-finish Western Red Cedar-clad buildings stretching along a stream through a forested glen, from the edge of a lake to a waterfall at the stream’s head. An elevated boardwalk echoes the twisting course as it connects the buildings. Upstream, the guesthouse and a structure combining office and exercise uses are clipped to yet detached from the main house, in a composition mirroring the path of the meandering brook. They each present a simple massing clad in cedar wood siding oriented both vertically and horizontally. Downstream, the main building’s living space opens to a full view of the lake and sky. Primary spaces are framed in Western Red Cedar and steel, as the southern glass wall reveals the waterfall at one end, the lake at the other. A linear steel beam, the fulcrum of the south edge, inflects upward to catch the sun above the ravine’s rim.

*Clockwise from top left: Combs Point Residence in Ovid, N.Y. by Bohlin Cywinski Jackson; Bernal Park Restroom Building in Pleasanton, Cal. by Mark Cavagnero Associates; and Pilot Dwelling Het Entreehuis by Bureau B+B in the Netherlands.*



#### BERNAL PARK RESTROOM BUILDING

The master plan for this city near San Francisco called for incorporating architectural elements into the 50-acre Bernal Community Park to support a baseball program and various special events. The solution for a restroom and storage building adjacent to the park’s central gathering area fits elegantly amid the picturesque setting. The rectilinear building is wrapped with a façade of horizontally oriented Western Red Cedar boards. An open-air and skylighted vestibule welcomes visitors, with staggered glass panels creating a visual band that allows natural light and ventilation to reach the interior. The solution meets the municipality’s needs for a lasting public accommodation, with the durable cedar cladding finished in a semi-transparent stain — and graffiti-resistant coating. The windows wrap the structure’s corners, making the roof appear to float above the bands of glass — and offering occupants unobstructed views from within.

### RESEARCH MEDICAL COMPLEX OF BARCELONA

Built along Barcelona's seafront promenade, the Biomedical Research Building is a large elliptical composition (about 600,000 square feet) featuring a high degree of functional flexibility. A double-skin façade incorporating Western Red Cedar performs two functions. It serves as a continuous envelope that resolves the structure's geometry while also ensuring that daylight can pass through without bringing the interiors unwanted heat, glare and direct ultraviolet exposure. More than 44,000 Canadian red cedar slats screen the building from the powerful Mediterranean sun. The slats, trapezoidal in shape to prevent rainwater from collecting, alternate in relative height. A break in the slats runs the full height of the floor at every sixth module, a rhythmic scheme that allows access for fire and emergency workers as required by code.

### FIRST PEOPLE'S HOUSE

Clients at the University of Victoria desired a multipurpose educational facility to honor the identity and pride of regional native peoples. Inspired by a Coast Salish longhouse in the post-and-beam structure is clad in vertical-grain, clear-finish Western Red Cedar, salvaged from the coast of Vancouver Island by the Dididat Nation. Organized as three discrete elements — classrooms, ceremonial hall, and administration area — the First People's House is made continuous by glazed curtainwall. An upper roof drains into a storm-water retention pond, while the lower roof is planted with indigenous grasses. Reflecting the integral nature of art in native cultures, the architecture incorporates carved house posts and ceremonial doors, as well a series of decorative carvings set amid woven cedar wall panels in the main hall. Registered LEED and targeting Gold, the facility evokes native principles of environmental stewardship through its use of reclaimed materials and passive ventilation techniques derived from traditional longhouses.



*The Research  
Medical  
Complex of  
Barcelona,  
Spain, designed  
by Albert de  
Pineda Álvarez  
and Manuel  
Brullet Tenas.*





*A view of the First People's House at the University of Victoria in British Columbia, Canada, designed by Alfred Waugh Architect.*



*Wood Block Residence, located on Mercer Island in Washington, by Chadbourne + Doss Architects.*

#### WOOD BLOCK RESIDENCE

Tasked with a major reconstruction of a 1962 residence by locally renowned architect Fred Bassetti, the architects sought to open up gathering spaces and expand interior sightlines and perspectives throughout the house. A metal skin with interior Western Red Cedar liner grounds the house to the wooded site. An aluminum bar grating encloses the outdoor patio, forming a diaphanous screen to the street. Cedar was selected to clad an existing painted hemlock ceiling, bringing natural warmth to an otherwise modern palette. Thin, tongue-and-groove cedar planks were installed between existing beams — a new roof gesture with the same material outside and in — folding down to cap the perimeter of the residence. Outdoor decks are also built from Western Red Cedar, stained a dark color for visual continuity with the interior floors and outside to the courtyard and patio.

*More Cedar Resources: For more details about the awards program or on the application, detailing and specification of Western Red Cedar, visit [www.realcedar.org](http://www.realcedar.org) or contact the Vancouver-based WRCLA directly at [wrcla@wrcla.org](mailto:wrcla@wrcla.org) or 866.778.9096.*



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Pelli Nabs Iowa Project 32  
 Demolition Alert 34  
 Balmond Quits Arup 36  
 Turning Point for ABI 40

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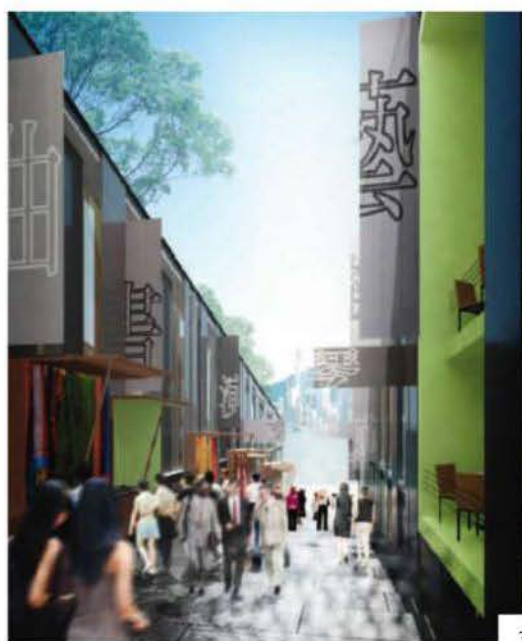
[ MASTER PLANNING ]  
**High Hopes in Hong Kong**

**WITH THE RECENT UNVEILING** of three competing master plans for the colossal West Kowloon Cultural District (WKCD), Hong Kong finds itself at a watershed moment – one that will not only shape a prominent waterfront site, but also help define the city's place in the firmament of global cultural destinations.

The \$2.8 billion publicly funded project will be Asia's largest cultural complex and is part of Hong Kong's drive to become "Asia's World City." Its scale and ambition – 40 hectares (99 acres) of prime real estate (including 23 hectares [57 acres] of open space, 264,200 square meters of cultural facilities, and 422,800 square meters of commercial property) – are daunting. Construction is scheduled to begin in 2015 and continue in phases until 2020 or later.

Sitting on reclaimed land left vacant for more than 13 years, the WKCD has a checkered history. In 2004, Foster + Partners won a developer-led bid competition with a scheme that placed a gigantic glass canopy over the site. But the project was abandoned after loud criticism. Eventually, the government set up an independent WKCD Authority, which relaunched the project in 2008 and commissioned three teams – guided by Foster + Partners, Rem Koolhaas/OMA, and Rocco Design Architects – to compete for the job. The winning master plan will be announced in early 2011.

The WKCD raises important questions about Hong Kong's future and highlights the need to balance what the public wants with what the world expects of a great city. Can a large cultural development actually fix Hong Kong's problems? Only time will tell if the WKCD helps Hong Kong measure up to other global creative cities and regional competitors such as Shanghai and Singapore. *Laurence Liauw*



like Hong Kong itself, the design alternates compact, generic developments with large areas of green space.

**2 | REM KOOLHAAS/OMA**

In its plan, titled "Project for a New Dimension," OMA draws on its recent research into preservation and regional development patterns, then reconfigures local/global elements. Three key ideas distilled from Hong Kong underpin the master plan: the village, agricultural field patterns, and urban streetscapes. Koolhaas and his team argue that it is the combination of these programmatic types that makes Hong Kong sustainable as a city and a culture. They hope to moderate the complexity of urban life with differentiated landscapes ranging from multiuse parks to dense urban grids. An Art Village, a Middle Village, and a Theatre Village occupy key locations in the plan and define distinct zones.

**3 | ROCCO DESIGN ARCHITECTS**

Rocco's master plan stitches together public space and local culture. A strategy of connective landscape creates three linear bands characterized as "city," "culture," and "green terrain." The idea is to weave together urbanity and nature. New cross streets join with the existing city grid, framing views of the harbor and connecting people to the water. In elements such as shop-lined alleys laced with cultural institutions, the design captures Hong Kong's dense urban character, while its waterfront areas recall the famous 12th-century Chinese scroll painting *Qingming Riverside*.

**1 | FOSTER + PARTNERS**

Foster's scheme arranges most of the cultural and commercial facilities in a central axis running east-west and linking the waterfront to older parts of the city. Direct and straightforward, it features orthogonal blocks of development along the axis, which terminates at two iconic oval buildings: an opera house and an exhibition center. Foster kept almost the entire 1.37-mile-long waterfront free of buildings and vehicles, creating an urban forest spotted with tea pavilions, public art, amphitheaters, outdoor mah-jongg tables, and shaded promenades. Much

IMAGES: COURTESY FOSTER + PARTNERS (1); OMA (2); ROCCO DESIGN ARCHITECTS (3)

[ STEVEN HOLL ]

## A New Landmark for the Glasgow School of Art

**GOING UP AGAINST** an icon, Steven Holl has released his plans for a new building that will rise directly across from the Mackintosh Building at the Glasgow School of Art.

Holl says his design will “respectfully contrast” with Charles Rennie Mackintosh’s 1909 masterpiece, adding that he drew inspiration from the play of light within the neighboring landmark. “It is really one of the most important buildings” in the world, says Holl, who is working with Scotland-based JM Architects on the project. “The beginning of Modern architecture is there.”

Holl won an international competition for the commission in September 2009, beating out more than 150 entries, seven of which were short-listed. Construction is expected to begin in mid-2011, with completion by fall 2013.

The 121,000-square-foot building will hold studios, seminar rooms, a lecture hall, student galleries, and an interpretation center for the Mackintosh Building. A series of vertical shafts, which Holl describes as “driven voids,” will puncture all seven floors (five above ground, two below) and bring in natural light. They also will assist in

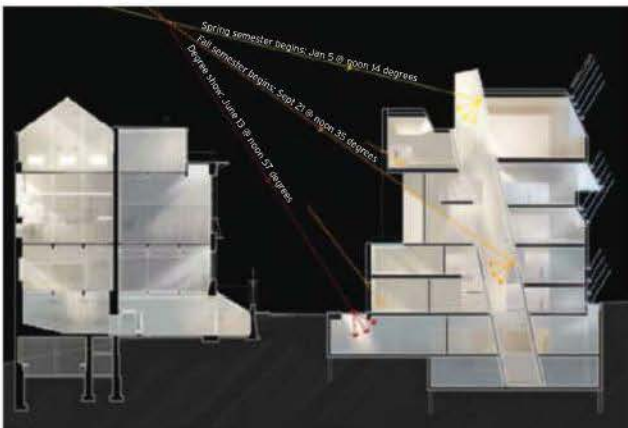
natural ventilation by pulling air up through the structure and out the top.

Ramps and stairs will wind through the center of the building, sometimes intersecting with the driven voids. As a result, Holl says, “everyone in the school will rub shoulders with everybody else.”

The contrasting relationship with the Mackintosh Building is most apparent in the application of materials. “That building has a thick, stone skin with thin bones, like steel straps and wooden beams,” says Holl. His building, in comparison, has a “thin skin” made of sandblasted, laminated glass and “thick bones” of white concrete.

Although some Scottish architects initially were upset that the commission didn’t go to a local architect, Holl remains undeterred. “The less nationalistic we are, the better,” Holl says. “Musical culture can go around the world, and art culture can go around the world.” So, he reasons, why not architecture?

*Tim McKeough*



Holl argues that his design will “respectfully contrast” with the century-old Mackintosh Building.



Hancher Auditorium was heavily damaged by the 2008 flood.

[ IN PROGRESS ]

## Pelli Building Will Replace Flood-Damaged Theater at U. of Iowa

**AS IT CONTINUES** to rebuild and fortify after the devastating flood of 2008, the University of Iowa has chosen Pelli Clarke Pelli Architects to design its new main theater.

On September 15, the school announced that the New Haven firm had won a competition to create a replacement for Hancher Auditorium, a performing-arts facility by architect Max Abramowitz that was significantly damaged when the Iowa River overran its banks two years ago.

The new Hancher will contain 2,100 seats across 144,000 square feet, plus a box office, dressing rooms, and loading docks, according to school officials. The building will be constructed near the original Hancher, on a natural rise 2 feet above the 500-year flood plain. Work will begin in 2012 and be completed by 2015.

Though its estimated cost is \$125 million, the Federal Emergency Management Agency (FEMA) will pick up 90 percent of the tab, as the site qualifies as a disaster area.

Pending FEMA approval, the school plans to bulldoze the original Hancher and the adjacent Voxman Music Building and Clapp Recital Hall, which together make up an arts complex designed by Abramowitz in the early 1970s. Voxman and Clapp will be relocated to a new building in downtown Iowa City.

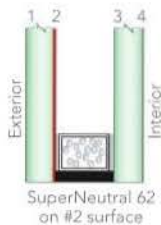
If the demolition goes forward, which is expected, the buildings would be the first on campus to be razed on account of the floods. But other buildings could follow. The school wants to replace its art museum, though FEMA has so far refused funding, arguing that its damage wasn’t extensive enough. In total, the 2008 flood caused \$753 million worth of damage on the University of Iowa campus.

What the new Hancher – named for former university president Virgil Hancher – might look like is still anybody’s guess. The international competition, which drew 59 submissions, merely required written proposals. Visual concepts were presented by the four finalists, which included Pelli, Snøhetta (of Norway), Trahan Architects (of Baton Rouge, Louisiana), and William Rawn Associates, Architects (of Boston), but complete drawings won’t be finished until next spring. Pelli will team with OPN Architects of Cedar Rapids, Iowa, on the project. *C.J. Hughes*

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The museum will anchor a \$2.8 billion waterfront redevelopment dubbed "Marvelous Port."

### [ SANTIAGO CALATRAVA ]

## Museum of Tomorrow to Showcase a Greener Future for Rio

AS RIO DE JANEIRO prepares to host several high-profile events, including the United Nations' 2012 Earth Summit and the 2016 Summer Olympics, the city is unveiling major architecture commissions and urban improvements. One such undertaking scheduled to break ground this fall is the Museu do Amanhã, or Museum of Tomorrow, by Santiago Calatrava.

Located on Pier Maua, adjacent to Rio's main cruise ship terminal, the museum will anchor a \$2.8 billion waterfront redevelopment plan dubbed "Marvelous Port." The 134,549-square-foot building and surrounding 5.4 acres of gardens and pools will showcase science and sustainability – suggesting a path for future, greener development. "It will be a living museum and pedagogical tool," Calatrava explains. "We want it to exemplify ecology for young people. They'll be able to see how things work with their own eyes."

The concrete building's most prominent feature is a series of photovoltaic panels protruding from its steel roof. During the day, they will tilt to follow the sun's course across the sky. "They're not passive elements," Calatrava says. "The building changes like a flower or a plant." Other green features include pools to capture rainwater for use in plumbing systems and pumps that will harvest seawater to cool interior rooms – all elements that could earn LEED certification from the Green Building Council Brasil, a USGBC affiliate.

As for the museum's contents, Hugo Barreto, secretary general of the project's

developer, the Fundação Roberto Marinho, describes it as "a collection of possibilities for the future." If this sounds ambiguous, the foundation has experience taking abstract concepts and making them concrete. It commissioned Paulo Mendes da Rocha to design the Museum of the Portuguese Language, in São Paulo, and Diller Scofidio + Renfro to design a Museum of Image & Sound, currently under construction in Rio.

At the Museum of Tomorrow, interactive exhibitions designed by Manhattan-based Ralph Appelbaum Associates will contextualize sustainability within Brazil's landscape. Visitors will enter from a ground-level plaza, then ascend two long ramps that terminate at windows overlooking the bay. From there, they will pass through a vestibule that rotates 180 degrees and deposits them into a navelike gallery running the building's length.

Dockside, Calatrava has proposed removing an elevated highway and extending a nearby plaza. Although the city is still evaluating this element, construction of the \$49 million museum is proceeding. The gardens and a plaza-level auditorium should open by 2012, in time to host Earth Summit events.

"The summit, the 2014 World Cup, and the Olympics are a huge opportunity to rehabilitate areas like the seaport," Barreto says, adding that he hopes Calatrava's Museum of Tomorrow will similarly become a catalyst and "iconic emblem" for more projects like it. *James Murdock*

### [ DEMOLITION ALERT ]

## To Save or Not to Save? Predock's CLA Building Faces Uncertain Fate

ANTOINE PREDOCK'S futuristic Classroom Laboratory Administration (CLA) Building, on the campus of Cal Poly Pomona, is only 17 years old, but it may be headed for demolition.

University officials say the structure, known as the "pointy building," needs extensive repairs and seismic upgrades that could cost as much as \$80 million. University President Michael Ortiz has said it makes more fiscal sense to build a new facility in a different location. On September 21, the California State University Board of Trustees approved a proposal to construct a new building.

Still, school officials emphasize that no final decision has been made. While they initially suggested Predock's building would be razed, they recently announced they will hire a consultant to study whether any portion can be preserved. "The wrecking ball is not imminent," says Mike Sylvester, the university's associate vice president for facilities, planning, and management. "Even if we made a decision today to demolish

the building, it wouldn't happen for at least five years."

Completed in 1993, the CLA complex (which includes both the triangular, eight-story tower and a more conventional building for classes and labs) is the most recognizable structure on campus. It has been used as a backdrop in several science fiction movies, including *Gattica*, as well as numerous car commercials. It's even part of the university's official logo.

Albuquerque-based Predock, recipient of the 2006 AIA Gold Medal, won a competition to design the building, which cost about \$24 million to construct. But Cal Poly officials say the building has numerous structural flaws, most notably water intrusion, which resulted in a lawsuit filed against a contractor. (The university won a \$13.3 million out-of-court settlement in 2005.) It also sits atop the San Jose Fault. Any major repairs to the CLA would require that it be brought up to current building codes, including ADA requirements and California earthquake safety standards. *David Hill*



School officials say the building has structural flaws.

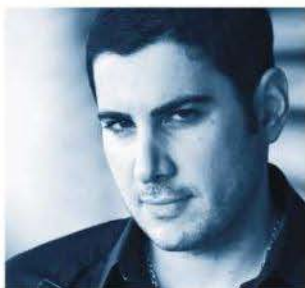


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## [ INTERVIEW ] Michel Abboud, Designer of Park51 Islamic Community Center



RECORD reporter Alex Padalka recently sat down with Michel Abboud (left), a principal at SOMA Architects, to discuss the New York firm's involvement in the controversial Park51 Islamic Community Center and prayer space proposed for Lower Manhattan. Renderings of the 15-story building – labeled the “Ground Zero Mosque” by its opponents – were released in late September. Visit us online to read the full interview.



The proposed Park51 design.

**ALEX PADALKA** What can you tell me about your firm?

**MICHEL ABBOUD** We have offices in New York, Mexico, and Beirut. With the economic crisis, we wanted to extend our projects in the Middle East, so in the past couple of years, we've done a lot of work there.

**AP** What about in the U.S.?

**MA** We're doing a building in TriBeCa that is almost finished. We did 93 Crosby St. [a condo] in SoHo. We've done mostly condos and also a lot of restaurants. We've built in seven different states.

**AP** How old are you?

**MA** [Laughs] I'm 33. Even the developer [Sharif El-Gamal, owner of SoHo Properties] is young [age 37]. We have 50-year-old people in our office, and we have 26 year olds. It's like any other office. I'm Catholic, so that shows we're not an Islamic firm.

For us, Park51 is about joining cultural differences. You've got a developer who's Egyptian, who's from a Polish Catholic mother, who goes to a Jewish community center. And you have a Lebanese architect who has citizenship in France and Mexico. It's a mix of cultures. Isn't that the whole point of this project?

**AP** What are you trying to convey with the design of the building?

**MA** We knew we didn't want the building to look like anything

else. We wanted it to be recognizable as Islamic, without necessarily being religious. So we went back to some of the most ancient traditional motifs [in Arabic architecture]. There's a single element, the *mashrabiya*, which is a sunscreen that incorporates abstract representations and very elaborate arabesques. We wanted to turn that into some sort of a map to create the facade – a map that would, through several manipulations and articulations, respond to the interior program.

**AP** What will Park51 contain?

**MA** In terms of program, the only religious component is the Muslim prayer space. We're not calling it a mosque because it's really not a mosque. A mosque has a very clear typology, with an open plaza and a minaret. You're never going to see those things in this building. It's called a prayer space, and it's on the two levels below the ground floor. Obviously, they are split between female and male. Everything above the ground floor will be secular architecture, for secular programming. You have restaurants, child-care facilities, a culinary school, a sports center with basketball courts, a pool, a library, an auditorium. Then you have the offices, workshops, even live-work spaces for artists. It's a little like the Villa Medici.

## [ STUDIO LAUNCH ]

### Balmond Leaves Arup to Start His Own Firm

**RENOWNED STRUCTURAL** engineer and designer Cecil Balmond is leaving Arup, the U.K.-based engineering firm where he has worked for more than 40 years.

“I'm stepping out to set up my own practice,” says Balmond, who is credited with making some of the most audacious structures in recent decades possible, including the CCTV Headquarters in Beijing by the Office for Metropolitan Architecture and the Centre Pompidou in Metz, France, by Shigeru Ban.

“I want to have more time to make some of the big art

installations I've been doing for the past four or five years,” Balmond explains, “and I want to do prototypes for the ideas I have.” His new firm, Balmond Studio, will be



Balmond joined Arup in 1968.

based in London, although he says, “I'll spend a little more time in America” than he does already (he's a professor of architecture at the University of Pennsylvania School of Design).

Balmond became deputy chairman of Arup Group in 2003. He stepped down from this position last year, yet continued to head the firm's Advanced Geometry Unit (AGU), which he founded in 2000. He quietly resigned in July but remains an adviser on the London Olympic Orbit project – a collaboration with Anish Kapoor – until the end of

2010. “I'm gradually easing myself out,” Balmond says. He will remain an Arup Fellow, a trustee of the firm, and a consultant.

Born in Sri Lanka, Balmond joined Arup in 1968. Notable projects he has worked on include the Seattle Central Library (with OMA), England's Imperial War Museum North (with Daniel Libeskind), and the annual Serpentine Pavilion program in London.

“Cecil has had an enormous impact on Arup, and on me personally,” says Philip Dilley, chairman of Arup Group. “He embod-

ies much of what Arup is about: design and technical excellence, quality, and collaboration.”

Balmond emphasizes that he is not fully severing ties with his longtime employer. “With contacts like Koolhaas, Ito, Kapoor, and the people I've worked with in the past, if they want engineering from Arup, that work will go to Arup. I'll just be a consultant who facilitates the whole process.” He adds: “I've been there for a long time, so it's time to move on. But we're close. Arup is family.”  
*Tim McKeough*

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[ ON VIEW ]

## Good Design, Modest Means

A new exhibition at MoMA explores the transformative power of humanitarian projects around the globe.



1

**AMONG THE VARIOUS** trends in architectural practice that emerged in the past decade, two occupied opposite ends of the spectrum. On one side, designers capitalized on the once-booming economy, conceiving grandiose towers for burgeoning cities like Dubai and Shanghai. On the other, they turned their attention to humanitarian work, using their skills to create pragmatic buildings for those in need, from hurricane victims to slum dwellers.

The latter is the focus of a noteworthy exhibition now on view at New York's Museum of Modern Art. Organized by curator Andres Lepik and curatorial assistant Margot Weller, *Small Scale, Big Change: New Architecture of Social Engagement* showcases 11 examples of contemporary do-good design across five continents. The featured projects range in purpose and size, from a series of housing blocks designed by Hashim Sarkis for fishermen in Lebanon to a small primary school that architect Diébédo Francis Kéré built for his native village in Burkina Faso. The show, which runs through January 3, also includes three Internet-based networks (The 1% program, Open Architecture



3

Network, and urbaninform) that facilitate socially conscious design.

MoMA's architecture and design department has presented several blockbuster shows in recent years, such as *Bauhaus 1919–1933* (2009) and *Home Delivery* (2008). In comparison, *Small Scale, Big Change* is relatively low-key. But its small scale, so to speak, does not diminish its importance. Through drawings, models, videos, and photographs, the show engages viewers in a field of design not often put on display. Moreover, it incorporates something not often

seen in architecture exhibitions: people. We watch villagers making and laying bricks for Kéré's simple yet elegant school. We see students attending Michael Maltzan's Inner-City Arts center, a bold, white complex in Los Angeles's Skid Row. We meet David Thornton, an Alabama man residing in a \$20,000, 600-square-foot house by Rural Studio. Each project underscores the fact that architecture is more than the fulfillment of an artistic vision: Good design can empower marginalized communities and transform lives.



2

1. Primary school by Diébédo Francis Kéré in Gando, Burkina Faso.
2. Metro Cable by Urban-Think Tank in Caracas, Venezuela.
3. \$20K House VIII by Rural Studio in Newbern, Alabama.

The timing of *Small Scale, Big Change* seems right. While architects have long been involved in social causes, a number of design-oriented nonprofit groups have cropped up in recent years. The most eminent, Architecture for Humanity, was launched in 1999 and today has more than 70 chapters around the world. In 2002, John Peterson founded Public Architecture and later started The 1% program, which encourages firms to contribute 1 percent of their working hours to pro bono projects. Other groups have sprung from natural disasters: flooding in northern France in 2001 prompted the establishment of the Emergency Architects Foundation; the 2004 Indian tsunami led to the creation of U.K.-based Article 25; and Hurricane Katrina, in 2005, spawned the Brad Pitt-backed Make It Right organization, among others.

While some might assume the MoMA show is connected to the recent recession, Lepik emphasizes that this is not the case. "We're not looking into the reaction to the actual crisis," he says. Rather, the goal is to examine a full-fledged, global movement and to question the role of the designer in the 21st century.

So have we reached a point where architects are no longer seduced by the chance to design glitzy skyscrapers for clients with deep pockets? It's unlikely. These projects do pay the bills. But the slumped economy has halted the big-building extravaganza, allowing the spotlight to shift to more altruistic undertakings. As *Small Scale, Big Change* confirms, modest projects for underserved areas can yield great rewards, for both the architect and the community. *Jenna M. McKnight*





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## Award Winners

The **Zaha Hadid**-designed MAXXI Museum of 21st Century Art, located in Rome, nabbed the **2010 Stirling Prize**. The Royal Institute of British Architects (RIBA) announced the winner of the £20,000 award during a ceremony on October 2 in London. MAXXI was up against five other nominees, including David Chipperfield's Neues Museum in Berlin.

**Chipperfield** is the recipient of **RIBA's 2011 Gold Medal**, which recognizes a person or group of people whose body of work has made an international impact. Previous winners include Le Corbusier (1953), Frank Gehry (2000), and I.M. Pei (2010). The winner is personally approved by Her Majesty the Queen. **William Pedersen** (above)

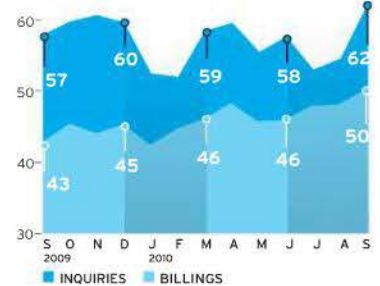


won the **2010 Lynn S. Beedle Lifetime Achievement Award**, bestowed by the Council on Tall Buildings and Urban Habitat. Pedersen, a founding partner at Kohn Pedersen Fox, was honored during an October 21 ceremony in Chicago.

**Steven Holl** will receive the **2010 Jencks Award** on November 30. Given by RIBA, the prize honors a person who has significantly contributed to both architectural theory and practice. *Jenna M. McKnight*

## ABI Climbs Above 50

At last, some good economic news: The **Architectural Billings Index** rose to **50.4** in September, after registering below 50 for 31 straight months. A score above 50 indicates an increase in activity. "This is certainly encouraging news, but we will need to see consistent improvement over the next few months in order to feel comfortable about the state of the design and construction industry," says AIA chief economist Kermit Baker. The inquiries score was **62.3**, up from **54.6** in August.



## Adobe Opens Virtual Museum

Software maker Adobe wanted more than a Web-site designer for its new virtual museum that would display work by multimedia artists. It wanted a forward-thinking architect who could make the space feel "physical." So it turned to Filippo Innocenti, cofounder of Spin+ and an associate architect at Zaha Hadid Architects. "They were looking for a real architect to do real architecture," says



Innocenti. The U.K.-based designer conceived a nest-like structure from which three sinuous towers rise.

The entire museum is reconfigurable, so galleries can be adapted to each artist's vision. For Innocenti, the lack of parameters proved more challenging than he anticipated. "The whole point of architecture is to put something in order," he says. "If you don't have any constraints, it becomes really complicated." The museum, located at [www.adobemuseum.com](http://www.adobemuseum.com), opened on October 6. *Tim McKeough*

IMAGES: COURTESY KPF (LEFT); ADOBE MUSEUM OF DIGITAL MEDIA (CENTER)

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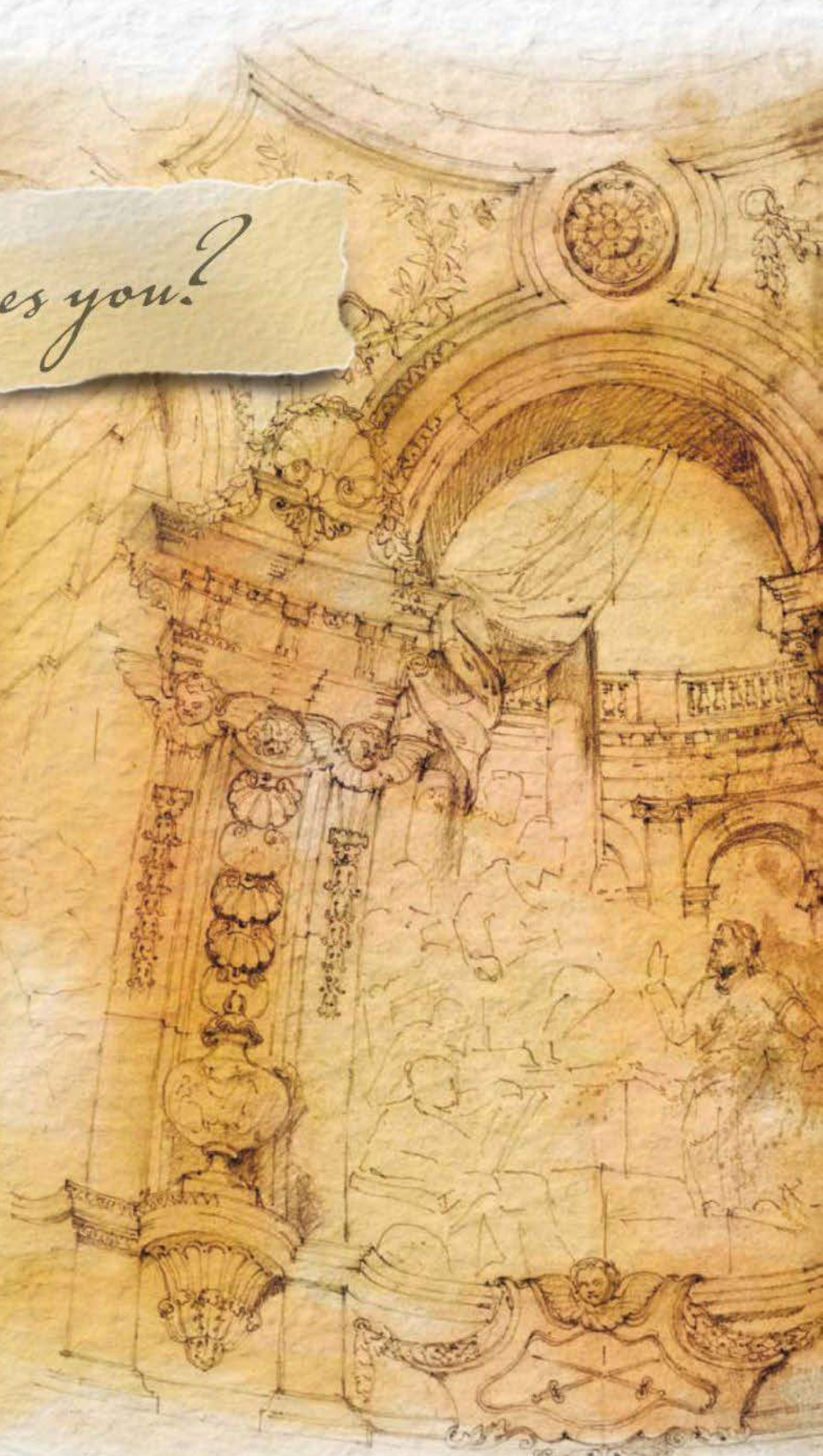
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CIRCLE 67



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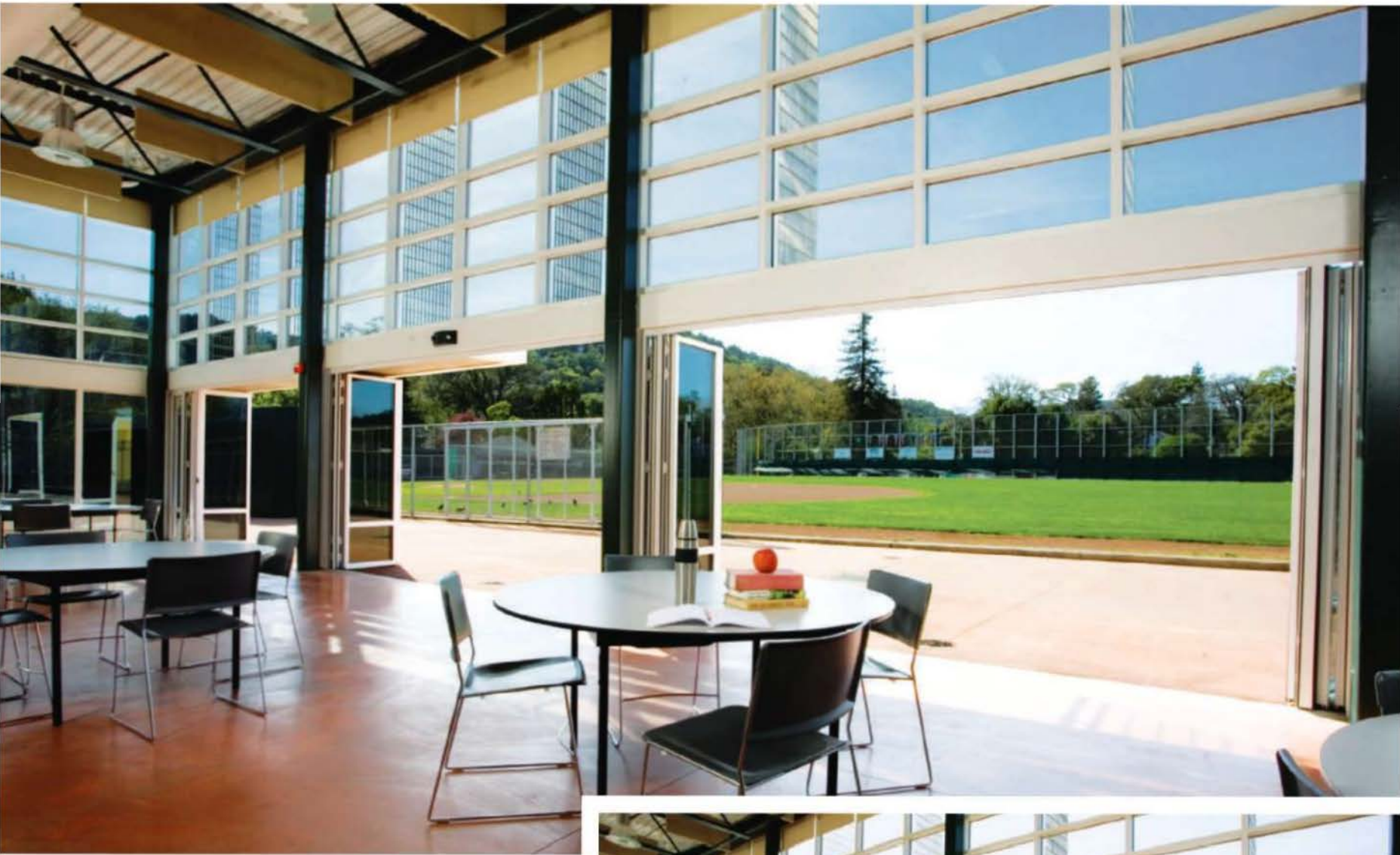
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# Julian King Architect



**PRINCIPALS:** Julian King, AIA; Christina Lyons

**LOCATION:** New York City

**FOUNDED:** 2006

**DESIGN STAFF:** 4

**PRINCIPALS' KEY WORK HISTORY:** King: LHSA+DP,

New York City, 2000–04; Rafael Viñoly Architects, 2000–01, Richard Meier & Partners, New York City, 1995–2000; Lyons: LHSA+PD, New York City, 2000–06

**KEY COMPLETED PROJECTS:** Tuscany

Barn, Tuscany, Italy, 2010; Greenwich House, Greenwich, Conn., 2008; Pottery Studio, New York City, 2008

**KEY CURRENT PROJECTS:** Chelsea Town House, New York City, 2010; LeJuene Gallery, New York City,

2011; Sorolea Assisted Care Living, Scottsdale, Ariz., 2012; Akwatia Library and Communications Center, Akwatia, Ghana, 2012

**WEB SITE:** juliankingarchitect.com



ABOVE AND LEFT: A wall of over 100,000 glass bottles, each etched with the words and images of Holocaust survivors, rises up out of the sand on the Atlantic City Boardwalk for this memorial design.

**JULIAN KING, AIA**, likes to tell stories. Or, rather, he likes the work of his eponymous firm to tell the stories. "Architecture is how I communicate with the world," says the architect and tennis pro, "and each design relays its own narrative. It's like creating little poems and dropping them around the planet." After six years, his firm's poetry is being appreciated more and more, and time to play tennis comes less and less. At press time, he and his coprincipal and wife, Christina Lyons, had just discovered their firm's design was one of six finalists for the Atlantic City Boardwalk Holocaust Memorial, and an exhibition of their work was on display at the Center for Contemporary Art in Bedminster, New Jersey. With its handful of completed residential projects in and around its New York City home base, and on-the-boards projects that include a residence in Tuscany, Italy, and a library and communications center in the West African town of Akwatia, Ghana, this is an exciting time for the four-person practice. "We are starting to get some traction," King says.

It's a good place for the firm to be after the recession of the past few years, when a large assisted-living facility and a few residential projects

were put on hold. Luckily, the projects are coming back to life. "There was a bright side to the slowdown, though," says King. "It gave us time to enter competitions we probably would not have otherwise, and we did well in them." Indeed. Those competitions include the Shinkenchiku Residential Design Competition, which King's firm won in 2009 for its Tuscany Barn project; the juried competition that resulted in its current exhibition; and the competition for the Atlantic City Boardwalk Holocaust Memorial in New Jersey.

King cites the firm's Tuscany Barn project, with its surreal take on past and present executed with simple materials formed in ways that create startling perspectives, as an example of what his firm does best. But it's the two memorial designs that really speak to King and Lyons's ability to use design to create a moment and stretch it into a narrative. For Atlantic City, over 100,000 glass bottles, each representing someone who survived the Nazi death camps, will rise out of the sand as glimmering testament to human resilience. The bottles will be etched with survivors' images and messages and bound together with a post-tensioned design.

As powerful, and much more in-your-face (quite literally), is the design for the Martin Luther King, Jr. National Memorial in Washington, D.C., for which the firm was a finalist out of more than 1,800 entrants. A 16-foot-tall glass wall with the words FREE AT LAST embedded in it repels the blast of a fire hose, as if the words alone are keeping visitors from a harsh drenching.

King credits his mentors with helping to develop his love of an architecture of spatial perception. Todd Dalland from FTL Solar (previously FTL Happold), where King once worked, is one standout. "He introduced me to his passion for tensile structures by taking me to climb the cables of the Brooklyn Bridge," says King. He credits Lyons, whose background is in exhibition and graphic design, with bringing more artistry to the mix. "We complement each other," he says. "We both have a real reverence for simple, timeless beauty." King admits that his firm isn't trying to do anything that his heroes – he cites Louis Kahn – didn't do. "We're trying to make architecture that is not so much about what you see, but about what happens to you when you experience it." *Ingrid Spencer*



## [ PRACTICE STRATEGY ]

### Transdisciplinary design

Once an academic outlier, transdisciplinary design went mainstream this fall. Parsons The New School for Design, in New York City, launched the first American degree program of the type, and curators Michael Rooks and Jonathan D. Solomon surveyed transdisciplinary design for the U.S. Pavilion at the Venice Biennale, which closes November 11.

The substance of transdisciplinary design is still up for grabs. Does it weave various masteries, remarkably tightly, into a design solution? Or does it “transgress disciplinary boundaries, with new knowledge not contained within any one of those disciplines,” as Parsons dean Joel Towers puts it? The approach is

largely agreed upon. Summed up by Biennale title *Workshopping*, transdisciplinary design is highly inclusive and participatory, embracing fields as disparate as economics and public policy.

Mason White and Lola Sheppard hadn’t settled on a definition of transdisciplinary design in London in 2003 when they cofounded Lateral Office, which is now based in Toronto. White recalls, “I think it was partly a realization that architecture has an opportunity to perform in a more integrated way – and a criticism of the fascination with signature practices.” More recently, the pair has focused on the economic and ecological causes and consequences of architectural

intervention, although they prefer broad research to partnerships. Lateral’s short-listed project in last year’s cityLAB WPA 2.0 competition, for example, proposed transforming the Salton Sea in southwest California – terminating its use as an agricultural reservoir; redeveloping its coastline into industrial, recreational, and ecological zones; and floating various pools within the water body to harvest the sea, regulate its salinity, or attract tourism. “What two issues could be said to dramatically affect building more than capital and operational costs, and, increasingly, its role in an urban ecology?” White asks.

Towers – who, predating transdisciplinary design’s emergence

even in academia, established SR+T Architects with Karla Rothstein in 1992 as a loose network of collaborators (“We thought that a diversity of opinions would help get at the most compelling and enduring idea”) – concurs that this burgeoning approach is well suited to the notion of urban ecology. “In the broadest sense, ecology is transdisciplinary activity,” he says. “It is heterogeneous, spatially complex, and involves social and natural systems and their relationships within some given boundary.”

Yet such breadth of vision can be applied to small-scale work, too. SR+T designed the three-family condominium DeanCarlton “in between” financing, building regulations, construction technology, and other topics. Towers says that that allowed superinsulating the building and outfitting it with a green roof, which otherwise would not have been possible with a speculative developer’s budget. “Design thinkers are particularly well positioned to address the most complex problems facing society. The sooner we recognize that and shun a nostalgic view of architectural practice, we’ll be able to regain relevance.” *David Sokol*

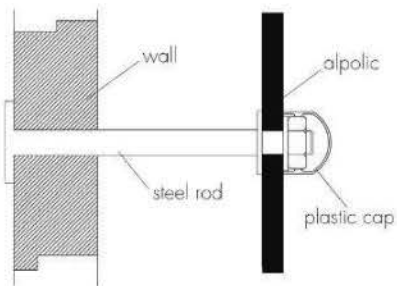


**ABOVE AND LEFT: Many are predicting that water will be the oil of the 21st century. This proposal reconceives the agricultural sump of California’s Salton Sea into a productive ecology that is simultaneously an economic catalyst for the region and a renewed interactive recreational destination.**



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# There Goes the Neighborhood



## WATCH VIDEO

Interview with Norman Foster.

Manhattan's Lower East Side has never been a great neighborhood. At best, at the turn of the 20th century it was a tenement-ridden haven for the city's new immigrants, and later a bargain district for shoppers from around the boroughs. For years, the only bright spots along the Bowery – the neighborhood's notorious drag – were the much-loved but now-defunct Amato Opera and CBGB's. Mainly, though, the area's seedy establishments and crime-infested streets hosted locals and visitors partaking in not-so-highbrow activity.

But like so much in New York, all that has changed. While the Lower East Side's affordable rents (by Manhattan standards) have lured artists for decades, recent years have witnessed an influx of galleries, creating a whole different kind of art scene. The completion of SANAA's New Museum on the Bowery in 2007 was just the anchor the area needed to draw Chelsea's heavyweights, long since driven out of SoHo's once-mighty downtown gallery scene.

The latest arrival is Sperone Westwater. Like the New Museum just a few doors down, the 35-year-old gallery uses architecture to mark its presence with a 131-foot-tall Norman Foster–designed building that nearly matches its pioneering neighbor in size but goes one better with a bright red, moving gallery along its 25-foot-wide translucent facade.

Architecture has always had the ability, for better or worse, to transform a place. But in this case, it may also transform, for better or worse, how we view art. The Lower East Side's narrow lots – perfect for cramming in low-cost housing and cheap storefronts – are not exactly ideal settings for museum-goers who prefer their art in large doses. In these vertical galleries, those art lovers better get used to the long wait for the elevator. *Josephine Minutillo*





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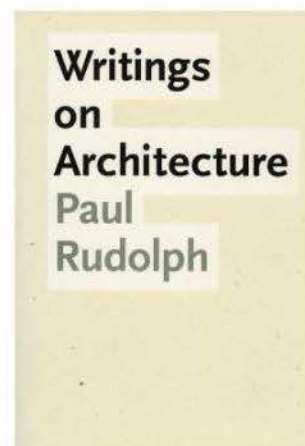
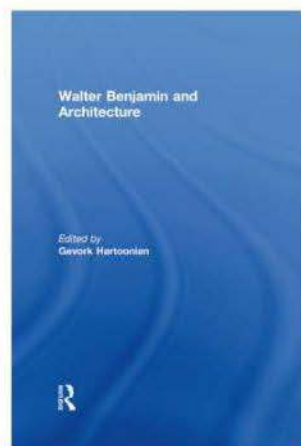
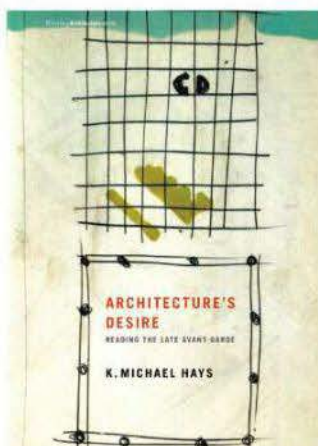
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# Reading Space: Words and Thoughts on Design



**Architecture's Desire: Reading the Late Avant-Garde**, by K. Michael Hays. Cambridge: MIT Press, 2010, 192 pages, \$20.

A series of sketches by John Hejduk from 1962 – enigmatic diagrams of a mysterious wall – prompt K. Michael Hays to state in his latest book that the images “resemble nothing so much as Lacan’s diagram of the gaze, of vision turned back on itself.” Indeed, they might lead us to think the architect had the analyst’s psycho-visual schemata in mind when he made them.

But, no: Lacan’s figure didn’t debut in print until 1973. But you wouldn’t know that from reading *Architecture’s Desire*, an edifying if irreverent history of architecture in the age of theory – one that’s more concerned with applying theory to history than in searching for theory *in* history.

Hays returns us to a time – the 1960s and ’70s – when discourse turned in on itself, looking to reevaluate its ontological foundations and its eschatological trajectory. It hoped to use architecture as a medium for philosophical thought. Conscripted into Hays’s late avant-garde are (in order of appearance) Aldo Rossi, Peter Eisenman, Hejduk, Bernard Tschumi, and, in a brief coda, Rem Koolhaas, who rushes in to crowd out his colleagues’ introspections and declare the return of the Real.

In a book that deals with architects-as-analysts, it is fitting that Hays should so frequently turn to Lacan to elucidate the deep psychic springs from which their architectures emerged. But it would be useful to know what, exactly, Hejduk and his contemporaries actually thought of Lacan. *Ian Volner*

**Walter Benjamin and Architecture**, edited by Gevork Hartoonian. Routledge, 2010, 179 pages, \$70.

On September 25, 1940, the philosopher Walter Benjamin, aged 48, was found dead in his hotel room in Portbou, Spain. Fleeing the Gestapo and intending to come to the United States, he carried with him a manuscript he deemed more important than his own life. To this day, it has never been recovered. Nearly three decades after Benjamin’s death, the discipline of architecture,

seeking new ideas, would turn to his oeuvre via Manfredo Tafuri’s influential *Teorie e Storia dell’Architettura*, which elaborated a debt to Benjamin and marked Benjamin’s entrée into architectural discourse. As demonstrated in *Walter Benjamin and Architecture* – a collection of essays – architectural historians and practitioners have found in Benjamin’s work a way of thinking that transcends eras and resonates with architecture’s deepest concerns. For example, Terry Smith’s essay, “Daniel Among

the Philosophers,” shows how Benjamin’s writings helped Daniel Libeskind as he struggled with his paradigm-breaking Jewish Museum in Berlin. Benjamin’s continued relevance is due, in part, to his intimate and sometimes mystical reflections on how space affects us. His ideas still matter because of their disciplined humanism. His essay “The Work of Art in the Age of Mechanical Reproduction” is prescient for a 21st century in which digital design has the potential to dehumanize and flatten space. *Guy Horton*

**Writings on Architecture**, by Paul Rudolph, foreword by Robert A.M. Stern. Yale School of Architecture, 2009, 164 pages, \$18.

Most admirers of Paul Rudolph believe that his native mode of communication was rooted in drawing. But he was also a skilled and influential verbal communicator. This elegant volume of selected writings and photographs provides access to Rudolph’s core preoccupations, from modularity and prefabrication to the design of civic space.

Rudolph’s residential work in Florida epitomized the first phase of his career; he founded his practice in Sarasota in 1952. Academic projects defined his 1960s output, and large-scale commissions in Asia provided the focus for his late work. During these distinct periods, a level of consistency persisted in Rudolph’s writing. Respect for the principles of regionalism, urbanism, and nuanced scale relationships appear throughout the volume.

*Writings on Architecture* invites the reader into an ongoing conversation between Rudolph and the masters: Gropius, Mies, Le Corbusier, and Wright. A pronounced admiration for grand public

spaces such as the Piazza San Marco in Venice and St. Peter’s in Rome infuse the writing with historical context. Rudolph implores students to experience architecture directly and engage “the joy of making things ... the realm of ideas and intellectual aspects of architecture: the sheer joy, and problems, and possibilities of materials, and techniques, and technology.” During his tenure as chairman of Yale’s school of architecture, Rudolph spoke of two selves, the objective teacher and the polemical architect, who were consistently at odds. His critique of teaching current trends instead of establishing design principles is still relevant today.

Rudolph recognized the importance of Gio Ponti’s concept of unconcluded works, acknowledging that use and context change over time. This notion that built projects are neither finite nor finished is evident in his expansion strategy for the Yale A&A Building and his modular design for Sarasota, Florida’s Riverview High School. Rudolph understood that work designed in the present would provide a context for the future. *Christopher Domin*



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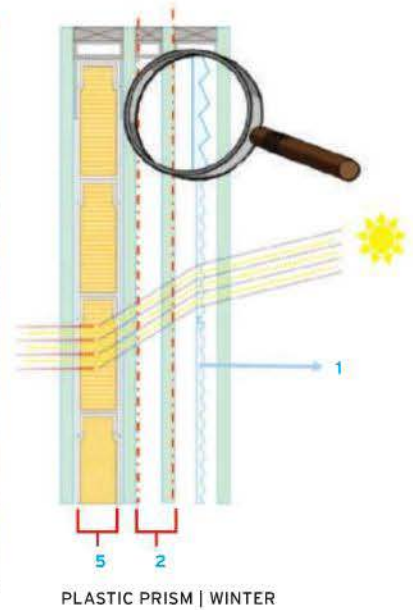
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According to Dennett, GlassX not only meets but exceeds the requirements of current building-energy-code standards. "People thought at one stage that glass buildings would be a thing of the past because you were going to have to have a concrete building with little punch-out windows in it. GlassX allows you to still have that glass facade and include visionless, spandrel areas that will still let light through but will meet the new standards for heat loss in buildings." As it is translucent and not transpar-

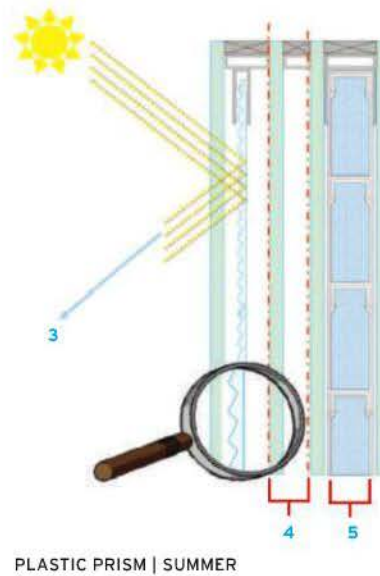
ent, in either its solid or liquid state, the glazing is better suited for spandrel and lower transom applications.

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The salt hydrate in the PCM is specifically formulated for the building market to melt and freeze within a narrow range that is close to room temperature. The 0.8-inch-thick section of the PCM can store as much heat as 9 inches of concrete; it will then release that constant heat at a rate of 16 to 30 BTUs over a 20-hour cycle. Depending on the usage and the amount in the building, interior temperatures can be reduced by 4 to 6 degrees in Celsius in the summer months. "You can think of the PCM as an ice cube for a building that doesn't melt," says Dennett.

Developed in Switzerland over a decade ago and used in many European buildings, the glazing is now being considered for projects in North America. In comparison to \$20 to \$30 a square foot for typical triple glazed IGUs, GlassX costs about three times as much, averaging \$60 to \$90 per square foot. "But you are looking at a payback time of five to 10 years given your up-front savings in HVAC systems and long-term energy savings," says Dennett.

One of the architecture firms currently considering GlassX for an upcoming project is SRG Partnership



- 1 HIGH TRANSMISSION OF RADIATION BY LOW ANGLES OF INCIDENCE
- 2 LOW-EMISSIVITY COATING
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- 4 LOW-EMISSIVITY COATING
- 5 PHASE CHANGE MATERIAL

- 1. The facade of this senior residence facility in Switzerland designed by Dietrich Schwarz uses 1,600 square feet of GlassX.
- 2. The glazing was used as a lower transom for this Swiss residence designed by architect Felix Kuhn.

in Seattle. According to project designer Christopher Colley, SRG is possibly using the glazing for a new nursing and health-science building for Everett Community College in Washington state. While the product's newness and cost may be hurdles, particularly for publicly bid projects, Colley thinks it is an intriguing new option for spandrel glass as his firm starts to design buildings for The 2030 Challenge. "This is a product that can potentially allow us to have more design freedom and still have a very high-performing building." Greenlite Glass Systems Inc., Vancouver, B.C. [www.greenliteglass.com](http://www.greenliteglass.com) **CIRCLE 200**



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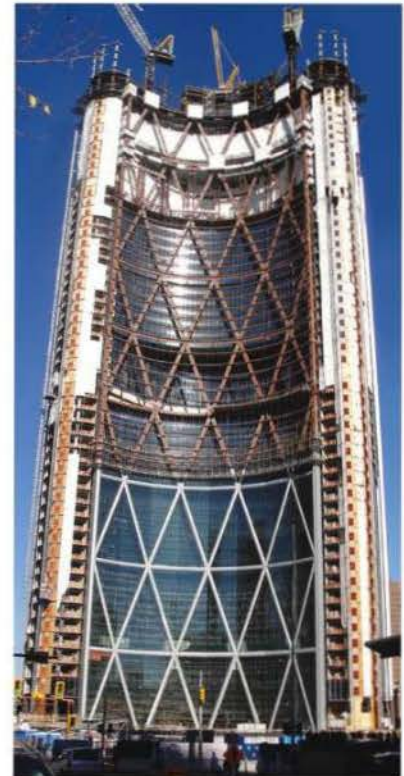


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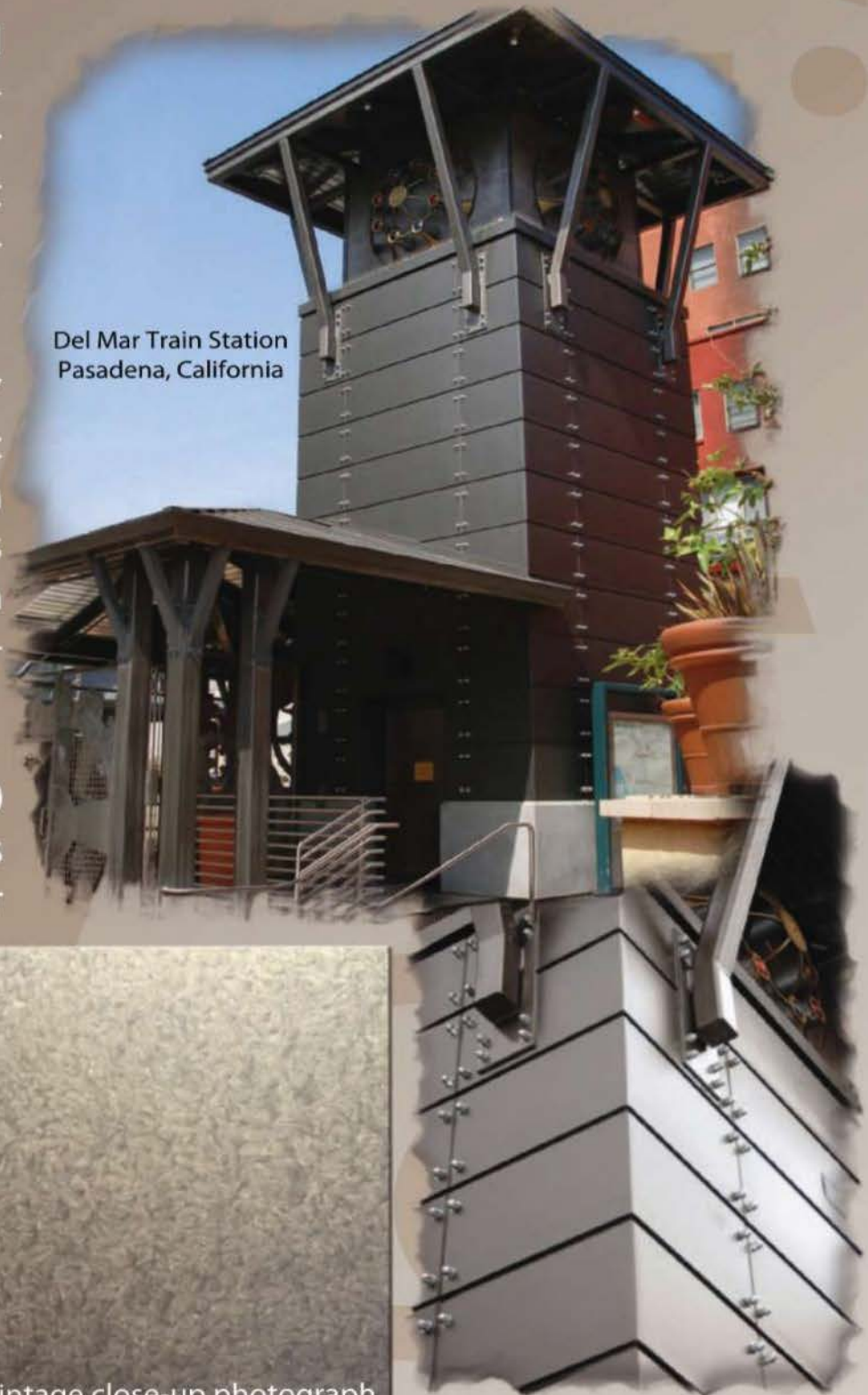
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2011

# Learning From America's Best Schools

Stepping into a successful career in architectural practice begins with education. Norman Foster, a Yale University graduate, said that two strong influences have contributed to his success and resilience over the years. They are, first, the people he met in school and during his formative professional practice years and, second, the time he spent in college. Foster has enjoyed a unique and storied career, but parts of his experience are common to all architects.

At university, students' experiences can significantly enhance or diminish their interests as well as their likelihood for future success. This gives schools both tremendous opportunity and huge responsibility, since what happens in them has the potential to change the careers of individuals as well as the architecture profession as a whole. This is one response to a question I've been called on to answer many times since publishing the first "America's Best Architecture & Design Schools" rankings in *DesignIntelligence* 12 years ago: Why rank schools?

Another answer is given by the architecture firms that employ recent graduates. If the purpose of a professional degree is to prepare students for professional practice, then how well are degree-granting institutions performing the task? Ongoing research by the Design Futures Council and Greenway Group shows that architecture firms and related professional practice careers are being deconstructed and reinvented at an accelerated pace. Beyond the economy, for example, the profession is being shaped by profound changes in technology, such as building information modeling. Can educational institutions keep pace with the changing needs of 21st-century practices? And so we ask in our survey, "In your firm's hiring experience in the past five years, which schools are best preparing students for success in the architecture profession?"

## Time for change

Since 2004, when *DesignIntelligence* began ranking undergrad and grad programs separately, Harvard University's Graduate School of Design has held top honors for its M.Arch. program. So it is fascinating to consider how the University of Michigan's Taubman College of

Architecture and Urban Planning nudged Harvard out of No. 1 this year. In fact, Michigan didn't even appear on our list of top 20 grad programs last year. It hovered just below the requisite votes needed to tie for 20th place.

Suddenly emerging at the top seems like an unlikely story for Michigan. Yet the unfolding story is even more interesting. In her *Dean's Message* posted on the Taubman College Web site, Monica Ponce de Leon explains how the school is reformulating a pedagogical strategy that has remained virtually unchanged in architecture education for more than a century. To forward Taubman's goal of more realistically paralleling contemporary professional practice, studio work is being integrated into other required courses; various areas of expertise (history, structures, urban planning) are being integrated into the studio; and design studios are being paired with courses in other areas of concentration – a structures course or a structures seminar, for example.

And the students seem to agree with this tactic. Among students who took a separate *DesignIntelligence* survey, 90 percent of University of Michigan attendees indicated a belief that they'll be well prepared upon graduation, with 96 percent giving the quality of their program an A (excellent) or B (above average).

Michigan is not alone among the rising stars of graduate education. Of the 20 top-ranked M.Arch. programs, seven schools improved their position this year: Cornell University, the University of Pennsylvania, Washington University in St. Louis, Southern California Institute of Architecture, the University of Illinois at Urbana-Champaign, Syracuse University, and the University of California, Los Angeles.

Each year in connection with the *Best Schools* survey, *DesignIntelligence* conducts a parallel survey of architecture deans

and department heads to assess opinions about their own and peer institutions. It is telling that this year the deans' five most admired M. Arch. programs are the same top five chosen by practitioners, albeit in a slightly altered ranking: Harvard University, Yale University, the Massachusetts Institute of Technology, Columbia University, and the University of Michigan.

### And space for continuity

In the undergrad program rankings, the interesting story this year is that school rankings are remarkably consistent. The top five schools have the following rank average over the past eight years: Cornell University, 1.25; Syracuse University, 3.75; Rice University, 5.37; California Polytechnic State University, San Luis Obispo, 3.75; and Virginia Tech, 4.50. In addition to these stalwarts, Carnegie Mellon University, the University of Texas at Austin, Rhode Island School of Design, and the University of Oregon have

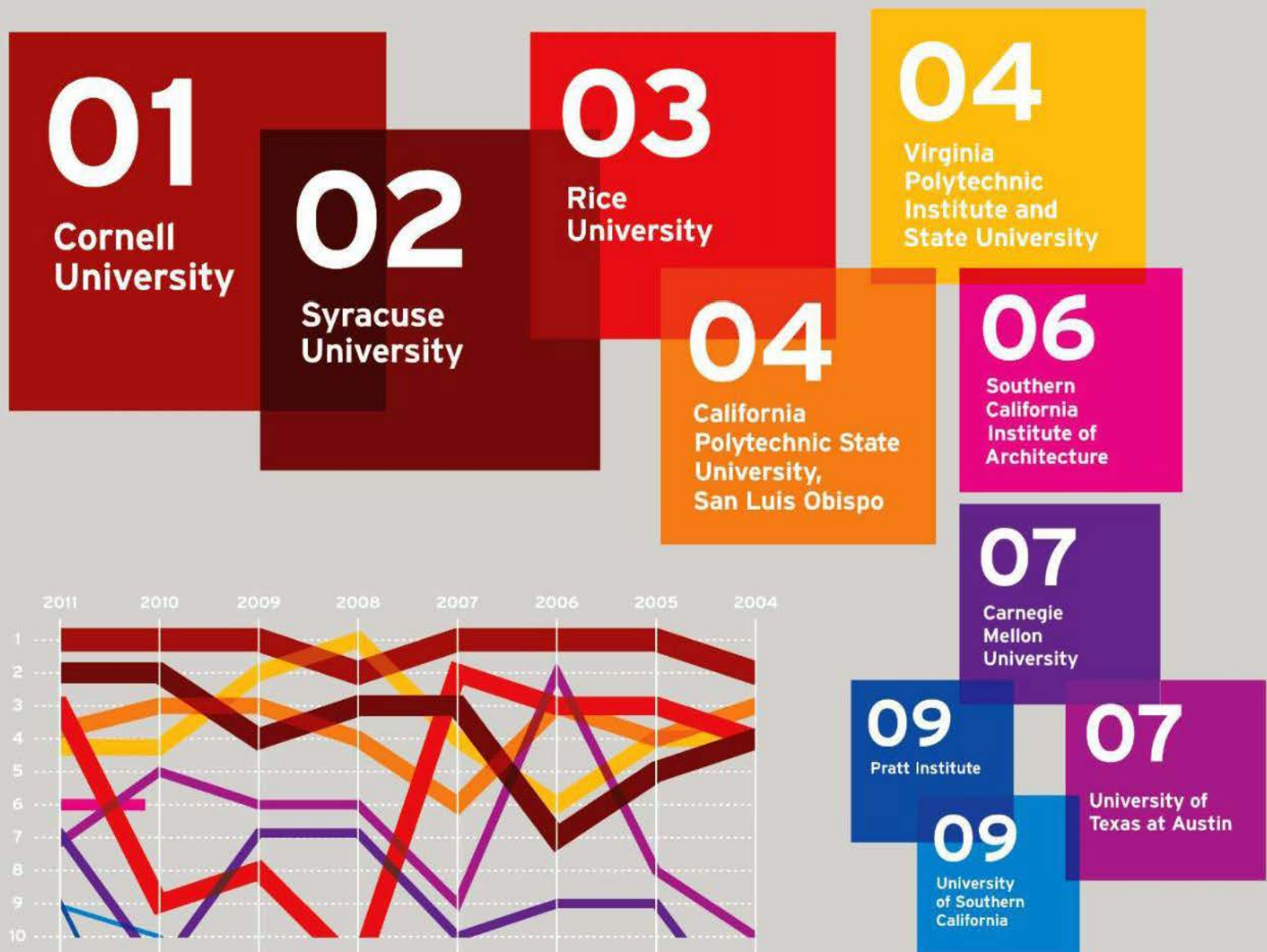
made the top 20 for eight straight years.

Top-ranked Cornell University shows devoted consistency among the student body as well, with 97 percent indicating a belief that they will be well prepared for their profession upon graduation, and 97 percent giving Cornell's program a grade of A (excellent) or B (above average).

Among the 20 top-rated B.Arch. programs this year, nine improved their position in the rankings: Rice University, Southern California Institute of Architecture, Carnegie Mellon University, Pratt Institute, the University of Southern California, the University of Kansas, Cooper Union, the University of Notre Dame, and California State Polytechnic University, Pomona.

Deans' picks for their five most admired B.Arch. programs diverged a bit from practitioners' favorites: Auburn University, which was ranked 18 by practitioners, was chosen No. 1 by deans. In particular, academics said they valued the program's integration with the Rural Studio and its

## TOP 10 ARCHITECTURE PROGRAMS UNDERGRADUATE



**About the rankings:** Occasionally, more than one school receives the same number of votes. This results in two schools being given the same numerical ranking; however, the next rank is omitted. For example, California Polytechnic State University and Virginia Polytechnic Institute received the same number of votes and are both ranked number four this year, and no school is ranked fifth.



highly focused curriculum, both of which serve to engage students at a high level. Rounding out the deans' most admired undergrad programs were Cornell University, Virginia Tech, the University of Texas at Austin, and Syracuse University.

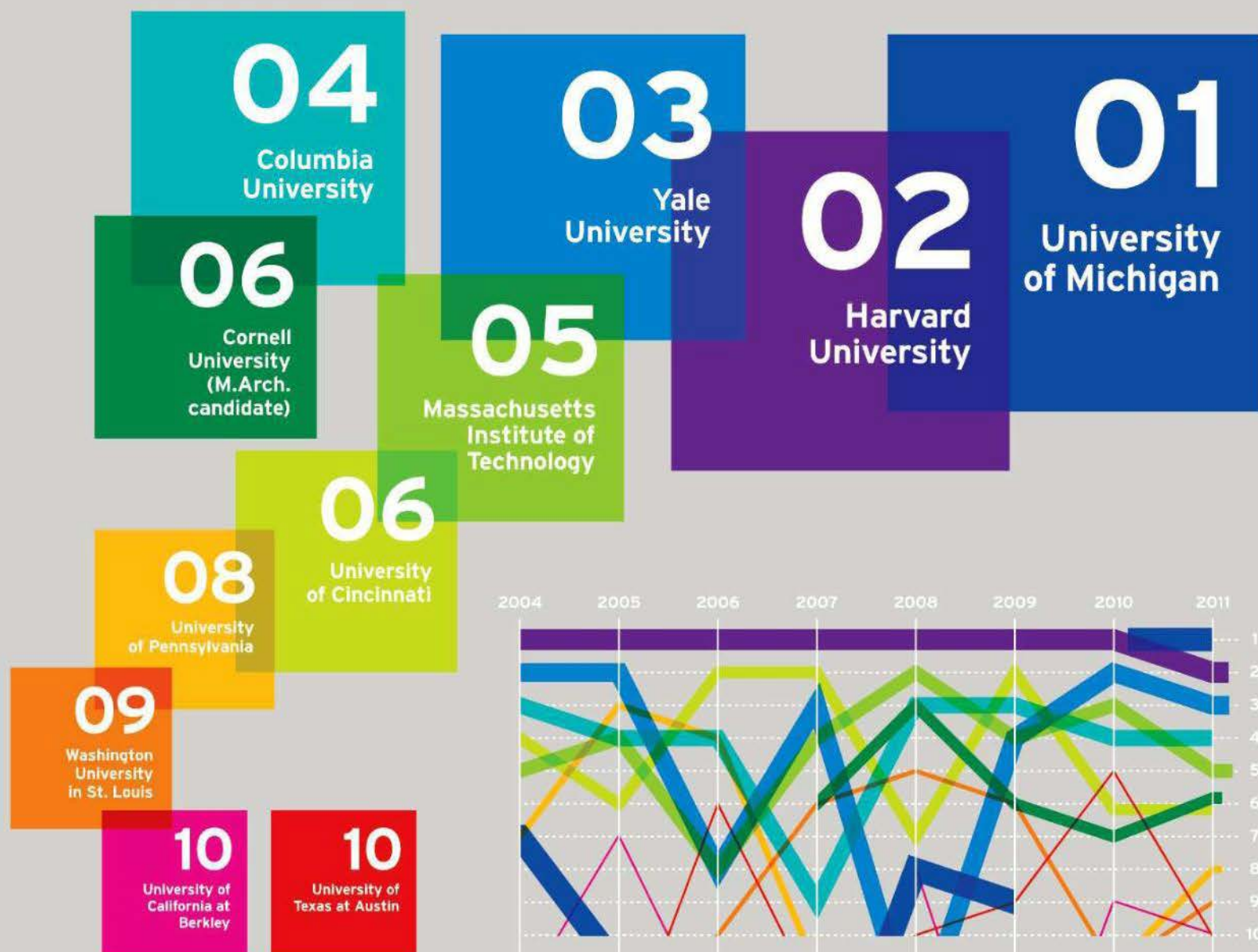
Whenever I speak or write about the *DesignIntelligence Best Schools* research, I add a caveat: It is important to be aware of the limitations of any ranking system. Small schools are at a disadvantage, as are newer programs, simply because there are fewer graduates; therefore, fewer professional practices are familiar with the fruits of these programs. And we've seen that some large programs that have drifted in the past are coming back with strong, innovative programs but may not yet have regained their brand strength. Some schools are a good deal better than they are able to communicate. And in any case, a student's choice of program must go beyond rankings and delve into the specifics important to that individual. The ability to connect with peers, mentors, and educa-

tional options that speak to personal needs and preferences is imperative.

A robust profession requires a regular infusion of strong up-and-comers. The architecture profession is dependent on schools to deliver fresh talent each year, individuals who are not only driven by their passion for the profession but who come prepared with what they'll need to begin a career that will last for decades. Many professional-practice beliefs and methods are born in tertiary education, with accredited architecture programs serving as either leaders or laggards in innovation. This is why professional-practice leaders and educators need to continue discussing how to align their priorities and establish strategic pathways forward. ■

*James P. Cramer is the founding editor of DesignIntelligence and cochair of the Design Futures Council. He is chairman of the Greenway Group, a management consultancy in the Atlanta area with clients worldwide. He discusses the survey and how schools make it to the top in a video on [architecturalrecord.com](http://architecturalrecord.com).*

## TOP 10 ARCHITECTURE PROGRAMS GRADUATE



**Methodology:** "America's Best Architecture & Design Schools 2011," by *DesignIntelligence* on behalf of the Design Futures Council, ranks accredited undergraduate and graduate architecture programs from the perspective of professional practitioners. The survey, conducted in mid-2010, polls professional practice leaders who have direct experience hiring and evaluating the performance of recent architecture graduates. Firms were queried about which programs are best at preparing students for professional practice. The top 10 of the 20 B.Arch. and M.Arch. programs ranked by *DesignIntelligence* are published here. In addition, students and the deans and chairs of NAAB-accredited academic programs participate in their own surveys. Some of the data collected from these studies is presented on the following page.

**ARCHITECTURE SKILLS ASSESSMENT**

These rankings, based on the hiring experience of firms surveyed, assess the preparedness of recent graduates in a range of vital skills. Survey participants were asked which collegiate architecture programs (undergraduate or graduate) are strongest in each skills category.

**Analysis and planning**

1. University of Michigan
2. Harvard University
3. Cornell University
4. Virginia Polytechnic Institute and State University
5. Massachusetts Institute of Technology
5. Yale University

**Communication**

1. Harvard University
2. University of Michigan
3. Yale University
4. Cornell University
5. Virginia Polytechnic Institute and State University

**Computer applications**

1. Massachusetts Institute of Technology
2. Southern California Institute of Architecture
3. University of Michigan
4. Columbia University
5. Virginia Polytechnic Institute and State University

**Construction methods and materials**

1. California Polytechnic State University, San Luis Obispo
2. Virginia Polytechnic Institute and State University
3. University of Michigan
4. Lawrence Technological University
4. University of Kansas

**Design**

1. Harvard University
2. Southern California Institute of Architecture
3. University of Michigan
4. Cornell University
5. Yale University

**Research and theory**

1. Harvard University
2. University of Michigan
3. Columbia University
3. Yale University
5. University of California at Berkeley
5. Cornell University

**Sustainable design practices and principles**

1. University of Oregon
2. University of Michigan
3. University of California at Berkeley
4. Virginia Polytechnic Institute and State University
5. Auburn University

**ARCHITECTURE DEANS SURVEY**

The *DesignIntelligence* "Survey of Architecture Deans and Department Heads" tallies the opinions of academic leaders, who weigh in on the status and progress of their own and peer institutions.

**Most admired B. Arch. programs**

1. Auburn University
2. Cornell University
3. Virginia Polytechnic Institute and State University
4. University of Texas at Austin
4. Syracuse University

**Most admired M. Arch. programs**

1. Harvard University
2. Yale University
3. Massachusetts Institute of Technology
4. Columbia University
4. University of Michigan

**56% OF STUDENTS GRADE THEIR PROGRAM AS EXCELLENT****ARCHITECTURE STUDENT SURVEY****OVERALL RESPONDENTS**

Undergraduate students	63%
Graduate (master's) students	34%
Doctoral students	3%

**BELIEVE THEY WILL BE WELL PREPARED FOR THEIR PROFESSION UPON GRADUATION**

92%

**HOW THEY GRADE THE QUALITY OF THEIR PROGRAM OVERALL**

A: Excellent	56%
B: Above average	34%
C: Average	8%
D: Below average	2%
F: Failing	1%

**WHAT THEY WILL DO AFTER GRADUATION**

Pursue an advanced degree in architecture	31%
Pursue an advanced degree in something other than architecture	5%
Work in private practice	48%
Work for a corporation	2%
Work in government	1%
Self-employment	4%
Volunteer for a nonprofit or community service organization	3%
Other (including undecided)	6%

Plan to take the Architect Registration Exam

84%

Plan to become LEED accredited

73%

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Many U.S. architects are struggling to make payroll during the Great Recession, which, interestingly, we hear is over. Others aren't worrying so much because they have work in China, India, and other countries with booming economies. Granted, figures gathered by RECORD's sister publication *Engineering News-Record* for our Top 250 Firms list [RECORD, July 2010, page 45] found revenues last year to be slightly down from 2008 for work abroad. But projected billings for 2010, just published by *DesignIntelligence* in its September/October 2010 issue, show a staggering leap up – for the biggies in the business. While AECOM Technologies (which recently swallowed DMJM, EDAW, and Ellerbe Becket) may have higher domestic billings than non-U.S. (\$405 million domestically, compared to \$275 million elsewhere), Gensler is billing \$408 million in non-U.S. projects this year, compared to \$102 million at home. HOK reports billings of \$264 million for non-U.S. work versus \$187 million domestically, and Perkins + Will is projecting \$291 million abroad against \$115.7 million at home. If revenues follow the same upward path as billings, the year looks very good.

In case you think you need to be a hugiyama firm to get work in emerging economies, look at Waggonner & Ball Architects of New Orleans, which has a 20-person office. David Waggonner, FAIA, got a commission in China about 10 years ago when an American friend there referred the firm to a Chinese government official in need of an architect to execute a master plan for a town near Beijing. That led to more plans, and the design of a school, with additional projects now in the offing.

Of course, the old story of luck, timing, and who-you-know holds true. But Waggonner emphasizes the importance of ongoing relationships – not just the old friend who referred you, but your new clients. Also familiarity with local culture and language is key, Scott Simpson advises in *DesignIntelligence* – the reason U.S. firms staff their offices with foreign architects from certain countries.

Since construction documents and oversight are often undertaken by a local firm or design institute, architects must stay unflappable. And with no strong legal structure to guarantee you get paid – especially in the final stages – “Your only real clout,” says Simpson, “is the power of persuasion.” The good news is that foreign clients have a refreshingly experimental attitude, much more so than their U.S. counterparts. In this issue, RECORD presents projects in Israel, Saudi Arabia, and Turkey designed by American architects. Different design approaches were involved in each, and the lessons learned are well worth paying attention to.

*Suzanne Stephens*



WHERE  
THE WORK  
IS

A MODERNIST  
MUSEUM IN JERUSALEM  
IS SENSITIVELY  
UPDATED BY JAMES  
CARPENTER DESIGN  
ASSOCIATES AND  
EFRAT-KOWALSKY  
ARCHITECTS.

BY MICHAEL Z. WISE

# THE ISRAEL MUSEUM





The Carter Promenade above the Route of Passage leads to renovated galleries.

**IN THE LATE 1950S**, when Teddy Kollek, the future mayor of Jerusalem, first suggested founding a national encyclopedic museum little more than a decade after Israel won its independence, many thought the idea pure folly. The young country was still struggling for its economic and political survival. But Vienna-born Kollek believed culture was "as vital a form of sustenance as the roof over one's head and the food on one's plate."

The Israel Museum opened in 1965, in a Modernist complex nestled on the Judean Hills near the Knesset – the national parliament building – and the Hebrew University. Since that time, it has become the most eminent cultural institution in the region and one of the leading art and archaeology museums

in the world, with collections growing exponentially over the past four decades. Now 45 years later, the museum has reopened after a \$100 million expansion and renovation. The New York firm of James Carpenter Design Associates (JCDA) was responsible for adding new structures, while Efrat-Kowalsky Architects of Tel Aviv refurbished the museum's stunning array of low-rise pavilions, spilling down a gently sloped 20-acre site. Together, they reaffirm the museum's status as the finest contemporary architectural landmark in the Holy City. Another Tel Aviv-based firm, A. Lerman Architects, served as local project architects.

Rather than formulate an entirely new architectural statement that might



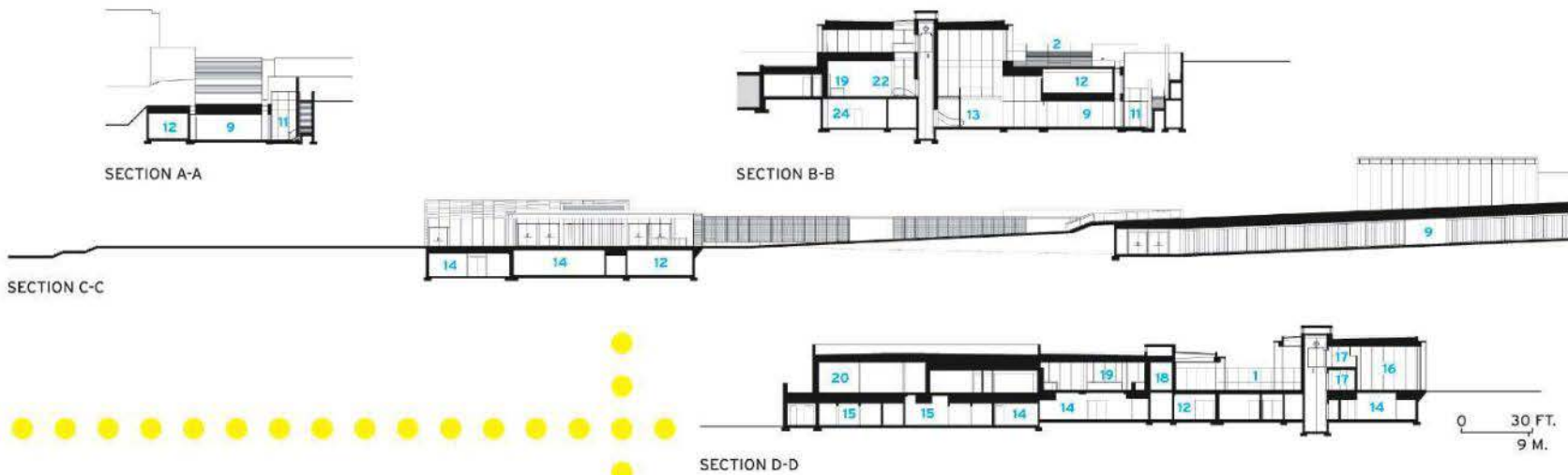
have proved more attention-getting in the short term – the museum had earlier commissioned a monumental addition by the late James Ingo Freed of Pei Cobb Freed, but then discarded that in favor of the Carpenter/Efrat-Kowalsky plan – the renovation pays homage to the original design by the Israeli architect Alfred Mansfeld and interior designer Dora Gad.

The sprawling Israel Museum campus also includes the recently restored Shrine of the Book (1965), with an eccentric but endearing white-tiled dome designed by Frederick Kiesler and Armand Bartos to house the Dead Sea Scrolls, and a sculpture garden (1965 – now known as the Billy Rose Art Garden) designed by Isamu Noguchi, which contains works by Noguchi,

Auguste Rodin, Henry Moore, Aristide Maillol, and James Turrell. Somewhat ironically for the national museum of the Jewish state, Mansfeld likened its design to an Arab village atop the hill. But he used the vocabulary of European Modernism to devise a matrix of modular units, each roughly 120 square feet in size, which could grow organically like that village. JCDA has replicated these modules with three new glass pavilions to create a subtle and elegant expansion while paying homage to the simple beauty of the original scheme.

Visitors arriving at new entrance and retail pavilions can walk up Carter Promenade to Crown Plaza.





## [MAKING IT WORK]

An interview with New York-based designer James Carpenter explores issues of working abroad.

**MICHAEL WISE:** How did you get involved in the project?

**JAMES CARPENTER:** Israel Museum director James Snyder invited me to take part in after reading an article in *The New York Times* about my role in the design of the Fulton Street Transit Center in Lower Manhattan and how we were attempting to bring daylight into the New York City subway system. He was intrigued and was looking for a similar way to illuminate a new underground passageway at the museum.

**MW:** What was it like to work overseas?

**JC:** You need to anticipate frequent travel – and constructing mockups is critical. They're more important when you're working at a distance. It's an opportunity to train the contractor about what you expect on site.

**MW:** What else can you do to control the design and construction process while being so far away?

**JC:** The biggest risk is loss of control of quality and overall design continuity. In working abroad, it is essential to have good coordination and communication with contractors in order to ensure quality standards. In some countries, more liberty is given to the contractor in terms of interpreting design documents. We didn't allow that to happen, but that's often the case when you're working overseas. We were happy to work with Tel Aviv-based A. Lerman Architects as project architect. We felt there was a good dynamic with them, and the firm, we felt, had a depth of experience with construction in Israel.

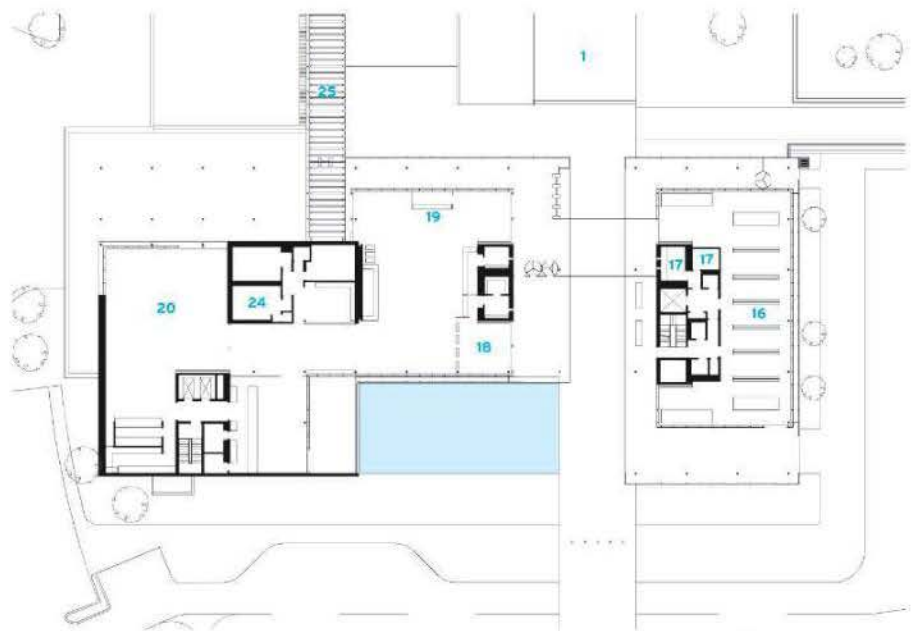
**MW:** What other projects do you have under way abroad?

**JC:** We are already working on an addition to the Bornholm Art Museum on a Danish island near the coast of Sweden, and an urban scheme involving the improvement of public plazas and walkways in Doha (Qatar) – and with architects in Oslo we are developing new curtain-wall ideas for a library. We also plan to enter an upcoming competition to design a new Israel national library on a site just across the road from the Israel Museum. ■

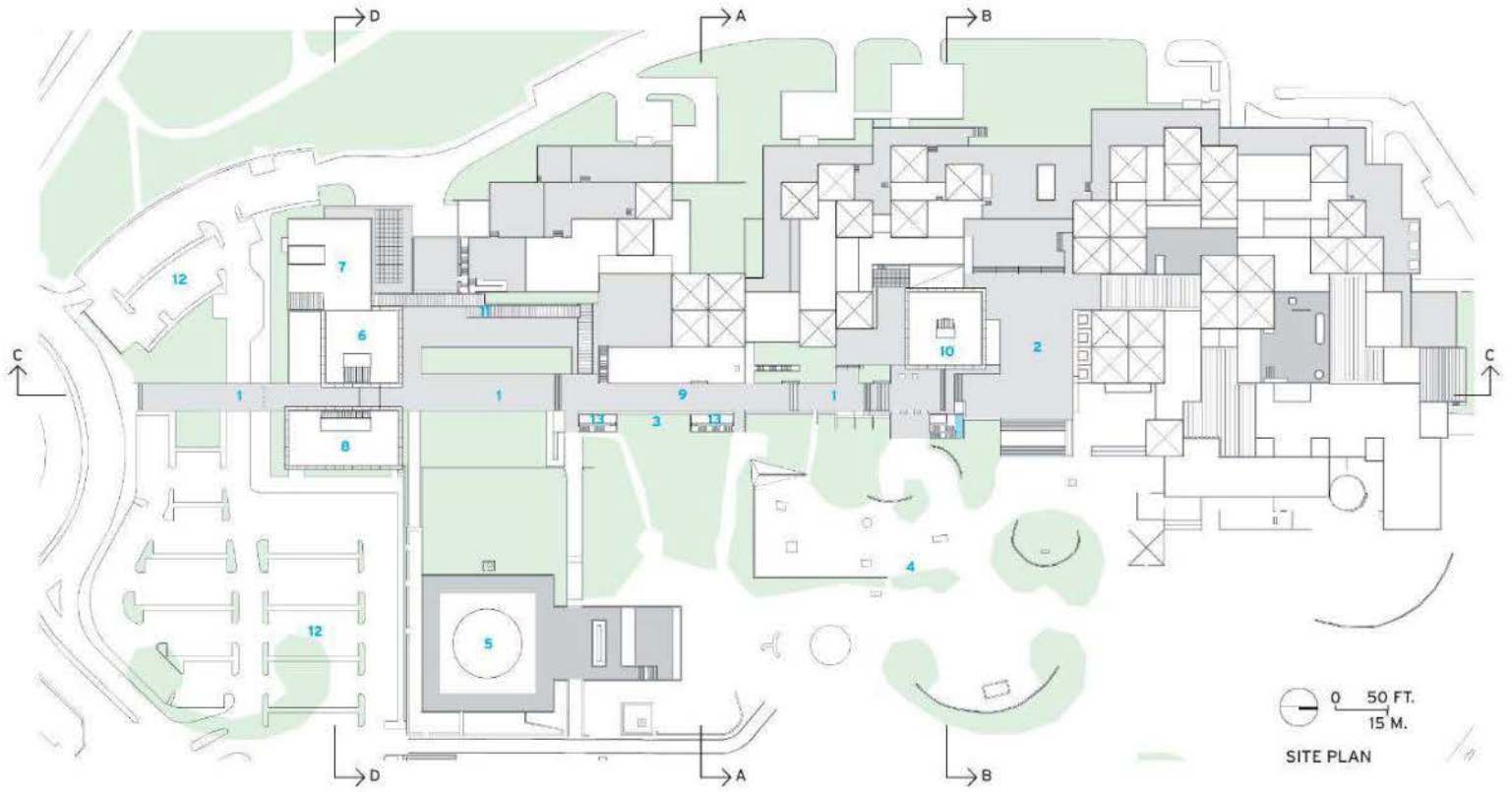
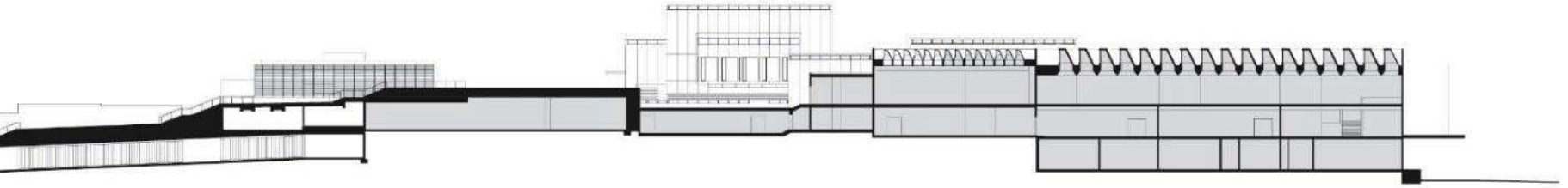
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|----------------------|-------------------------|----------------------|
| 1 CARTER PROMENADE   | 20 RESTAURANT           | 23 CAFÉ              |
| 2 CROWN PLAZA        | 21 TEMPORARY EXHIBITION | 24 BATHROOM/SERVICES |
| 3 WATER FEATURE      | 22 UPPER LOBBY          | 25 COVERED PASSAGE   |
| 4 BILLY ROSE GARDEN  |                         |                      |
| 5 SHRINE OF THE BOOK |                         |                      |
| 6 ENTRANCE PAVILION  |                         |                      |
| 7 WEISBORD PAVILION  |                         |                      |
| 8 RETAIL PAVILION    |                         |                      |
| 9 ROUTE OF PASSAGE   |                         |                      |
| 10 GALLERY PAVILION  |                         |                      |
| 11 COURTYARD         |                         |                      |
| 12 MECHANICAL        |                         |                      |
| 13 LOWER LOBBY       |                         |                      |
| 14 STORAGE           |                         |                      |
| 15 KITCHEN           |                         |                      |
| 16 MUSEUM STORE      |                         |                      |
| 17 STORE OFFICE      |                         |                      |
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| 19 INFORMATION DESK  |                         |                      |



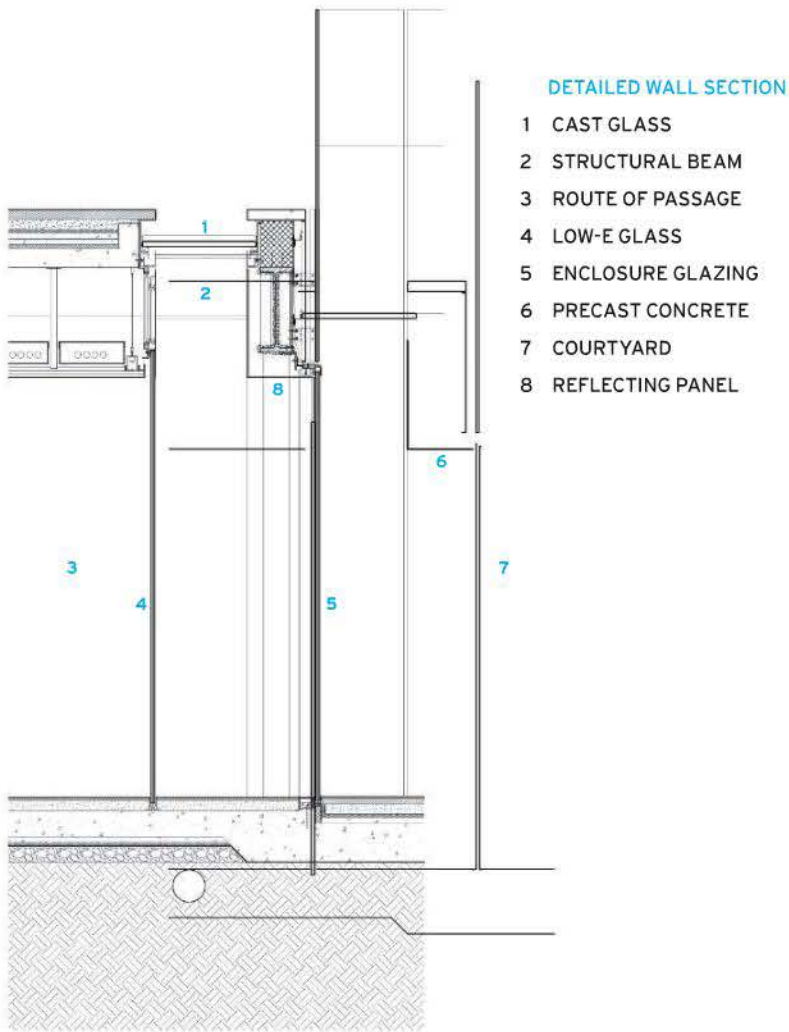
GALLERY PAVILION



WEISBORD, ENTRANCE, AND RETAIL PAVILIONS



PHOTOGRAPHY: COURTESY JCDA



SECTION ROUTE OF PASSAGE/COURTYARD



ABOVE: A wide hall in the existing museum known as the Cardo leads to permanent exhibitions and galleries as well as Crown Plaza.

RIGHT: The Route of Passage, inserted by JCDA under the Carter Promenade, is edged by a slot topped by cast glass on its western elevation. Water running over it animates the light in the spaces below and illuminates the black terrazzo floor. Vine-filled courtyards rise up behind the wall of frosted glass.







## CREDITS

**PROJECT:** The Israel Museum, Jerusalem

**ARCHITECTS/DESIGNERS:** James Carpenter Design Associates – James Carpenter, principal; Reid Freeman, project architect and manager; Catherine Hudak, Jennifer Gillette, Richard Kress, Ben MacDonald, Eva Rothmeier, Torsten Schlauersbach, Xavier Schirlin, Joseph Welker, Cameron Wu, design team

**ARCHITECTS FOR RENOVATION:** Efrat-

Kowalsky Architects; Pentagram (reconstruction/installation Bronfman Archaeology Wing)

**ARCHITECT OF RECORD:** A. Lerman Architects  
**CONSULTANTS:** J. Kahan & Partners (structural engineers); Tillotson Design Associates (lighting); RTLD (associate lighting designer); West End Architects and Environmental Planners (landscape); Kasher Visual Communications (graphics); Nizan-Inbar (project management)

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**ACOUSTIC CEILINGS:** Baswa Acoustic

**PLUMBING:** Duravit



The renovation provides a far clearer and more accessible path into and through the museum, which had expanded several times since it opened nearly a half-century ago. “It grew like topsy, but it was not great for a self-guided museum experience,” says museum director James Snyder. The new pavilions that echo the rectilinear geometry of the original design now serve as the entry and house ticketing and a bookstore. In addition, JCDA reconstructed an existing pavilion to serve as a restaurant and café. But in contrast to the more solid, insular modules for the exhibition areas used by Mansfeld – made of cast-in-place concrete clad in limestone and banded by unshaded clerestory windows – Carpenter wanted a greater transparency to heighten the connection between the architecture and landscape, and so made the new pavilions out of glass, shielded by louvers.

Carpenter, who is not an architect by training, is a Minimalist known for blurring the lines between art and architecture in glass works that involve a highly refined exploration of light and its impact on spatial experience. He has collaborated with many architects, winning acclaim for creating the luminous curtain wall at the base of the Time Warner Center in New York City (2004) and the shimmering facade of 7 World Trade Center (2005) in Lower Manhattan (both designed by David Childs of Skidmore, Owings & Merrill), plus a lens-shaped ceiling for Richard Meier’s Federal Courthouse in Phoenix (2000). Carpenter’s firm has several licensed architects, including the project

architect for the Israel Museum, Reid Freeman.

Employing a system of terra-cotta louvers, manufactured in Germany, Carpenter has sought to soften and diffuse the intense Mediterranean sunshine while permitting views of the surrounding rocky terrain, olives trees, pines, and other vegetation. On the north and south exposures, the stationary louvers are more open, while those on the east and west merely allow the light to penetrate and reflect. At night, the pavilions glow like lanterns from within on all sides. Carpenter and his crew tested light levels over two years by building a mock-up of the terra-cotta louver system on-site.

JCDA also inserted an underground passageway leading from the entry to the hilltop exhibition area that permits visitors the choice of avoiding an open-air ascent via steps in the blazing heat. The air-conditioned passageway, reminiscent of one that Carpenter devised a decade ago for the German Foreign Ministry in Berlin, is lined with glass. On its west side, a cast-glass skylight over which water cascades down the hill’s incline now covers the water feature, originally built by landscape architect Lawrence Halprin in concrete and stone. Sunlight passes through the water and prismatic glass, animating the black terrazzo passageway, while vine-filled courtyards rise up behind a wall of frosted glass that also runs along its edge.

The addition of the new enclosed passageway enabled the removal of a service road previously used to transport supplies, the elderly, and the

1. Pentagram Partners was in charge of the installation and reconstruction of the Samuel and Saidye Bronfman Archaeology Wing, which includes the Holy Land Gallery.
2. Paper moths form *Black Cloud (latent studio)* created by Carlos Amorales (2007), and shown in the new galleries for contemporary art in the Edmond and Lily Safra Fine Arts Wing.
3. Efrat-Kowalsky Architects renovated the Impressionism and Postimpressionism galleries of the Safra Fine Arts Wing, which features new skylights.



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physically challenged by vehicle to the hilltop, and thereby eliminated a visual barrier between the museum buildings and the Noguchi garden. By transferring ticketing and retail services from the center of the museum to the new pavilions at the bottom of the hill, the architects opened up more exhibition space without expanding the museum's original footprint too much.

Inside the museum itself, Efrat-Kowalsky created a new central corridor off of which the exhibition galleries radiate and are easily reachable by visitors. "We wanted to do almost nothing, but to do almost nothing means a lot," says Meira Kowalsky of her firm's seamless reorganization of the earlier parts of the building. "You almost don't feel it. We see our role as one of continuation and not as one of destroying and making new."

The new core eliminates the mazelike feel that had prevailed prior to the renovation and gives clarity to the museum's three original main wings – Archaeology, Jewish Art and Life, and Fine Arts. The museum reedited and reinstalled its permanent collection, showcasing the significant troves of Judaica and Levantine archaeology, as well as Impressionist and Postimpressionist masterpieces, Old Masters, Surrealist photography, and Contemporary art. Also added are new site-specific works, such as a stainless-steel, hourglass-shaped sculpture by Anish Kapoor and a series of 300 canvases re-creating the color spectrum by Olafur Eliasson.

Over the past decades, curators seeking to protect objects in their care

from light exposure had sealed up the clerestory windows that Mansfeld had installed to create the appearance of ceilings floating atop the individual pavilions. Efrat-Kowalsky, known for championing heroic Modern architecture during Israel's first decades, made certain that these windows were exposed again throughout by replacing original glass panels with thicker UV-sensitive glass.

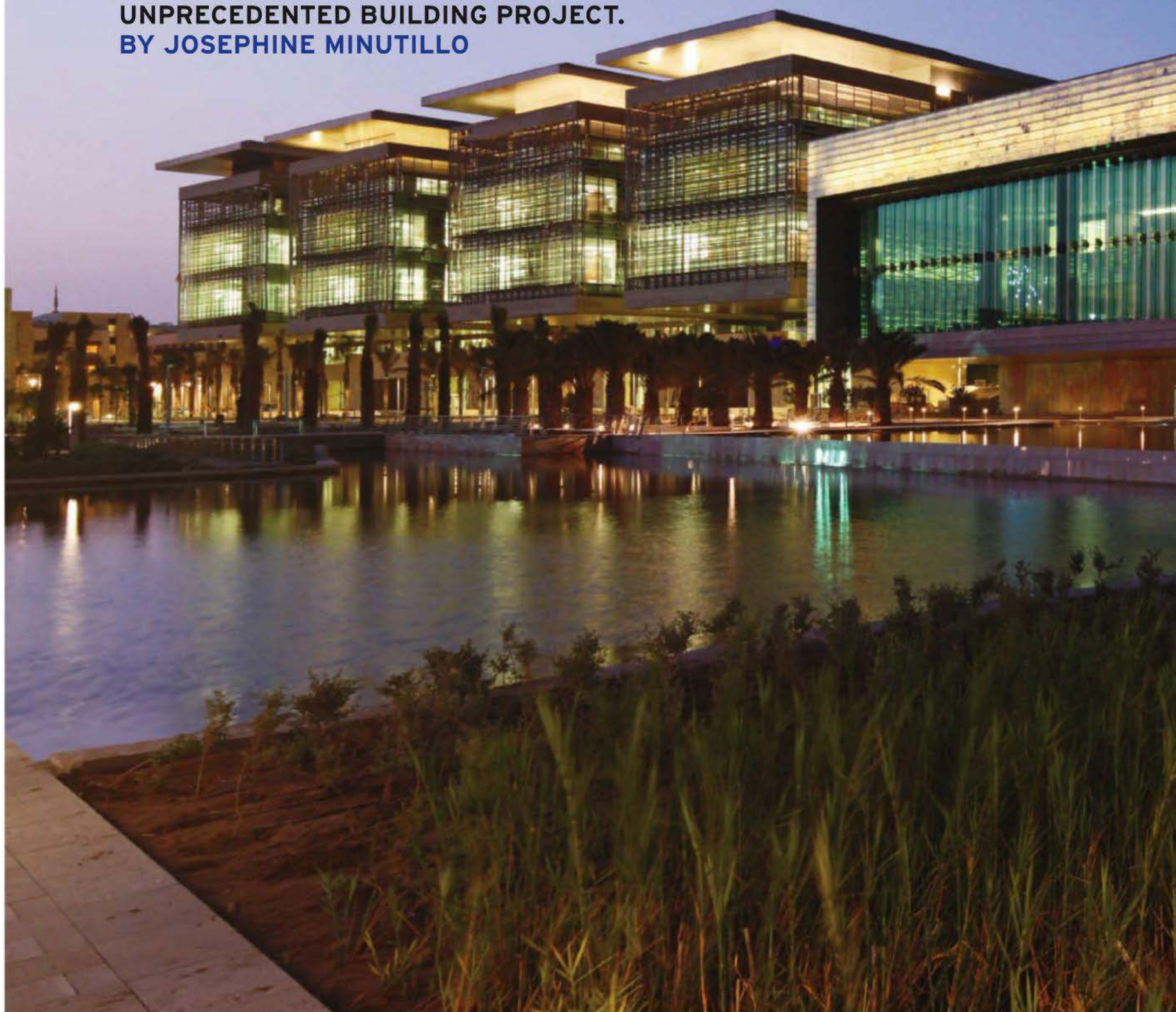
Pentagram Partners of London oversaw the new archaeology installation, while Efrat-Kowalsky refurbished and reconfigured interior spaces, giving them a new unity by relying on Mansfeld's original vocabulary of corduroy concrete and wood-tread stairways, along with hefty railings and door frames of mahogany and rosewood.

If at first glance this renovation and expansion appears to be highly restrained, the overall approach is anything but timid. The blend of Carpenter's Minimalism with Efrat-Kowalsky's preservation skills and successful advocacy of adaptive reuse celebrates the daring original vision and architecture of an Israeli national museum while reconnecting its parts into a more coherent whole. ■

*Michael Z. Wise is the author of Capital Dilemma: Germany's Search for a New Architecture of Democracy. His writing has appeared in The New York Times, Foreign Policy, The Atlantic, and Travel + Leisure magazine.*

# KAUST

**AN AMBITIOUS PLAN FOR A WORLD-CLASS RESEARCH UNIVERSITY IN SAUDI ARABIA'S DESERT SPURS AN UNPRECEDENTED BUILDING PROJECT.**  
**BY JOSEPHINE MINUTILLO**





**IT SEEMED LIKE A FAR-FETCHED IDEA.** Build a world-class research university from scratch on the edge of the desert that would contain state-of-the-art facilities and be an exemplar of sustainable design. And do it in under three years. But since the idea belonged to Saudi Arabia's King Abdullah bin Abdulaziz Al Saud, it got done. The result is King Abdullah University of Science and Technology, known by its acronym, KAUST.

Getting it done required the intense collaboration of architects, designers, engineers, builders, and suppliers around the world. With 24 offices in North America, Europe, Asia, and the Middle East, HOK was in a unique position to coordinate the job. By coincidence or not, it had also designed Saudi Arabia's first large-scale university, King Saud University in Riyadh, more than 30 years earlier – at the time (1975–83) considered the single largest building-construction project in the world. Originally hired in October 2006 to do a master plan for KAUST, which included a commercial center, a research park, and residential areas for the school's students and staff, HOK was awarded the commission for the architectural, landscape, structural, m/e/p, interior, and lighting design of the campus's 23 buildings in March 2007.

Located along the coast of the Red Sea in Thuwal, home to a small fishing village about 30 miles north of Jeddah, KAUST's 5.5-million-square-foot campus would spread out over 100 acres in one of the world's most extreme climates. On the one hand, its design had to mitigate the intense sun and ubiquitous sand of the desert. On the other, it had to contend with the high humidity and unusually high salinity of the marine site, which included a unique coral reef ecosystem that required protection.

KAUST's glowing library sits between the commons and several lab buildings. Behind it is the oval-shaped rotunda.



1. A sea court fronts the white stone-glass-clad library, which appears opaque during the day, but glows at night.
2. A large roof supported by treelike columns shades the plaza leading into the pedestrian spine. KAUST's roof system alludes to Bedouin tent design by blocking out the intense sun and encouraging airflow.
3. Roof perforations enhance the character of light and generate shadow patterns inside buildings.
4. The integrated terra-cotta solar shading on the lab buildings emulates the traditional *mashrabiya* screen.
5. During the day, the library provides a soothing, protective environment away from the harsh sun.
6. Interior designers from HOK offices in St. Louis, Los Angeles, San Francisco, New York, Atlanta, and Houston collaborated through a Facility Registry System (FRS), a Web-based database, to keep interior details consistent throughout the various campus buildings. Strong accent colors contrast with the earth tones of the building exteriors.

The site itself needed improving from a geotechnical point of view. So while work on the master plan was being completed, 42,000 stone columns were being drilled into the ground to stabilize the soil and bring it to a condition that could support the weight of the buildings, the designs for which had only just begun at that point. Engineers arrayed 30-inch-diameter holes on a 5-foot-on-center grid that covered the horseshoe-shaped campus. Crushed limestone was injected under high pressure, typically 25 feet deep, into the openings. "It's a unique upgrading process that has been used elsewhere, but never at this magnitude or speed," says Ed Abboud, a structural engineer in HOK's Houston office, which shared the primary design role with HOK's founding office in St. Louis.

With site preparations under way, and after several weeks of separate groups working somewhat independently, HOK gathered design leaders for a three-week-long focused design effort. During this period, the firm established design principles and a strategy for carrying them out. "We created a structure that stratified work not by building or typology but by ground plane, middle plane, and roof plane," explains Jeff Ryan, AIA. "Ten percent of the design would be of special structures that have a strong character and give identity to the campus. The rest would be elegant background – quiet, but extremely well-crafted buildings."

The buildings also needed to be extremely flexible since the university's program was being worked out concurrently with the design. This, and the

project's condensed time frame, led to buildings with a largely modular design with many repetitive features. Paris-based Oger International, whose work in Saudi Arabia until this point consisted mainly of constructing opulent palaces, came on board as the contractor. Members of its team, which included architects and engineers, relocated to HOK's St. Louis office for six months at a time during design development.

Just as HOK proposed certifying the project through LEED to senior staff at Aramco – the state-owned oil company commissioned by the king to act as the project manager because of its experience doing large, complex projects – the client revealed that the graduate-level university would focus its research on postpetroleum sciences, including sustainable agriculture, next-generation photovoltaics, and other urgent challenges related to energy and the environment.

The multistory lab buildings – rendered taller by the 10-foot-high interstitial spaces between lab floors that allow a variety of layouts to be serviced mechanically over time – are the most prominent on the campus, containing a total of 48 research neighborhoods fitted out to meet the needs of individual professors as they are hired. Flanking the campus's core, the clustered buildings' latticelike terra-cotta cladding alludes to the *mashrabiya* screen, one of several traditional Arabic elements incorporated into both the campus and building design for aesthetic and environmental reasons.

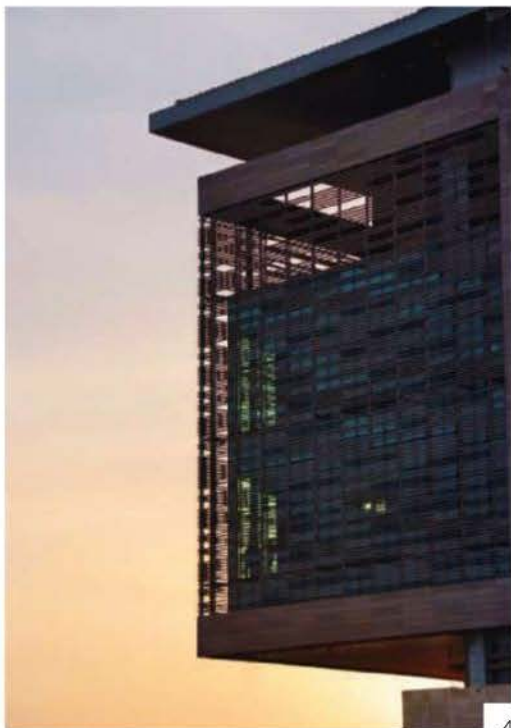
At the heart of the campus, around the main quad, are conventional



2



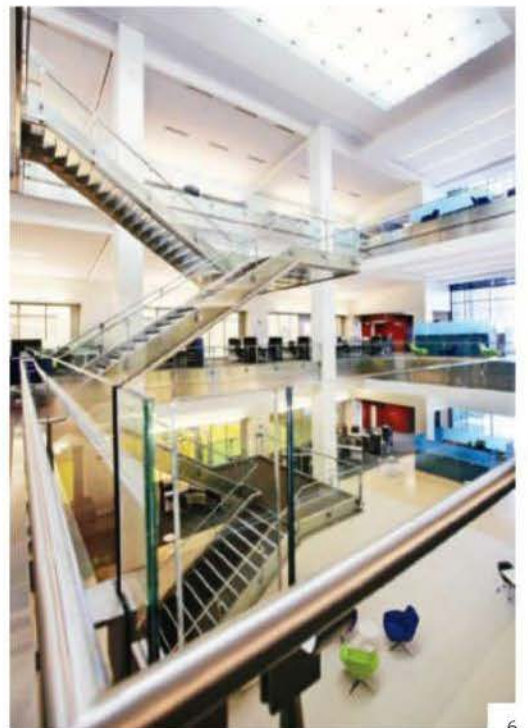
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academic buildings, including classroom and administrative buildings, an auditorium, and a conference center. The rotunda – a tall, oval-shaped, glazed exhibition space supported by diagrid steel bracing – represents one of the campus's special objects, along with the stone-glass-clad library and a pair of slender, rectangular solar towers. A diagrid structure, not always steel, became a unifying strategy for these unique elements. Other such elements, like the entry pavilions for the pedestrian spine, feature lofty roofs and treelike columns to express its singularity.

While KAUST's campus design shares much in common with American universities, familiar to many of Aramco's employees who studied in the United States, the contemporary campus aesthetic is grounded in historical building precedent. HOK looked to the compressed buildings and covered spaces of traditional Middle Eastern cities when laying out the campus and designing its features, creating closely knit buildings with protective roofs, or, as HOK refers to it, a singular megabuilding linked by a number of interior and exterior courtyards, improving proximities among researchers, faculty, and students in the hot and humid climate.

Based on energy modeling HOK conducted with environmental consultants RWDI, it determined that this approach, which minimized the amount of exterior envelope exposed to the sun, would result in an approximate 10 to 15 percent decrease in energy use compared to a layout in which buildings were spread out and exposed on all sides. Building orientations also limit harsh

eastern and western sun exposure while taking advantage of prevailing Red Sea winds to act as a cooling mechanism.

Like a traditional souk, or market, the layout also promotes greater social activity by providing a shaded pedestrian zone. This active outdoor course houses conference, meeting, office, and retail space while bisecting and interconnecting all research buildings. HOK designed the pedestrian area to be accessible not only to wheelchairs and carriages, but to Segways – an increasingly popular method of getting around campus, and to and from the residential areas less than a mile away.

The marine site's saline environment is highly corrosive to steel, and limited its use to only select elements that could be encapsulated. The buildings' primary structure is cast-in-place concrete, the construction of which draws from a labor pool that is abundant in the area. During construction, the site was home to three concrete-batch plants and one precast plant that allowed work to proceed throughout the day and night and eliminated the need to bring material in from afar (the closest town capable of providing it is an hour away).

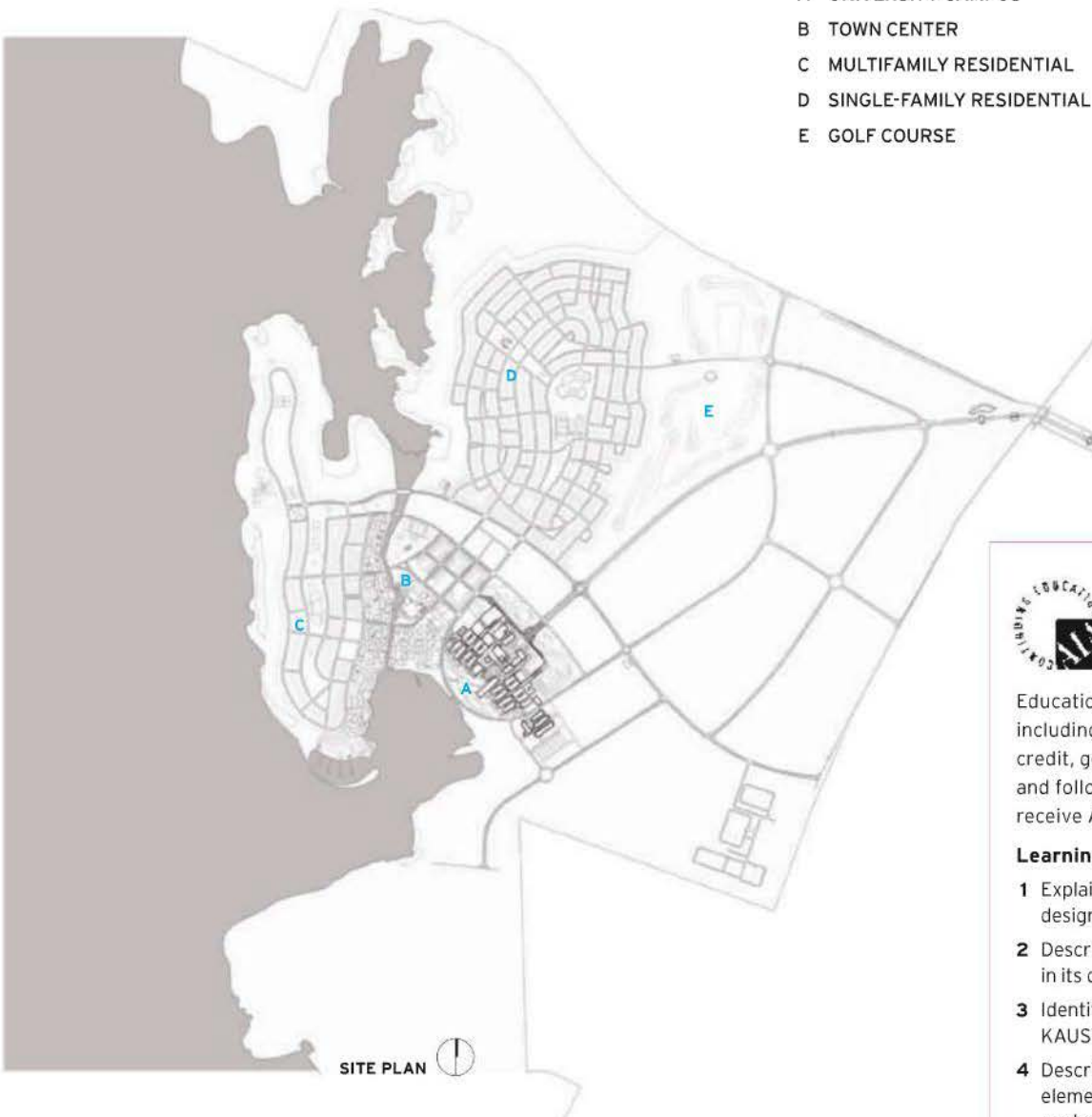
"In the middle of our first meeting with Oger once they came on board, members of their team got on the phone to tie up all the cranes they could get," recalls HOK's Bill O'Dell. "They knew it would have been impossible if they waited because of all the construction in the region at the time." Midway through construction of KAUST, Oger introduced precast concrete to save

#### SITE PLAN

- A UNIVERSITY CAMPUS
- B TOWN CENTER
- C MULTIFAMILY RESIDENTIAL
- D SINGLE-FAMILY RESIDENTIAL
- E GOLF COURSE

#### MAIN FLOOR PLAN

- 1 MAIN QUAD
- 2 COMMONS AND DINING HALL
- 3 LIBRARY
- 4 RESEARCH LABS
- 5 CAMPUS MOSQUE
- 6 APPLIED MATHEMATICS
- 7 ADMINISTRATIVE BUILDING
- 8 ENGINEERING SCIENCES HALL
- 9 CONFERENCE CENTER
- 10 AUDITORIUM
- 11 PARKING GARAGE
- 12 GREENHOUSE
- 13 DATA CENTER
- 14 SOLAR TOWER
- 15 STUDENT CENTER



#### CONTINUING EDUCATION

Use the following learning objectives to focus your study while reading this month's ARCHITECTURAL RECORD/AIA Continuing Education article. To earn one AIA learning unit, including one hour of health, safety, and welfare (HSW) credit, go to [continuingeducation.construction.com](http://continuingeducation.construction.com) and follow the instructions. Other opportunities to receive AIA/CES credit begin on page 149.

#### Learning Objectives

- 1 Explain the challenges KAUST's site presented in its design and construction.
- 2 Describe the challenges KAUST's program presented in its design and construction.
- 3 Identify passive-sustainable-design strategies used at KAUST.
- 4 Describe how and why traditional Arabic design elements were incorporated into KAUST's contemporary design.

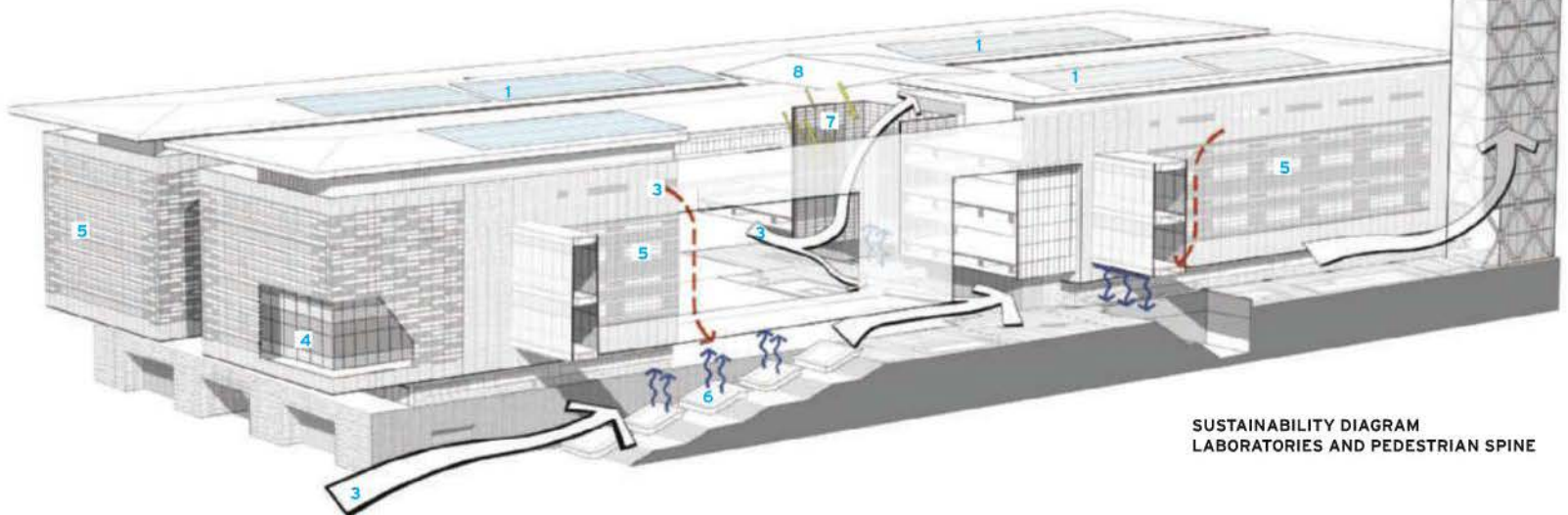




MAIN FLOOR PLAN



- 1 HIGH-PERFORMANCE ROOF
- 2 SOLAR TOWER
- 3 PASSIVE VENTILATION
- 4 HIGH-PERFORMANCE GLAZING
- 5 INTEGRATED SHADING
- 6 LOCAL EVAPORATION
- 7 PASSIVELY COOLED COURTYARDS
- 8 FILTERED DAYLIGHT



SUSTAINABILITY DIAGRAM  
LABORATORIES AND PEDESTRIAN SPINE



OPPOSITE: Much of the 900,000 square feet of roof surface is covered in large solar-photovoltaic and solar-thermal panels, which provide 7.8 percent of the total energy required to operate the campus.

ABOVE: The primarily cast-in-place concrete structure went up at an incredible pace. At the peak of construction, as many as 45 cranes were on the site.

time. Though cement replacement for high-performance concrete is preferred when building environmentally sensitive structures, according to HOK, more sustainable substitutes like fly ash and silica fume were not readily available in the kingdom.

Since aluminum fares better than steel in this environment and does not require as skilled a labor force, it was used extensively in the shading roofs and special space-frame structures. Concrete trusses in the Applied Mathematics Building are used to achieve a 55-foot cantilever, shading pedestrian areas below it. Several other buildings use sheer walls for smaller cantilevers, averaging around 30 feet. All steel rebar was treated with a special epoxy coating.

To ensure that future rising sea levels and changing climate patterns do not adversely affect the campus – designed as a 100-year building – work crews elevated the site by adding 8 feet of soil, creating a massive plinth. The plinth includes the lower stone walls of the campus buildings as well as the stone horizontal surfaces that make up the plaza and courtyard hardscapes. Between the plinth and the shading roof, which in some areas spans up to 195 feet, the restrained, earth-toned building faces reside. These terra-cotta enclosures are distinguished from the stone plinth by a window ribbon of glass. Integral solar shading over most of the facades reduces heat loads and creates dappled light in building interiors.

The roof is articulated as a monumental floating plane hovering above all the buildings. Much of its upper surface's 900,000 square feet is covered in an array of large solar-photovoltaic and solar-thermal panels. While the combination of these two systems provides just 7.8 percent of the total energy required to operate the campus, as the faculty and student population increases – the 2009 inaugural academic year consisted of 72 faculty and

374 students, but those numbers are expected to reach 600 and 2,000, respectively – future plans call for the creation of a solar farm to harness much more of the sun's potential. Because the sun is so intense on the site, how the campus addresses the sun's energy is a key part of KAUST's sustainable strategy.

The design team employed primarily passive solutions, including building placement and orientation, shading, and daylighting, to achieve much of the campuswide energy reduction. "Sustainable design is passive first," says Duncan Phillips of RWDI. "If we have to introduce a system to solve something, it's because we haven't solved it passively."

At KAUST, many of the sustainable strategies are invisible, but two very prominent sustainable features are the 195-foot-tall solar towers, which have become campus icons. (The only other nearby vertical element is the campus mosque's smaller minaret.) The glazed towers serve an important, mostly passive, role in terms of comfort by ventilating the courtyard spaces between the lab clusters. More important, from a safety perspective, since some of the labs are expected to be wet labs where chemicals and biological materials are tested, designers had to ensure that the particles that come out of those labs do not go back into the buildings. The towers act as chimneys in which the sun and wind work together to draw the tainted air out. Dampers located near the top of the towers regulate airflow and prevent downdraft in negative pressure conditions. Fans provide supplemental airflow under extreme demands. The labs also utilize a heat-recovery ventilation system to provide fresh air while saving energy.

A comprehensive irrigation plan allocates water-reclamation loads from condensate, storm, gray, and black water to satisfy a majority of the irrigation requirements, which would have been less if HOK's original xeriscaping design was implemented. An on-site desalination plant creates potable water from the sea, though the process is energy-intensive.

Since opening its doors in September 2009, KAUST has become the first built project in Saudi Arabia to achieve LEED certification, and the largest in the world to attain LEED Platinum. Though this is a major accomplishment in some respects, and definitely a step in the right direction for a country whose

oil-based economy has served it very well until now, there is an inherent irony in the story. Creating a city out of nothing so remote from much of its own country's population, and farther still from the professors and students with whom it wishes to collaborate, defies the very notion of sustainability. Filling the campus with high-energy-intensity lab buildings – despite the well-intentioned research conducted within them – in one of the world's most extreme climates, seems counterintuitive; blanketing parts of its desert site in turf grass and adding a golf course, downright absurd.

These were decisions beyond HOK's control. It was charged with making the design, construction, and operation of the buildings themselves as sustainable as possible within the project's accelerated time frame. Despite the fact that construction of the buildings used more than 16 million cubic feet of conventional concrete and all of the buildings' interior spaces require air-conditioning, the project still managed to garner the highest possible LEED rating, which speaks to obvious shortcomings of LEED, not HOK's sustainable-design efforts. KAUST's administrative buildings are said to use up to 40 percent less energy than the U.S. standard, its lab buildings 20 to 25 less – statistics that clearly point to deficiencies in construction here in the United States, not in Saudi Arabia. ■

#### CREDITS

**PROJECT:** King Abdullah University of Science and Technology (KAUST), Thuwal, Saudi Arabia

**ARCHITECT:** HOK

**ARCHITECT OF RECORD:** Oger International

**ENGINEERS:** Walter P. Moore (structural); RWDI (environmental, daylighting, and wind); AEI (m/e/p and energy modeling); Vanderweil (m/e/p)

**CONSULTANTS:** Front (facades); Solar Design Associates (alternative energy)

**GENERAL CONTRACTOR:** Saudi Oger

#### SOURCES

**CONCRETE:** GRC System Building

**RAIN SCREEN:** Hunter Douglas (terra-cotta); Intermarmor (limestone)

**STONE-GLASS CLADDING:** Cricursa (library)

**GLASS:** Saint Gobain; Pilkington; Cricursa

**ELEVATORS:** ThyssenKrupp

**DEMOUNTABLE PARTITIONS:** Clestra

**INTERIOR SOLAR SHADING:** Hunter Douglas

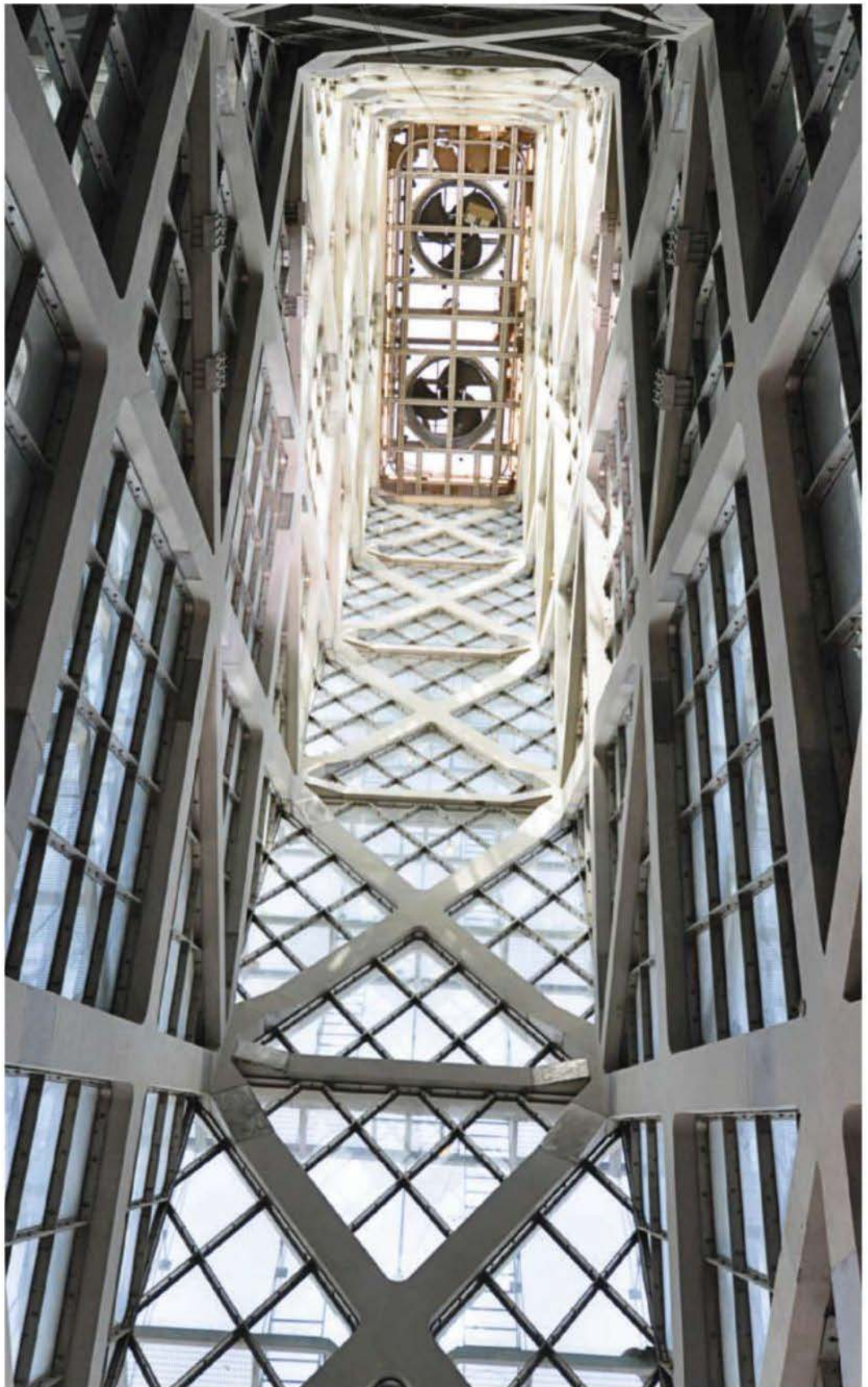
**RAISED FLOORING:** Tate

**RESILIENT FLOORING:** Forbo; Johnsonite

**SOLID SURFACING:** Corian

**WALL COVERINGS:** Armstrong; Knoll

**PLUMBING FIXTURES:** American Standard



Two 195-foot-tall solar towers act like chimneys to ventilate the courtyard spaces between lab buildings. A high-strength, precast-concrete diagrid frame supports two layers of glass. The sun heats the air within the tower to draw it upward. Fans at the top provide supplemental airflow.



## [MAKING IT WORK] A fast-track project for a desert startup led to collaboration around the globe.

Abbie Gregg is the owner of AGI, an Arizona-based firm that provides engineering and consulting services for advanced technology industries. She and her staff traveled frequently to Saudi Arabia to provide on-site support for construction of KAUST's state-of-the-art research and laboratory facilities.

**JOSEPHINE MINUTILLO:** How did you get involved with KAUST?

**ABBIE GREGG:** HOK invited us to join the team in 2008 to assist with the design of an advanced fabrication clean room. We subsequently designed or consulted on the design for a thin film lab, hazardous material storage and dispense rooms, a photovoltaic research lab, and a mechanical and electrical utility room.

**JM:** You traveled there much more than the architects did. Why?

**AG:** We were hired to supervise on a daily basis. We had people on the ground all the time to assist with the clean-room construction and tool installation, which has a fairly large scope in terms of mechanical, electrical, and even plumbing and architectural hookup. We also assisted Aramco in purchasing the equipment. It was a fairly unique project. I don't believe they have any other equipment like this in all of Saudi Arabia.

**JM:** What were the specific challenges of being a woman on this job?

**AG:** There were lots of things that had to be dealt with in terms of protocol and getting the visas, and in terms of understanding the behavior in advance so that we would know what to expect. Even more so in Jeddah, where we stayed and which is about an hour away from the site. We wore the *abaya* all the time. That was certainly challenging – being on a construction site in a cloak when it is 130 degrees. We were told that there were about 20,000 male workers. The only women that were there on a regular basis were from AGI. A female architect employed by the construction company, Oger, visited the site periodically.

**JM:** Was it difficult then for some of the men who are not used to working with women to collaborate with your team?

**AG:** It is a very respectful culture. Everyone wanted to do a good job. There was some trepidation because they weren't familiar with most of this high-tech construction and didn't necessarily know what the end result would look like. But since it was a fast-track

KAUST's advanced research and laboratory facilities were designed to usher in a new, postpetroleum age of scientific achievement.



project, you couldn't afford to wait around. Because HOK and the engineering firms were not on-site, much of the responsibility and decision-making went to Aramco and Oger. I would say that they were glad to have people around from our firm – men, women, whomever – who had the insight and the experience and could answer their questions.

**JM:** Would you do it again?

**AG:** Absolutely. It was an eye-opening, firsthand experience with the Arab world, and with super-large, green-site construction. It was also extremely multicultural. The contractor was a French company, several subcontractors were from Lebanon, and the subcontractor we supervised was from Germany. The construction workers were from Bangladesh, the Philippines, India, Pakistan, Indonesia, and Malaysia. We worked closely with Professor Xixiang Zhang from China, the director of the Advanced NanoFabrication Center. Japanese providers brought in some of the critical tools. There were workers and people to interact with from all over the world, which makes communication an interesting challenge. It forces you to listen very carefully to what's being said. ■

# VAKKO

**REX RECYCLES AN  
ABANDONED STRUCTURE  
AND AN UNREALIZED  
DESIGN TO CREATE AN  
ORIGINAL HEADQUARTERS  
FOR A FASHION AND MEDIA  
COMPANY IN TURKEY.  
BY FRED A. BERNSTEIN**

A fourth-floor terrace offers a place to appreciate the angled geometry set within a simple envelope.





**SOMETIMES, FORM FOLLOWS FORTUITY.** In the 1990s, Rem Koolhaas developed an idea for a private house near Rotterdam; when that project was shelved, he adapted the concept to a much larger building – a concert hall in Porto, Portugal.

Now, Joshua Prince-Ramus, who had been a partner with Koolhaas at OMA, has pulled off an even more audacious “reuse” of a cancelled project. Asked to design a fashion-company headquarters in Istanbul, on an impossibly tight schedule, Prince-Ramus made use of plans he had originally developed for the Annenberg Center for Information Science and Technology at the California Institute of Technology, in Pasadena. The Caltech project had been called off just before construction was set to begin. Prince-Ramus says that if there is a wariness among architects about reusing designs, there shouldn’t be. “It’s not about copying,” he says, “but about advancing an idea.”

To the owners and employees of the Vakko Fashion Center, what matters is that REX Architecture, Prince-Ramus’s Manhattan-based firm, produced a spectacular building – and did it in less than a year. Even more remarkably, it was built using a structure that had been intended for a hotel, but abandoned some 20 years earlier. (In Turkey, speculative building sometimes means starting a project and seeing if it succeeds – and just walking away if it doesn’t, Prince-Ramus explains.) Incredibly, the existing concrete structure had almost precisely the same dimensions, both in plan and section, as the building Ramus had designed for Caltech.

In each case, Prince-Ramus’s parti consists of a simple, three-story rectangular doughnut with a ground-floor arcade. In the center of the doughnut, and structurally independent, rises a set of steel-framed boxes that tilt upward, providing vertical circulation and some excitingly eccentric spaces. At Caltech, where the administration required a sober exterior, “We called it ‘the wolf in sheep’s clothing building,’” Prince-Ramus says. (There, the interior spaces, the “wolf,” included classrooms, lounges, and exhibition areas.) At Vakko, the feral spaces include showrooms, conference rooms, a 200-seat auditorium, and a small fashion museum; many of these areas sport mirrored surfaces that create kaleidoscopic effects. “It’s like the baby bursting out of Kane’s stomach in the movie *Alien*,” says Prince-Ramus, describing the contrast between the restrained perimeter and the apparent chaos inside.

The Vakko project began when the company’s owner, Cem Hakko, learned that the Turkish government planned to raze his company’s existing headquarters to build a highway interchange. During New York’s Fashion Week in February 2008, he interviewed architects, hiring REX (then a partnership of Prince-Ramus and Erez Ella) practically on the spot. Hakko told him the building had to be designed and built within a year, but not to worry, because there was an existing structure



1

to work with. Prince-Ramus gulped, assuming the existing structure would make his job harder, not easier. But on a trip to Istanbul a few days later, he discovered the uncanny similarities between it and the proposed Caltech building.

Less than a two weeks after meeting Hakko, Prince-Ramus put in the steel order for the building's core: boxes designed so that they could be freely oriented, even tilted to provide vertical circulation, after they were built. This strategy, Prince-Ramus says, gave him six weeks – while waiting for the steel to be delivered to the site – to “devise the composition of boxes that best resolved the buildings' programmatic requirements.”

In another piece of good luck, the old hotel foundation included a large underground parking garage, and Power Media, Vakko's sister company (sometimes called the Turkish MTV), needed soundproof and lightproof studios. Prince-Ramus repurposed the subterranean spaces for Power Media, even turning what would have been an outdoor swimming pool (set within the garage space) into a landscaped courtyard. So ingenious was Prince-Ramus's reuse of the garage that Power Media was able to move into its space while construction of the above-ground portion of the building was still in its early stages.

Long interested in bending glass to increase its strength, Prince-Ramus had an X-shape slumped into each of the facade's large panes. The stiffness provided by the Xs meant the glass could be thin ( $\frac{3}{16}$  inch) and light enough to be held to the



2

concrete floor plates with corner pins. Supple and lacking mullions, the skin suggests a building covered in Saran Wrap.

Turkey, which Prince-Ramus calls “a country going through its industrial revolution,” retains many of its old construction trades, so the architect had no trouble finding craftsmen to make the jigs on which the glass was slumped. “Other fully industrialized countries would no longer have had the craftsmen capable of such precision,” he says.

But the playfulness of the facade barely hints at the surprises in the middle of the building, which explodes with the kind of exuberance reminiscent of Koolhaas and Prince-Ramus's Seattle Public Library. The boxes, bolted together on-site and

1. The abandoned concrete frame of a partially built hotel was incorporated into REX's design for the Vakko complex.

2. Completed in January 2010, the headquarters encompasses 58,000 square feet of space for Vakko in the glass-and-metal boxes (right in photo) and 40,000 square feet of mostly subterranean space for Power Media (left in photo).

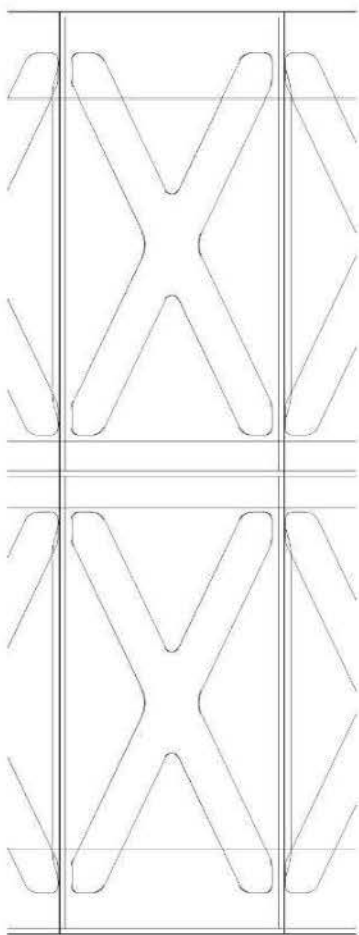
3. By incorporating a slumped X in the glass-molding process, REX increased its strength so it could be just  $\frac{3}{16}$  inch thick and attached to the building's concrete frame with no mullions.

4. From inside the building, the slumped glass offers intriguing views and light refractions.

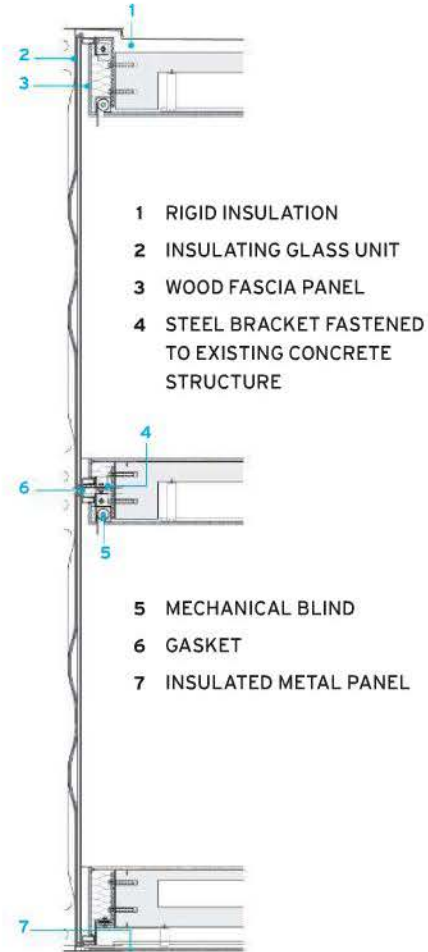




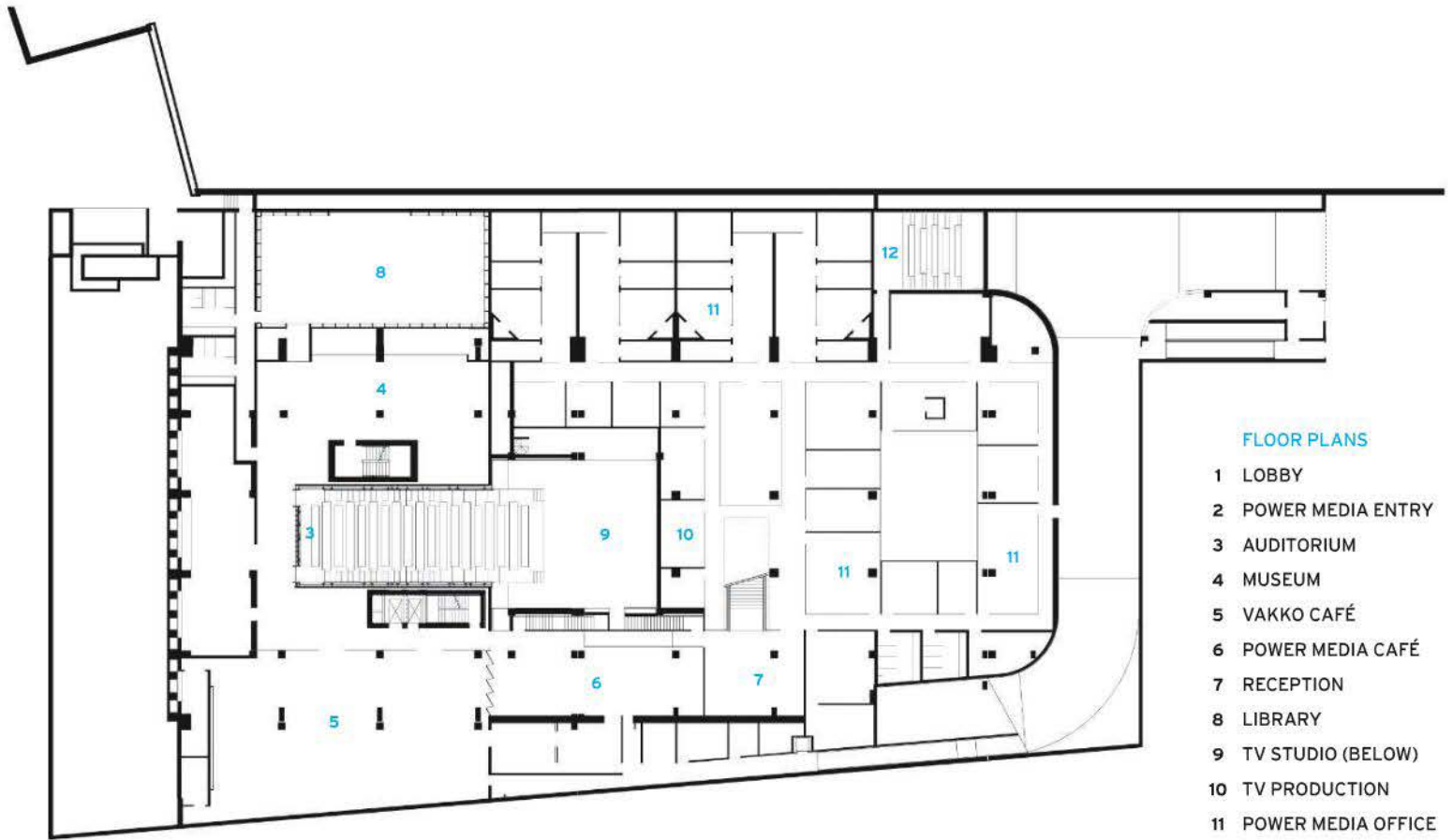
3



FACADE DETAIL



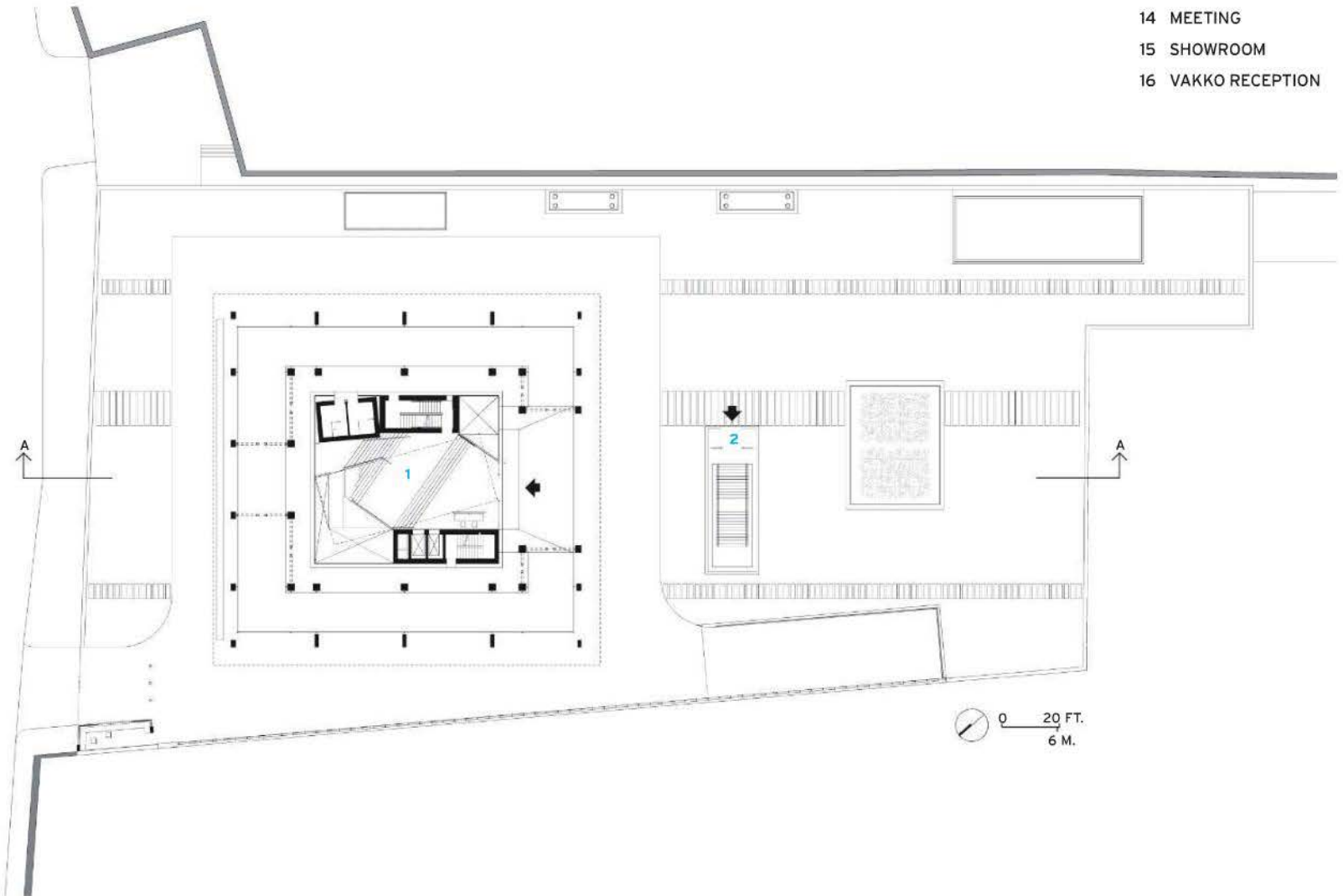
4



FLOOR PLANS

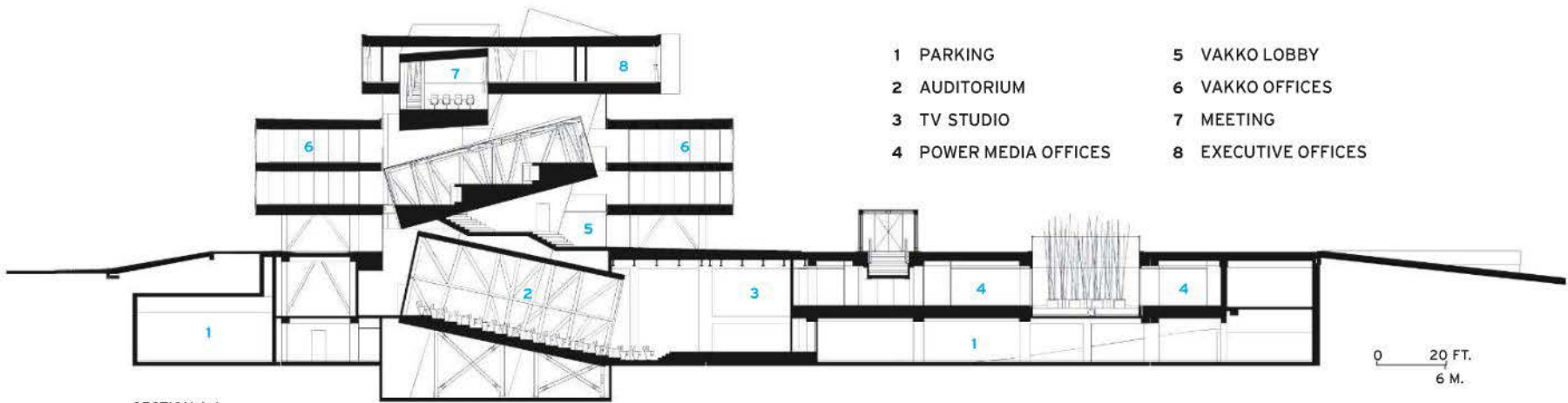
- 1 LOBBY
- 2 POWER MEDIA ENTRY
- 3 AUDITORIUM
- 4 MUSEUM
- 5 VAKKO CAFÉ
- 6 POWER MEDIA CAFÉ
- 7 RECEPTION
- 8 LIBRARY
- 9 TV STUDIO (BELOW)
- 10 TV PRODUCTION
- 11 POWER MEDIA OFFICE
- 12 VIDEO LOUNGE
- 13 VAKKO OFFICE
- 14 MEETING
- 15 SHOWROOM
- 16 VAKKO RECEPTION

SECOND FLOOR



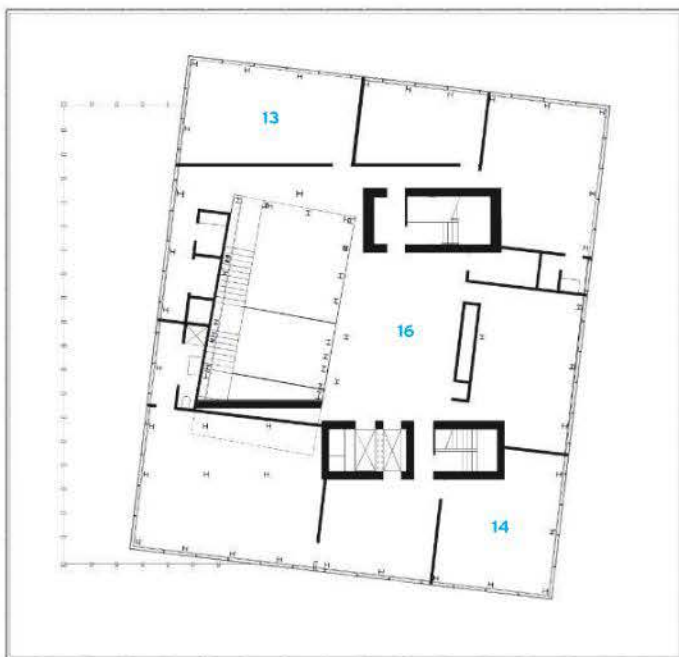
0 20 FT.  
6 M.

GROUND FLOOR



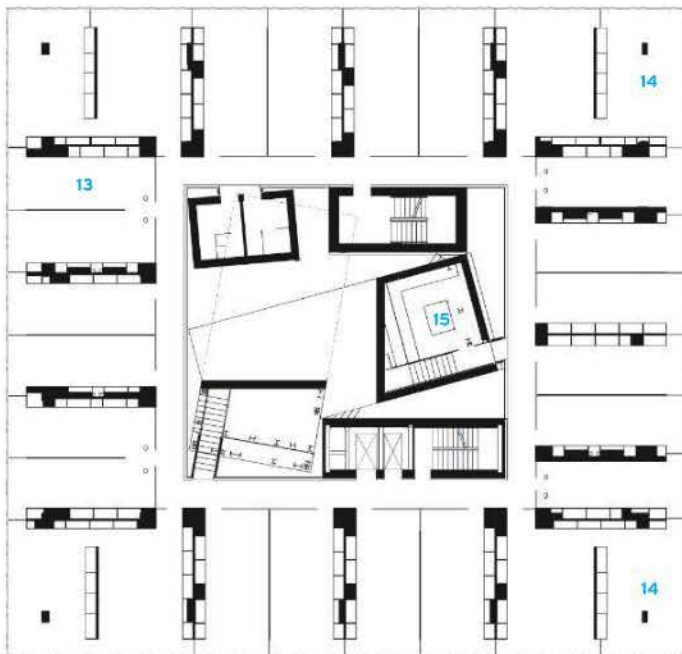
- 1 PARKING
- 2 AUDITORIUM
- 3 TV STUDIO
- 4 POWER MEDIA OFFICES
- 5 VAKKO LOBBY
- 6 VAKKO OFFICES
- 7 MEETING
- 8 EXECUTIVE OFFICES

SECTION A-A



FIFTH FLOOR

BELOW: Angled elements and mirrored surfaces create a kaleidoscopic effect in the atrium rising through the center of the building. REX wanted to create a contrast between the building's restrained perimeter and its seemingly chaotic core.



THIRD FLOOR

0 10 FT.  
3 M.

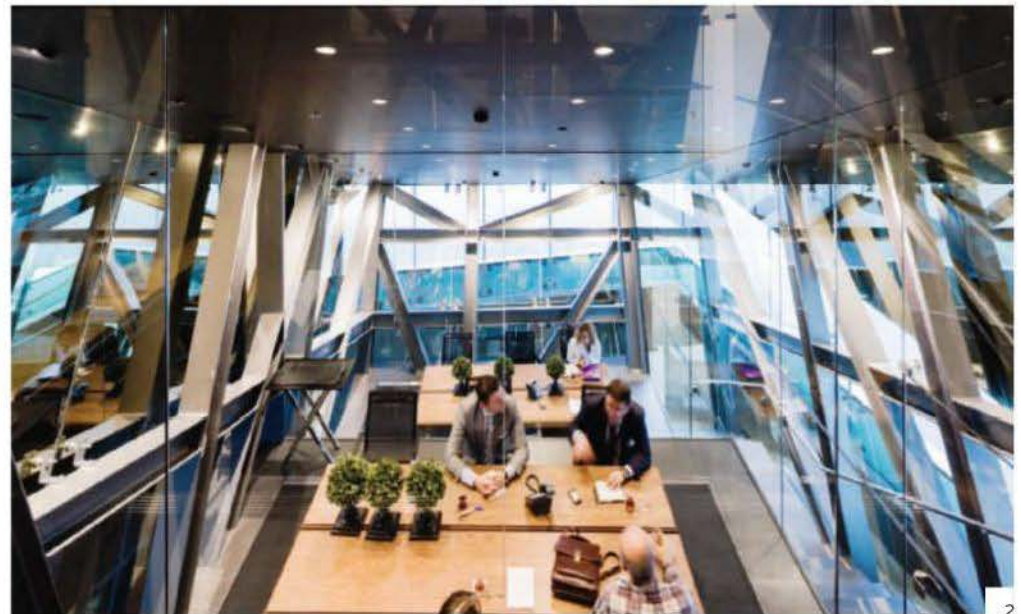
lifted by crane into the doughnut hole, include (from bottom to top) the fashion museum; an auditorium; a series of stepped showrooms; and, finally, offices for Vakko executives, from which they can descend onto a wraparound terrace with a mirrored ceiling. What looks, from the outside, like a fairly conventional three-story building, feels expansive inside – thanks to the incorporation of underground space, the disorienting effects of the angled boxes, and the multiplying effects of mirrored surfaces.

For Prince-Ramus, the building offers a lot of symbolism. A gutsy decision by a client to create a showplace out of essentially detritus (a long-abandoned structure) says a great deal about the possibilities of adaptive reuse. And because the building recycles not only a structure, but an idea developed for another place and purpose, the project has special meaning in a time of recession. To Prince-Ramus, who split from OMA in 2006 and has endured the ups and downs of any young practitioner, the experience offers a lesson: "If you're developing an idea, don't ever believe it's dead." ■

1. From offices on the fifth floor, executives get a good sense of the steel structure inserted within the old concrete frame inherited from the abandoned hotel project.
2. The architects placed meeting rooms in the center of the "wild" portions of the building.
3. A library offers a relatively calm retreat for reading and research.



1



2



3

#### CREDITS

**PROJECT:** Vakko Fashion and Power Media Center, Istanbul, Turkey

**ARCHITECT:** REX – Joshua Prince-Ramus, Erez Ella, Tomas Janka, Mathias Madaus, David Menicovich, Tsuyoshi Nakamoto, Ishtiaq Rafiuddin, Tielu Wu, project team

**ARCHITECT OF RECORD:** Dora Yapi

**ENGINEER:** Buro Statik

**CONSULTANTS:** Tillotson Design Associates (lighting); EPA (acoustics); Front (facade); Autoban (interiors)

**GENERAL CONTRACTOR:** Dora Yapi

#### SOURCES

**SLUMPED-GLASS FACADE:** Lampglas

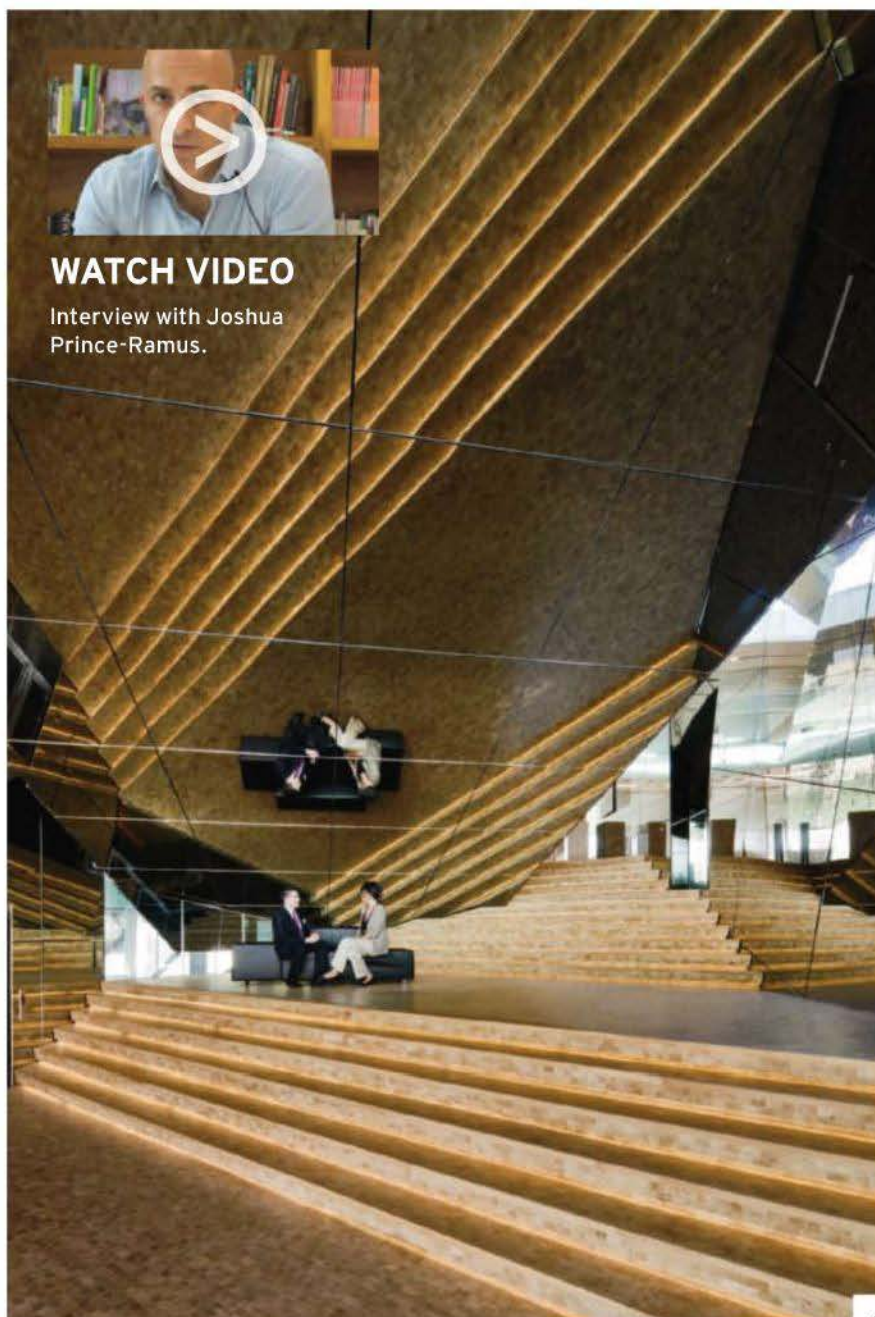
**INTEGRATED FLUORESCENT AND HALOGEN LIGHTING:** Delta Light

**FLUORESCENT WALL WASHERS:** Regent

**LIBRARY WALL PANELS AND SHELVING:** Custom by Kurama

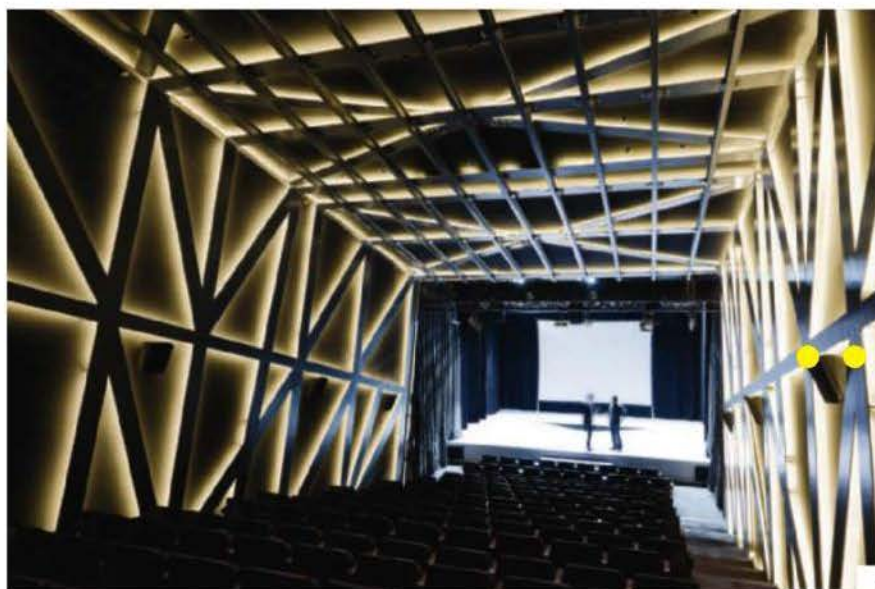
**GRANITE FLOORING:** Provin

**OAK PARQUET FLOORING:** Oldenburger



## WATCH VIDEO

Interview with Joshua Prince-Ramus.



## [MAKING IT WORK]

Joshua Prince-Ramus discusses the challenges and opportunities of working abroad.

**FRED BERNSTEIN:** Did you work with a local architect? What do you look for in a local architect?

**JOSHUA PRINCE-RAMUS:** Due to the incredibly compressed schedule, we collaborated with a general contractor, moving directly from design development to shop drawings. The contractor would send drawings at the end of their day in Turkey; we would develop them and send them back for the start of their next day – it was almost a 24-hour cycle. On nearly all our other projects, we have collaborated with local firms. We seek true partnerships in which both firms are intimately involved from start to finish.

**FB:** How do you control the design and construction process from far away?

**JP:** We work to lead the design and construction process, not control it, through effective communication with the client and the general contractor. In the case of the Vakko Fashion Center, it helped to have two members of our staff – David Menicovich and Ishtiaq Rafiuddin – both young, capable architects, on-site to resolve design issues as they came up.

**FB:** What are the risks in general of working overseas?

**JP:** The biggest risk is cultural: misinterpreting verbal or written communication. Having a team member who gets local customs and idioms is crucial. In addition to David and Ishtiaq, we relied on a former REX employee, Sevla Gurdogan, who is Turkish and has returned to Istanbul to practice.

**FB:** What countries are you working in now? Are you looking for more jobs in these countries and projects in other countries?

**JP:** We currently have projects in the U.S., Belgium, and South Korea. And we are finalists in competitions in Scotland and England. We look for interesting challenges and intelligent clients; if both are present, it doesn't matter where the project is.

**FB:** Is the payment process similar to that of domestic work? If not, what are the differences? Any yellow flags to look for before signing on the dotted line?

**JP:** To guarantee you'll get paid, you need not just a well-written contract but a client interested in maintaining a good reputation. If the latter isn't clearly present, signing the contract is a gamble. ■

4. A grand stair takes visitors from the ground floor to the first, introducing them to many of the materials found elsewhere in the building and alerting them to the project's innovative approach to space and enclosure.
5. A 200-seat auditorium expresses the unorthodox geometry running through the center of the building.



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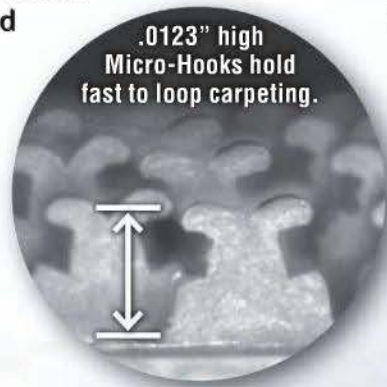
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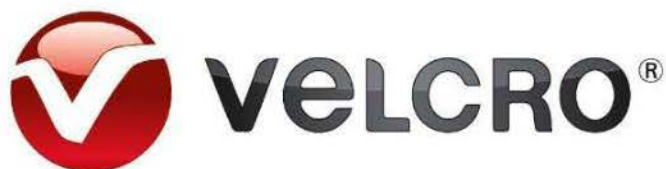
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CIRCLE 94

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## Media Production Center, Columbia College Chicago

CHICAGO

Jeanne Gang turns to cinema to shape the spaces inside a new academic building.

By Joann Gonchar, AIA

**THE SOUTHERN REACHES** of Chicago's South Loop might seem an odd place for a college academic building: The neighborhood is a gritty mix of warehouses, surface parking lots, loft conversions, and recently constructed residential towers. But for Columbia College Chicago, a private, 12,000-student arts and media school, a long-vacant city-owned plot at the corner of 16th and State Streets was a nearly ideal location for a Media Production Center (MPC) to house its programs in film, television, and related fields, such as video-game design.

### Program

The site is within walking distance of many of Columbia's 21 other build-

ings, all to the north, but scattered throughout the South Loop. School officials had assumed they would only be able to afford land much farther from this existing cluster for the 35,000-square-foot MPC and its professional-level facilities, including sound stages, a motion-capture studio, a set-production shop, and classrooms. So when the city issued a request for proposals in June 2004 for the 1-acre lot, offering it at a discount to encourage nonresidential development, Columbia jumped at the chance. The location had only one liability—the rumble from heavy car traffic on State Street as well as from trains on nearby freight tracks and a Chicago Transit Authority "L" line. The noise and vibra-



1. A stair in the lounge at the building's northeast corner is wide enough to perform double-duty as vertical circulation and seating.
2. The MPC's State Street facade is clad in colorful vertical glass bars to resemble a television test pattern.
3. The architects conceived the MPC as programmatic elements arranged around an interconnecting ramp.

tion were potentially disruptive to the audio and visual recording that would go on inside.

### Solution

To design the MPC, Columbia turned to Jeanne Gang, FAIA, and her firm, Studio Gang, now best known as the architects of Aqua, the 82-story mixed-use tower with a rippling facade that sits just to the north of Chicago's Millennium Park [ARCHITECTURAL RECORD, May 2010, page 60]. Curiously, the MPC displays none of Aqua's sculptural expressiveness. Except for a colorfully glazed elevation inspired by the bars in television test patterns, the long and horizontal MPC is a much more low-key affair that seems to respond to the still largely industrial character of its surroundings.

Gang has organized the essentially one-story building as three parallel strips. The main studios, where occupants needed complete control of lighting and sound, are contained inside the largest strip – a windowless box bordering an alley at the western edge of the site. Spaces where a connection to the activity outside and access to daylight were considered desirable, including classrooms, the set shop, and the directing studio, are lined up along State Street, behind the colorful facade. Sandwiched in between these two outer volumes are spaces devoted primarily to equipment and prop storage.

A system of precast-concrete walls and steel trusses supports and encloses much of the building. This construction method, with fabrication of the wall panels performed off-site, helped contractors stick to the tight 13-month construction schedule and the \$13.7 million budget. In addition, the precast units,

**CREDITS**

**ARCHITECT:** Studio Gang Architects  
 – Jeanne Gang, FAIA, design principal;  
 Mark Schendel, AIA, managing principal;  
 Margaret Cavenagh, senior project  
 architect; Kara Boyd, William Emmick,  
 project architects

**CLIENT:** Columbia College Chicago

**CONSULTANTS:** Magnusson Klemencic  
 Associates (structural); Spaceco (civil);  
 dbHMS Design Build Engineering (m/e/p);  
 Threshold (acoustics)

**SIZE:** 35,000 square feet

**COST:** \$13.7 million

**COMPLETION DATE:** December 2009

**SOURCES**

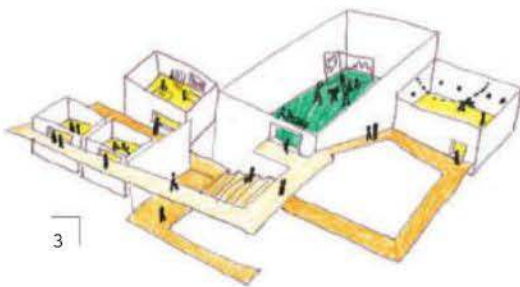
**CONCRETE PANELS:** Dukane Precast

**METAL/GLASS CURTAIN WALL:**  
 Kawneer; Viracon

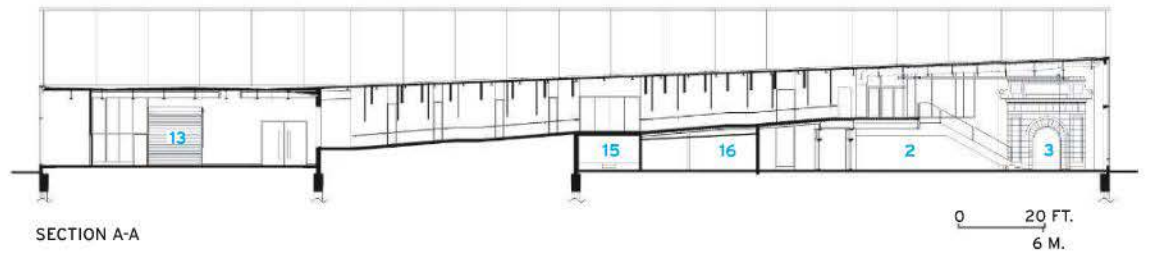
**GREEN ROOF:** American Hydrotech



2



3



SECTION A-A

0 20 FT.  
6 M.



FIRST FLOOR

South State Street

16th Street

0 20 FT.  
6 M.

- 1 ENTRY
- 2 LOBBY
- 3 LOUNGE
- 4 VIEWING STAIR
- 5 ANIMATION LAB
- 6 MOTION-CAPTURE STUDIO
- 7 MAIN STUDIO
- 8 LIGHTING STUDIO
- 9 PREP STUDIO
- 10 MAKEUP
- 11 DRESSING ROOM
- 12 "BACK LOT"
- 13 SET SHOP
- 14 CLASSROOM
- 15 PRODUCTION OFFICE
- 16 DIRECTING STUDIO
- 17 EQUIPMENT CHECKOUT
- 18 EQUIPMENT STORAGE
- 19 PROP STORAGE
- 20 WARDROBE
- 21 GREEN ROOM



made up of outer and inner layers of concrete of different thicknesses separated by several inches of insulation, provide an “impedance mismatch” that prevents unwanted noise from penetrating the sound stages, according to Scott Pfeiffer, a principal at Threshold, the project’s acoustics consultant. This combination of thicknesses and acoustical properties would have been difficult to create had the walls been poured in place, he explains.

A green roof covering about two thirds of the MPC also plays an acoustical isolation role. One of its chief benefits is that it nearly eliminates noise from pelting rain. And, as green roofs often do, it helps counteract the urban heat-island effect and reduces storm-water runoff. The roof, along with other resource-conserving features, is part of the MPC’s bid for LEED Gold certification.

Visitors and regular users enter the building through a slight kink in the vibrant State Street facade. Just off this space, at the northeast corner, is a double-story lounge. It contains an artifact from the beginnings of Chicago’s movie industry – an early-20th-century masonry arch that was part of a recently demolished film-distribution building a few blocks away. A wide stair doubles as bleacher seating for lounging or for viewing movies and other programming that faculty and students can

display on the room’s set of retractable LED screens.

The studios and other instructional spaces are on the lobby’s opposite side, reached by way of a clerestory-topped circulation spine that first passes a skylit equipment-checkout area envisioned by Gang as the MPC’s hub. A ramp leads to the classrooms, then loops around to hug the building’s State Street edge, ending at the top of the lounge’s viewing stair.

Cinematic compositional devices shaped this route, explains Gang, with windows framing views through multiple spaces and to the building’s exterior. Other openings have been carefully positioned to create different daylighting conditions and accentuate the sense of layering.

#### Commentary

These film-inspired visual links are intended to encourage collaboration among students, according to Gang. Whether or not they actually facilitate this hoped-for interaction remains to be seen. However, the interconnections, which might have seemed contrived if less skillfully executed, do provide a welcome complexity to an otherwise almost industrial building type. In a similar way, the colorful facade escapes being hokey: It lends the MPC a spirited energy and hints at the program housed inside, stopping just shy of the overly literal. ■



OPPOSITE, LEFT:

Openings are positioned to frame views through multiple layers of space.

1. From a ramp behind the vibrant facade, occupants can observe activity on the street and in the classrooms.

2. A courtyard next to the set shop can be used for socializing, filming, and nighttime outdoor movie viewing.

BELOW: A vantage point at the top of the lounge stair provides views of the equipment checkout and the main circulation spine.



2



# Peter Buck Center for Health and Fitness, Bowdoin College

BRUNSWICK, MAINE

Cambridge Seven creates an ethereal extension for exercise on a traditional campus. *By Suzanne Stephens*

**BOWDOIN COLLEGE** in Brunswick, Maine, has one of the few consistently picturesque New England campuses where brick-and-stone 19th-and-20th-century Federal, Classical Revival, and Gothic Revival structures are clustered around a large, tree-lined quad. You can walk from one end of the campus to the other without getting depressed by aggressively substandard Modern architecture built after World War II – as is too frequently the case elsewhere. Only one oversize eyesore (a tower) sits at the edge of the campus, but removed enough not to destroy the gestalt.

Considering what the small, 1,700-student college has at stake, it is not surprising Bowdoin trustees get a bit apprehensive if an architect says something like, “I see an all-glass building here.” As Timothy Mansfield, AIA, a partner at Cambridge Seven, puts it, “They immediately think of a commercial office building on a highway.”

Fortunately, his long-standing firm, established in Harvard’s Modernist heyday (1962) by Peter and Ivan Chermayeff, Thomas



## CREDITS

**ARCHITECT:** Cambridge Seven Associates – Timothy D. Mansfield, AIA, principal; Stefan Bold, project architect (design); Berton Bremer, AIA, project architect (construction); Alike Hasiotis, Achyut Kantawala, AIA, Kirsten Lawson, project team

**CLIENT:** Bowdoin College, Brunswick, Maine

**ENGINEERS:** Harriman Architects + Engineers (civil, m/e/p, f/p); Goldstein-Milano (structural)

**SIZE:** 44,659 square feet

**COST:** \$11,800,000

**COMPLETION DATE:** September 2009

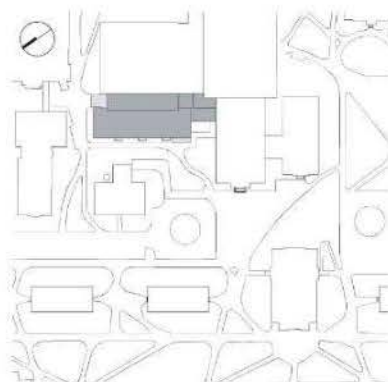
## SOURCES

**METAL/GLASS CURTAIN WALL:** Kawneer (1600 series)

**ROLLER SHADES:** MechoShade

**GLASS:** Solar Seal

**CLADDING:** Kawneer (storefront); Trespa Miteon (canopy and ceilings)



SITE PLAN

Geismar, and four other partners in Cambridge, is trying to integrate the Modern with the historic. At Bowdoin, Cambridge Seven and firms such as Machado & Silvetti [RECORD, February 2008, page 120] have introduced glass and metal successfully into a campus made sacrosanct by buildings designed by McKim, Mead & White and by Henry Vaughn, not to mention the granite, Romanesque Revival Bowdoin Chapel (1844–55) by Richard Upjohn.

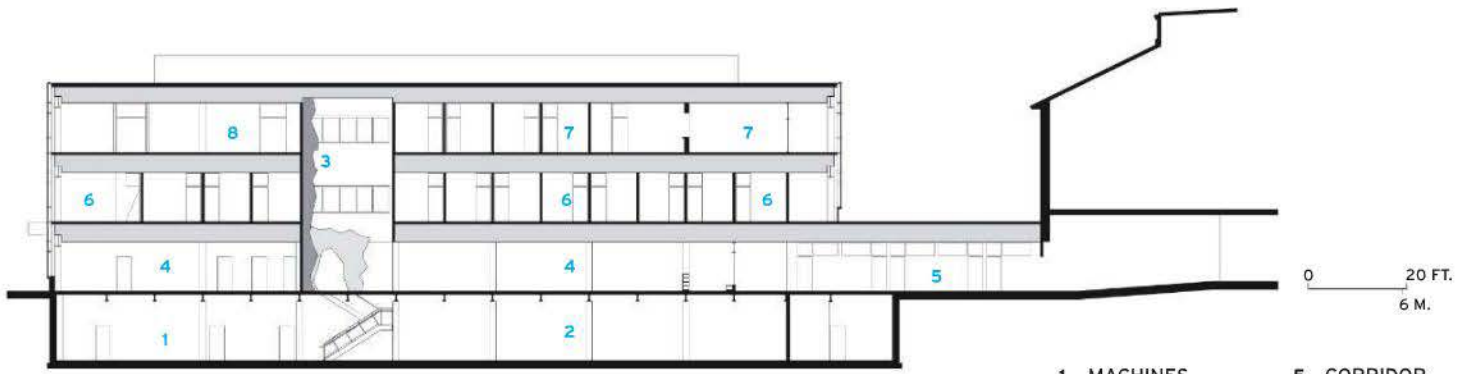
## Program

When the school needed to expand Morrell Gymnasium (1965), a brick-walled structure with Soanian blank arches designed by Hugh Stubbins, it turned to Cambridge Seven. Previously the firm had adeptly added the Modernist, glass-and-brick Kanbar Hall (2005) at the northern edge of

1. On the north facade, an entrance to the lobbylike spine separates the new glass structure from the old brick one.
2. Clear glass combined with two types of translucent glass on the west elevation reflect the pines and the chimney of the power plant.

the campus, and earlier, in 1999, had renovated and expanded Vaughn’s Gothic-style brick Searles Hall (1894).

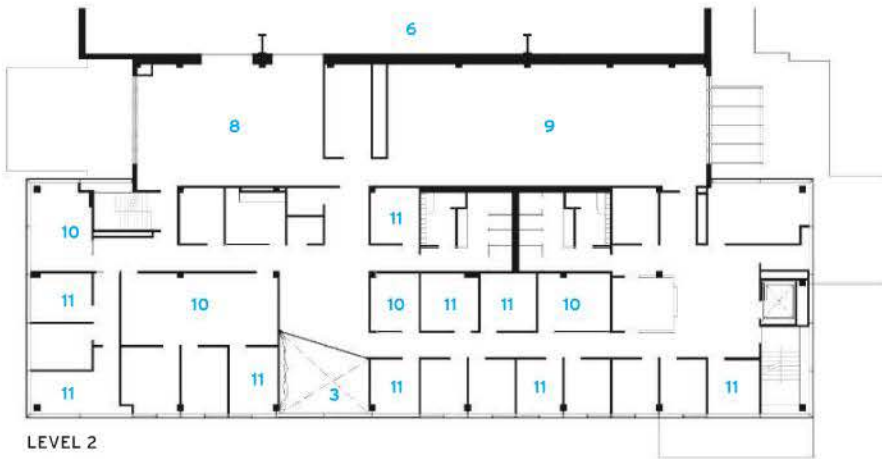
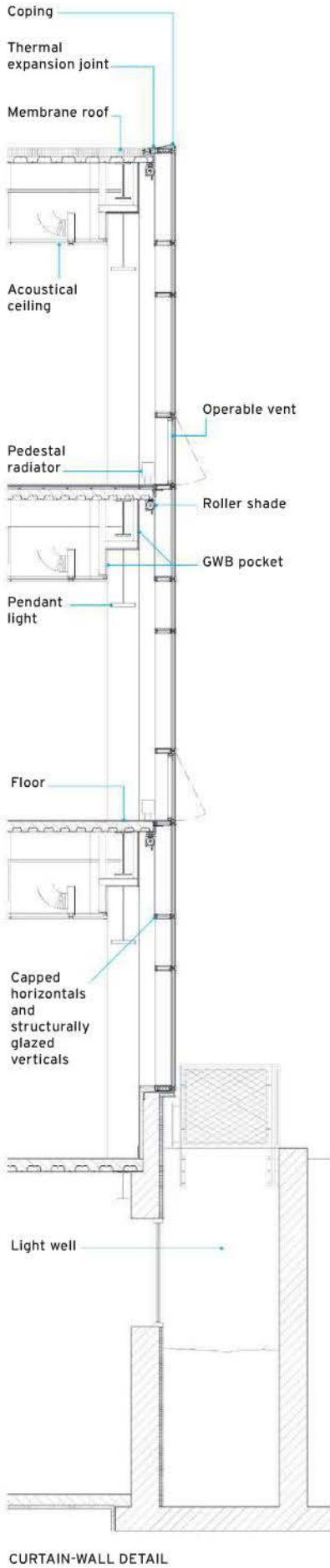
While the Stubbins gym sits on the periphery of the quad, it is very much a part of the campus – and not on the outskirts by the arena and playing fields. In addition to refurbishing the old gym, the college needed a new fitness space, along with offices for the athletic coaches, an infirmary and medical rooms, plus spaces for yoga and meditation. All of this would be placed in a 44,659-square-foot



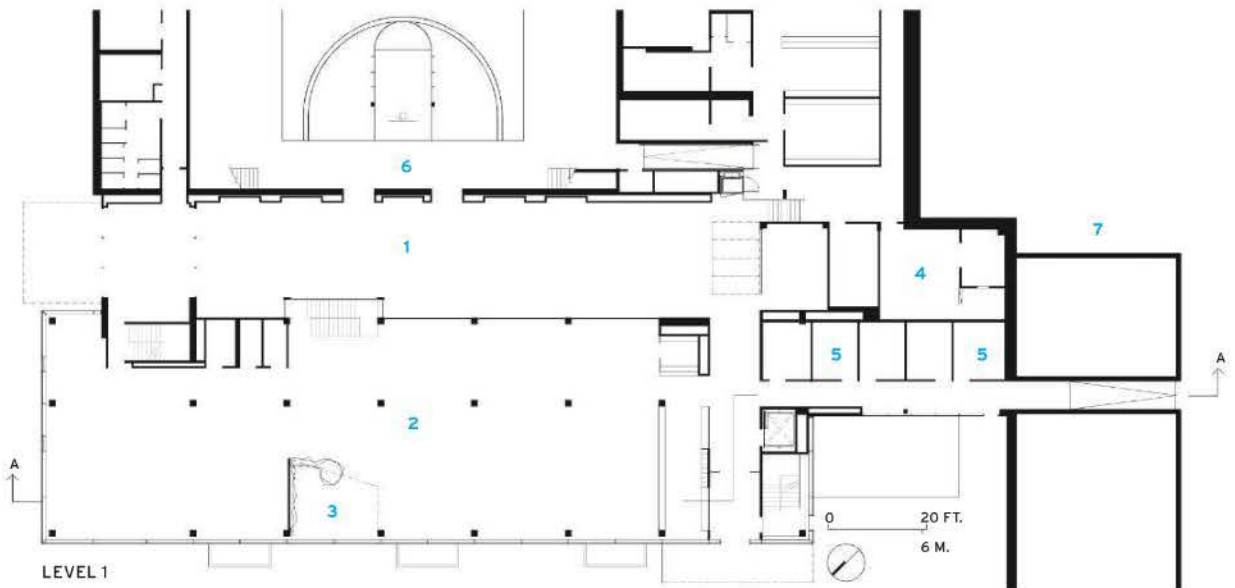
LONGITUDINAL SECTION

- |                 |                   |
|-----------------|-------------------|
| 1 MACHINES      | 5 CORRIDOR        |
| 2 WEIGHTS       | 6 COACH OFFICES   |
| 3 CLIMBING WALL | 7 HEALTH SERVICES |
| 4 EXERCISE      | 8 YOGA            |





- 1 LOBBY
- 2 EXERCISE
- 3 CLIMBING WALL
- 4 TRAINING ROOM
- 5 OFFICES
- 6 EXISTING GYM
- 7 EXISTING UNION
- 8 CONFERENCE ROOM
- 9 MULTIPURPOSE
- 10 HUDDLES
- 11 COACH OFFICES



building, the new Peter Buck Center for Health and Fitness.

### Solution

The almost 1-acre site was tight, so the architects removed about one third (15,200 square feet) of the existing gym to create a lanternlike glass-and-steel-frame structure, with a footprint of 13,250 square feet. The 160-foot-5-inch-long rectangular bar is edged on the east by a 135-foot-long, 24-foot-wide spine that functions as the lobby and exhibition space between the existing gym and the new structure. Cambridge Seven raised the main exercise room slightly above grade, and inserted three light wells on the western edge of the lower exercise floor to prevent its having that dark, palace-basement feeling. On the exterior, cementitious panels resembling slate cover poured-concrete foundations and create a plinth that appears to recede under a floating glass box.

The architects installed a curtain-wall system that features three types of glass: clear panels alternating with two gradients of translucent glass formed by varying the pressure during the sandblasting. The limpid, reflective skin wraps around the west and the north elevations, mirroring pines and nearby structures in its glossy surfaces. The glazing pattern of transparency and translucency mitigates glare and provides both view and a sense of privacy for those occupying the different levels within.

The carefully detailed curtain wall has no spandrel panels – just a horizontal mullion aligned with the floor plate – to prevent the appearance of a dark band at each level. The architects stepped back the fascias of the ceiling plenums to make the glass skin seem more unified. Since the gypsum pockets are set away from the glass, the floor plates look transparent all the way up. In addition, the widths of the glass panels vary in a regular rhythm of a 3-foot height on the lowest portion (where the vents are), followed by 5-foot-high and 2-foot-high panels that extend to the 10-foot-high ceiling. Another 4-foot-high panel completes the 14-foot, floor-to-floor height.

While most of the offices average 100 square feet – smaller than the

offices in the former quarters – the architects have included “huddles,” or conference rooms, on the interior of the floors for informal meetings. Other strategies – such as the use of recycled materials, the reliance on building products with low-volatile organic compounds, the inclusion of fluorescent lighting, and the installation of a highly reflective roof membrane – got the building awarded a LEED Silver rating.

### Commentary

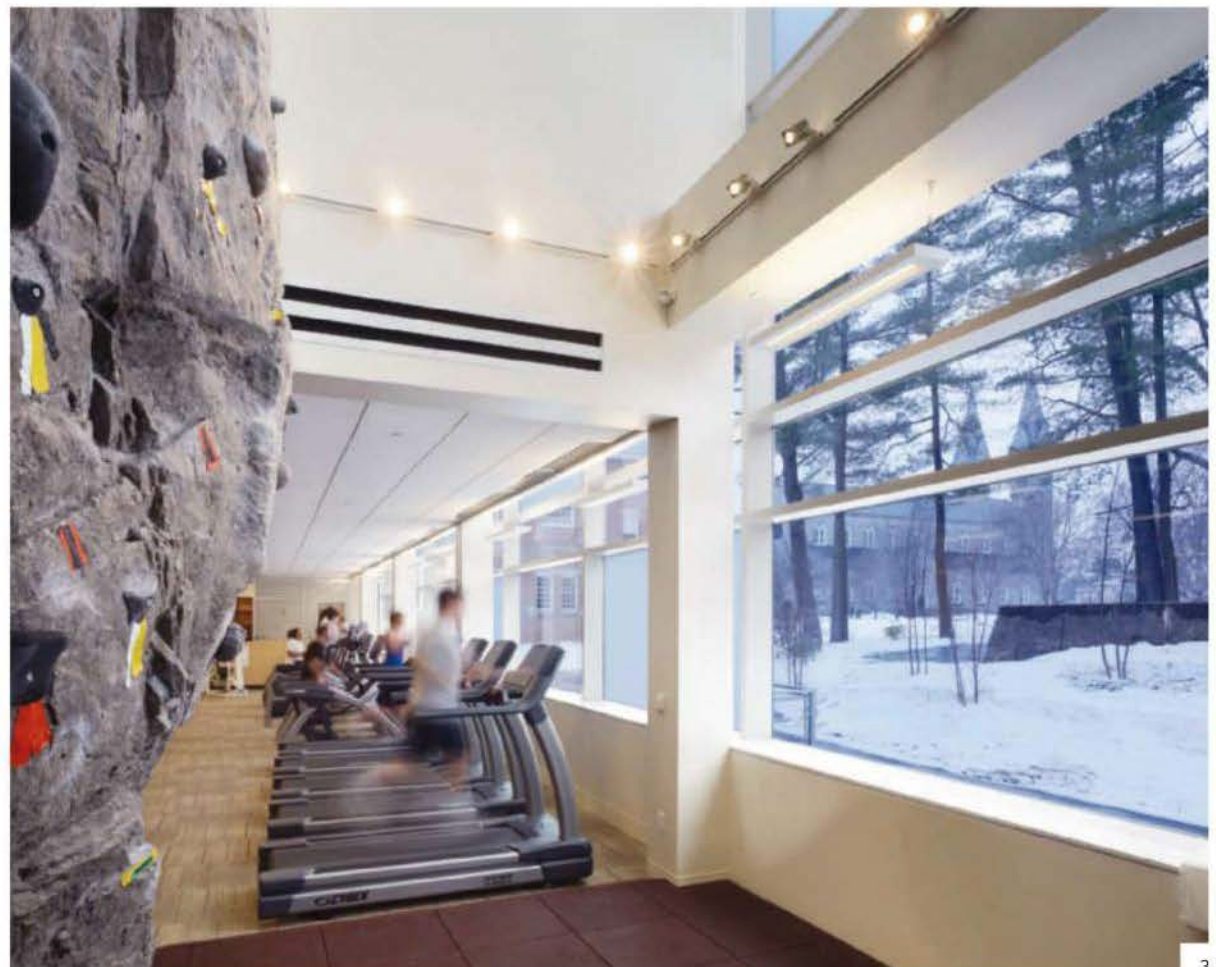
The amount of daylight and the generous views that enter the Buck Center create a bright, pleasant atmosphere. Daylight also helps mitigate the effect of overhead fluorescent lighting, which, however virtuously “green” it may be, too often creates a harsh and cold ambience.

The clear organization of plan and circulation enhances the combined functions of the building, where the heavy-duty grunt work (exercise) takes place on two lower levels, and the most contemplative or quiet activities (yoga and meditation) have



their own space on the top floor. As important is the fact that these spaces come with views of the surrounding campus. From the exterior, the center's glass skin attracts the most attention, and well it should. Sitting among the halls of ivy, Buck Center's ethereal surfaces reflect its leafy, traditional environs memorably. ■

1. A detail of the west facade shows the absence of spandrel panels.
2. In the top floor's yoga room, clear and translucent glass panels cut glare while allowing views out.
3. In the main floor exercise room, students can scale the climbing wall (at left), which imitates local granite.



# William L. Clay Education Center

ST. LOUIS

Adrian Luchini brings contemporary form and a new material palette to Harris-Stowe State University's traditional campus. [By Josephine Minutillo](#)

## CREDITS

**ARCHITECT:** LuchiniAD – Adrian Luchini, principal and designer; Peter Elsbeck

**ARCHITECT OF RECORD:** KAI Design & Build – Donald A. Koppy, project executive; John Cahill, Ryan Daniels, Pamela Todd, design team

**CLIENT:** Harris-Stowe State University

**ENGINEERS:** Grimes Consulting (civil); Alper Audi (structural)

**CONSULTANTS:** Michael Ashley & Associates (landscape)

**SIZE:** 48,000 gross square feet

**COST:** \$12 million

**COMPLETION DATE:** August 2009

## SOURCES

**CURTAIN WALL:** United States Aluminum; CPI International; Danpalon (polycarbonate)

**ELASTOMERIC ROOFING:** Firestone

**COURTYARD CLADDING:** Sto

**GLASS:** Pilkington

**PLAYGROUND SURFACE:** Surface America

**METAL DOORS:** Steelcraft

**ENTRANCE MATS:** Construction Specialties

**ELEVATOR:** Otis

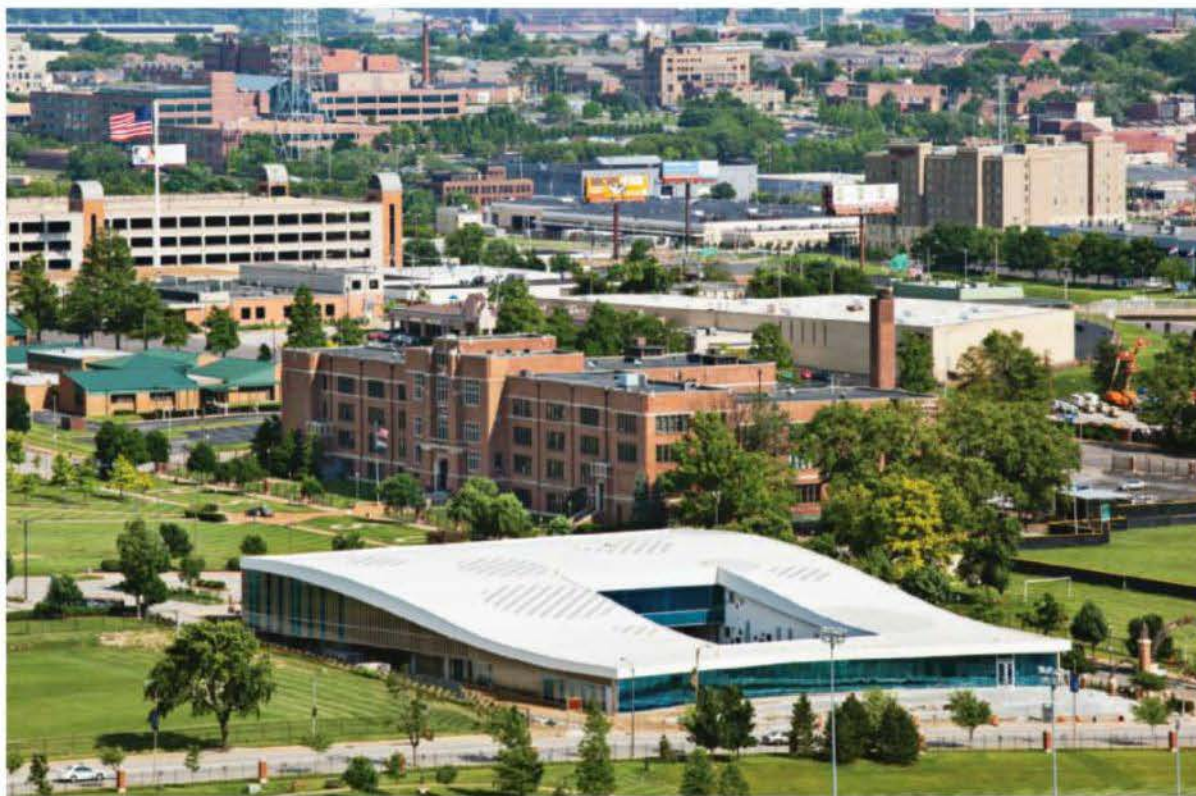
**ACOUSTICAL CEILINGS:** Armstrong

**WALL COVERINGS:** Wolf Gordon

**CARPET:** Mohawk; Karastan; Shaw

**SPECIAL SURFACING:** 3form

**FIXED SEATING:** Theatre Solutions; Herman Miller



## ST. LOUIS IS A CITY OF BRICK.

That most traditional of materials clads the majority of structures in this midwestern metropolis, including the academic buildings on Harris-Stowe State University's (HSSU) small midtown campus. But the school's leaders were open to something different for a new education center they were planning in 2007, and enlisted Adrian Luchini, a professor of architecture at nearby Washington University, to design a contemporary facility to meet the future occupants' diverse needs.

## Program

The building required spaces where HSSU Early Childhood Education majors could attend class as well as observe children, in a linked but separate child-care center that would also offer learning opportunities for parents.

## Solution

The low, softly undulating structure – prominently located at the entrance to HSSU's campus – occupies the full area of the site, covering it like a blanket. Its one-story western face, completely glazed with blue-tinted glass, serves as the community entrance to the child-care center on the ground level.

There, two rings – an inner one of classrooms for children aged three months to five years, and an outer one of activity and support spaces – envelop a courtyard, the rather conspicuous hole in the blanket. "It's very easy to recognize the building when I'm flying over the city," says Patricia Johnson, the center's director.

The partially covered courtyard, inaccessible to outsiders, provides a safe outdoor space where the children can play, and filters light into both the

children's classrooms and the HSSU student classrooms on the upper level overlooking the playground. Daylight penetrates all areas of the building, including the generous, double-loaded corridors along the north and south faces of the lower level and on the second story of the building's eastern half, where HSSU students and staff access lecture rooms, professors' offices, and an auditorium.

Luchini chose to clad these three facades in bronze polycarbonate. In many areas, only the 3/4-inch-thick honeycomb panels, which sometimes span as much as 27 feet uninterrupted, separate the exterior from the interior. In spaces like the auditorium that do not require daylight, the panels, often mistaken for metal from a distance, are backed by a stud wall.

This seamless approach to cladding



both the outer facades and the insulated finish surface of the courtyard walls is carried over to the building's top, where large, circular graphic elements punctuate the otherwise stark white rubber roof membrane. To maintain a pure and sloping roofline, HVAC equipment is concealed in a plenum space, as tall as 8 feet, above the second floor.

### Commentary

The HSSU campus is located in a part of the city that is slowly being redeveloped after years of neglect. For Luchini, the presence of numerous empty lots around the building site – what the architect refers to as “erasures” – was just as significant as its scattered buildings. By blanketing the site's entire buildable area, the structure literally fills a void (or creates one, as in artist John Baldessari's paintings/camera images, from which Luchini drew inspiration).

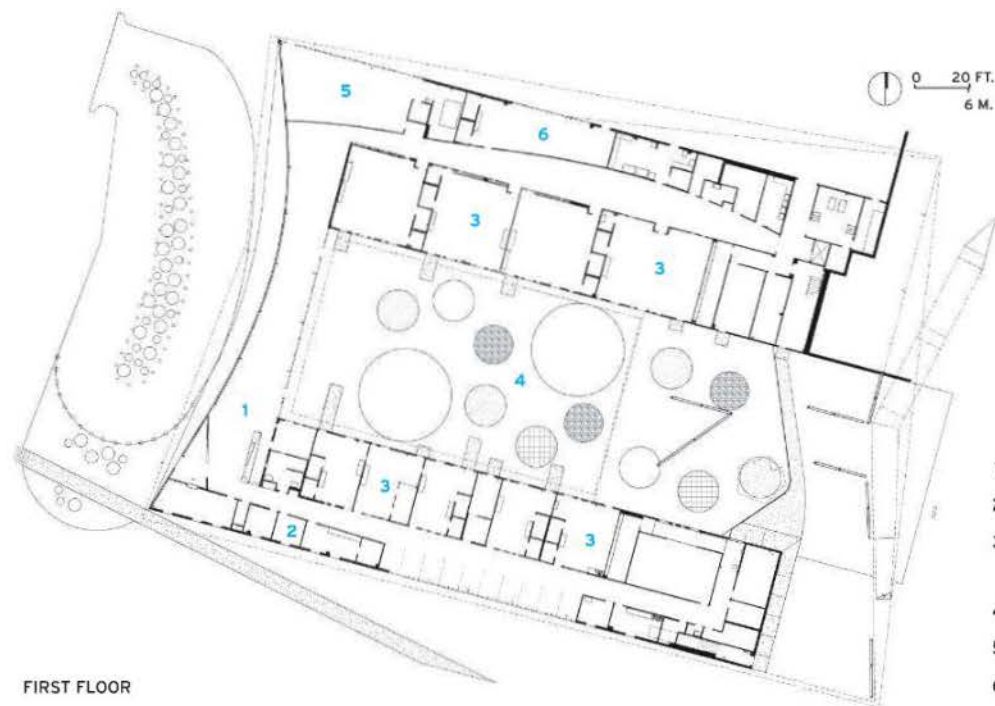
And unlike the tall, solid, brick-clad structures surrounding it, which either recall a more illustrious period in St. Louis's history or try to recapture it, the new building's transparent, lightweight materials and gestural form – like a tissue in the wind – speak to an urban condition that can be fleeting, while providing a structure that is meant to last.

HSSU has since hired Luchini to design a second project, to restore and expand an abandoned brick building on its own campus. ■

**OPPOSITE:** The William L. Clay Education Center's low-slung, curving form is a departure from the traditional buildings on Harris-Stowe's campus.

**ABOVE:** The polycarbonate-clad structure rises to include a second story of adult classrooms, professors' offices, and an auditorium that are accessed from the east side of the building facing the campus.

**RIGHT:** Early-childhood-education students can observe children from the second-level classrooms overlooking the playground.



- 1 RECEPTION
- 2 OFFICE
- 3 CHILDREN'S CLASSROOM
- 4 PLAYGROUND
- 5 MOTOR ACTIVITIES
- 6 COMPUTER ROOM



## 10 Akron Street

### CAMBRIDGE, MASSACHUSETTS

Referencing Harvard's historic buildings, Kyu Sung Woo designs student housing on a sensitive site that extends the campus into the community. **By Jane F. Kolleeny**

#### CREDITS

**ARCHITECT:** Kyu Sung Woo Architects – Kyu Sung Woo, FAIA, principal; Mark deShong, AIA, director; Randy Whinnery, Nathaniel Skerry, project architects; Kyoung Eun Kwon, Jared Fulton, Motomu Nakasugi, Andrew Longmire, Charles Lee, Sam Choi, Cameo Roerich, Juliana Teo, Li Lian Tan, Rori Dajao, project team

**CLIENT:** Harvard Real Estate Services

**ENGINEERS:** Green International Affiliates (civil); Lim Consultants (structural); SEI Companies (m/e/p)

**CONSULTANTS:** Michael Van Valkenburgh Associates (landscape); Viridian Energy & Environmental (LEED); Walker Parking (parking consultant); Bond Brothers (general contractor)

**SIZE:** 115,000 square feet

**COST:** \$56 million

**COMPLETION DATE:** July 2008

#### SOURCES

**MASONRY:** Morin Brick Company

**GLAZING:** PPG Solarban 60

**CURTAIN WALL AND WINDOWS:** Schuco

**ACOUSTICAL CEILINGS:** Armstrong

**PAINTS AND STAINS:** Benjamin Moore

**BAMBOO PANELING:** Teragren

**AS THE OLDEST CAMPUS** in the U.S., tradition matters at Harvard University. This applies not only to its academics, but also its buildings. From the freshman dorms around Harvard Yard to the River Houses that line the Charles River, the textured brick and Neoclassical details of these buildings root the campus to its early history.

But as times have changed, so has the campus. Growing from a school of nine students in the 1630s to one of more than 20,000 graduate and undergraduate students today, the university encompasses 210 acres on both sides of the Charles River, providing housing to many of its students. Joining the original Collegiate Gothic residence halls are a plethora of Modern ones, including three 22-story residential towers called Peabody Terrace. These were designed in



SITE PLAN

1962 by Josep Lluís Sert who, while running his firm, Sert, Jackson and Associates, also served as chair of Harvard's Graduate School of Design in the 1950s and '60s. The 10 Akron Street residence hall, designed by Kyu Sung Woo Architects and completed in 2008, sits at the foot of these towers.

#### Program

Woo, FAIA, the firm's Soeul-born, Cambridge, Massachusetts-based

**ABOVE AND RIGHT:** A seven-story arm of the building cantilevers out toward the Charles River. Hovering over an outside deck, its underlip is clad in mahogany. A multipurpose room occupies the ground floor of this elevation, offering all residents access to dramatic water views.

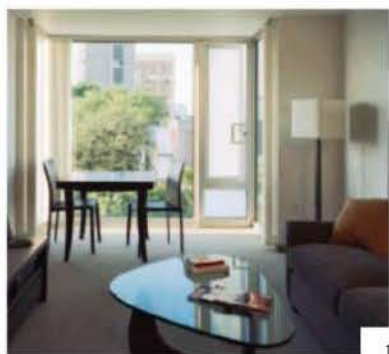
principal, fulfilled a program that offered 215 beds in different suite types for graduate students. The facility includes a faculty director's suite, a fitness room, multipurpose rooms, study lounges, and an underground parking garage. Situated at a crossroads, the land at 10 Akron Street abuts the Charles River, forming a gateway that joins the south edge of campus to the Allston academic buildings across the river, as well as Peabody Terrace to







GROUND-FLOOR PLAN



1. Dorm rooms are well lit by large view and bay windows, which both animate the exterior and admit abundant light into the modest-size spaces.

2. A multipurpose room provides an inviting lounge and study area. Well-appointed interiors incorporate numerous green features, including regionally sourced siding with recycled content, bamboo flooring and paneling, and low-VOC finishes.

the north and a development called Riverside to the east. "The site is a very special one. It is the beginning of the Harvard campus and the only access to the Charles River for the Riverside community," explains Woo.

The architect, who had studied under Sert at Harvard in the 1960s and then worked for him in the '70s – founding his own firm in 1979 – set out to design a building to reference Sert's domineering towers. "I wanted this building to relate to and complement Peabody Terrace both in massing and scale. These two projects, however, are designed 50 years apart and are reflections of their own time. Innovation was the essence of Peabody Terrace for housing typology, construction, technology, and aesthetics; while Akron housing was an attempt to retain tradition and innovation within the given changing conditions of the city and campus," says Woo.



2

### Solution

Woo's 115,000-square-foot, U-shaped building surrounds a Michael Van Valkenburgh-designed courtyard garden. The north elevation and the west arm of the U (which runs along the river) are both seven stories tall, while the east side is three. An entry portal at the U frames an axial view of Peabody, while the courtyard opens to a park on the south. The project recalls Harvard's River Houses through its brick, and responds to their scale and massing with its mid-rise elevation. It references the backdrop of Peabody Terrace with portions of concrete-colored siding. The low-rise block of the building steps down to the Riverside neighborhood, complementing its modest scale. "The building responds to its context with a two-story porch creating a gateway for Harvard as well as providing a view corridor for the community," says Woo.

One of a series of residence halls being built with a strong sustainability component, the project reflects Harvard's "Green Campus Initiative" with numerous strategies, including brownfield redevelopment, recycled materials, efficient fixtures, high-insulation roofing, high-efficiency mechanical systems, and natural ventilation and lighting. Together, these resulted in the building receiving LEED Gold certification.

Floor-to-ceiling glass allows dramatic views from the modest-size rooms. Windows at the terminus of double-loaded corridors bring in light,

while, as Woo notes, other interventions, such as top-floor skylights and different color accents, animate the halls. In the lobby, an LCD monitor provides a dashboard for tracking energy use and other conditions, and also encourages resident students and building staff to observe green strategies within the building. "Residents of 10 Akron and 5 Cowperthwaite Street [another dorm built the same year] are pitted against one another each year in a friendly competition during Earth Week to see who can use less heat, electricity, and water," commented Lisa Valela, a program coordinator at Harvard.

### Commentary

From issues related to zoning, easements, neighborhood objections, and its enviable and highly visible location on the Charles, the building required years of navigating through a maze of site challenges in order to get built. In the end, what the design team may have gone through to bring the building to completion is quite invisible – the final experience feels appropriate to its location. It's not just the inviting views – scullers gracefully whisking down the Charles with Allston visible across the river – but also the establishment of a new entry sequence. Van Valkenburgh's courtyard opens to a park to the south, knitting the campus to the city. Perhaps that's why Woo calls the building one that heals: While it responds to conflicting interests, it negotiates a solution that resolves them. ■



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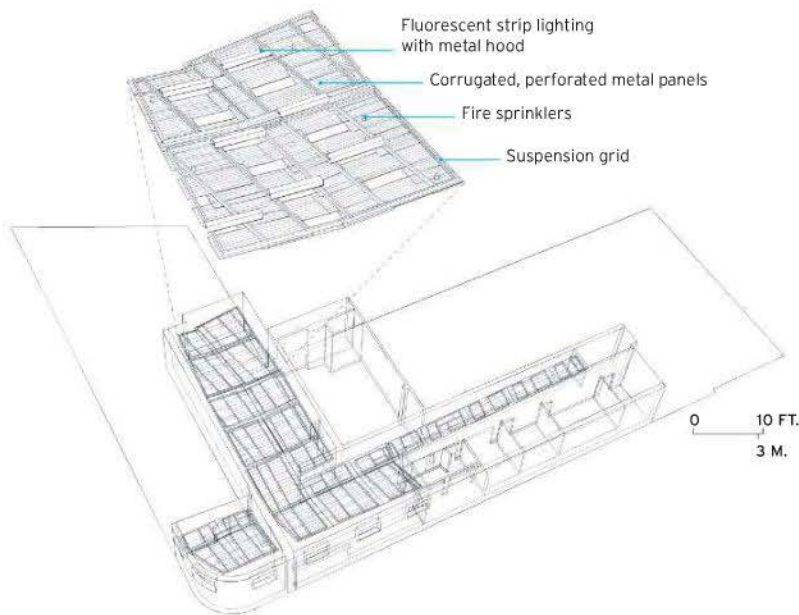
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## LIGHTING

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CEILING COMPONENT DIAGRAM

## Harvard Digital Images and Slide Collection

Architect **Daly Genik**

**RIGHT:** To create a serene research zone in a former fabrication shop, Daly Genik installed an undulating wave of white perforated ceiling panels to diffuse light for slide and digital-media viewing.

**THE DIGITAL IMAGES** and Slide Collection at Harvard College's Fine Arts Library in Cambridge, Massachusetts, houses more than 750,000 images in 35-millimeter-slide and digital formats. Visitors can scrutinize details of a fireplace in the 1885 Edward Ayer Residence in Chicago, or a 17th-century Turkish carpet from the Ottoman period, its intricate star pattern eaten by time.

Until recently, the collection was tucked into the basement of the Fogg Museum, on campus. But when the building at 32 Quincy Street that housed both the Fogg and Busch-Reisinger museums closed for renovation in 2008, the slide collection needed a new, dedicated home of its own. Harvard chose the basement of the Sackler Museum as the new location, even though the dark, rough space was less than ideal for browsing Wikipedia on an iPad, let alone time travel by way of a lantern slide (the earliest form of photographic slide for projection, which was developed in the 19th century).

Transforming the basement into a serene environment conducive to research was a three-phase process that included demolition, modification, and, finally, relocation. "There's a certain bittersweet quality to the collection," says architect Kevin Daly, of Santa Monica-based Daly Genik, the firm tapped to tackle the project. As an increasing amount of research shifts to the Internet, slides are becoming antiques to be archived. In addition to having to complete the project without interrupting class schedules or shutting down the



PHOTOGRAPHY: © JOHN HORNER





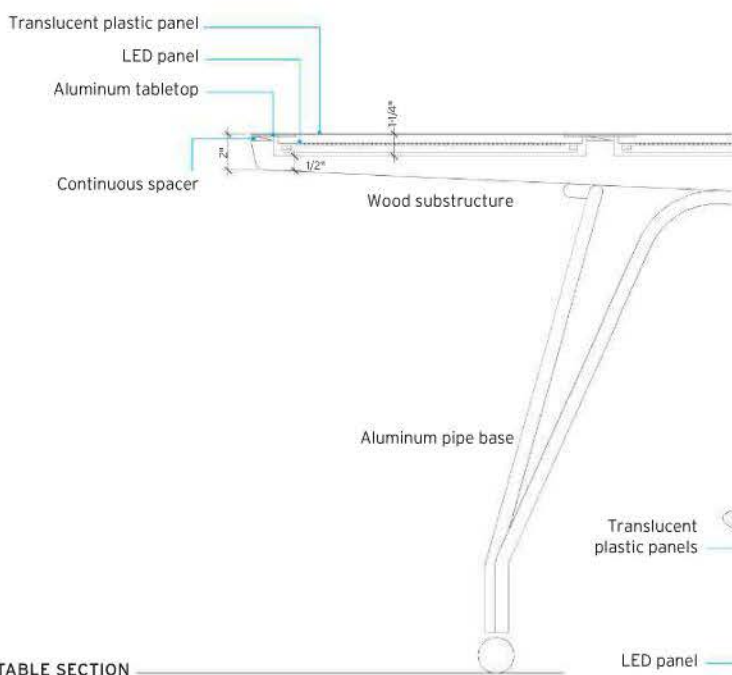
museum, one of Daly's biggest challenges was lighting the 5,000-square-foot space.

"Ultimately, if there's ever a program that's fundamentally about light, it's the slide library," says Daly. However, the room had clearance of 14 feet in some areas and less than 9 in others, and the only source of daylight in the partially subgrade facility is a bank of six clerestory windows that curve around its northwest corner. To illuminate the deep interior, the architect and his team transformed the ceiling into a continuous plane of light, concealing infrastructure, fire protection, security systems, and 3500 Kelvin (K) T5 fluorescent lamping with an undulating surface of white corrugated, perforated metal panels. The configuration of the structures and mechanicals above the ceiling dictated its form. The ingenious ceiling system diffuses and reflects light throughout the space – acting as an integral luminaire. Warm plywood surfaces, used in staff offices and for casework, along with concrete walls and floors, complement the ceiling's soft, effective glow.

To provide access to m/e/p systems for maintenance, the architects snipped and cut the panels, forming broken planes that hint at the plenum's anatomy. Light switches with scalable levels eliminate the need for dimmers. This scheme also dispenses with the need to turn on groups of lights, leaving other areas dark.

For a slide-viewing area, Daly and his team worked with LED consultants eLumination to design and fabricate a pair of contemporary media "light tables" compliant with 5000K standards of color transparency evaluation. Each table accommodates viewers with individual LED "place mats" made of translucent acrylic enclosing dimmable LED panels (with tabletop controls) inserted into a softly beveled wood base clad with a thin sheet of aluminum.

"One of the things that is surprisingly successful is that we didn't end up with a sterile place," says Daly. "We get decent color." The scheme provides a place for each slide drawer, so Daly became familiar with all of the library's contents, including the lantern slides, many of them compiled for art history courses. "These are amazing pieces of intellectual history," says Daly. "They are an archive all their own – how people thought about works of art and how they related them to others." *Laura Raskin*



ABOVE: **Two custom LED light tables were designed by Daly Genik and fabricated by eLumination, a big step up from clunky light boxes.**

BELOW: **Eight individual pools of light with local controls are integrated into two tables that become one, allowing a number of people to work at one time.**

TABLE SECTION

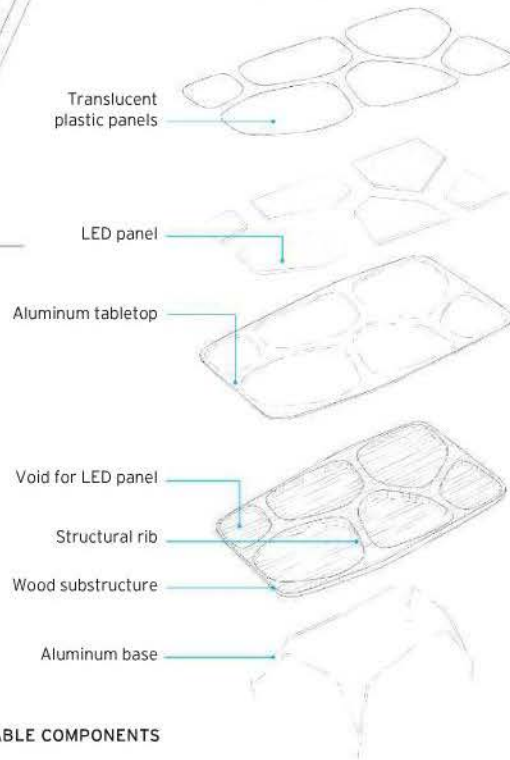


TABLE COMPONENTS



**CREDITS**

**ARCHITECT:** Daly Genik – Kevin Daly, AIA, principal in charge; Tom Perkins, project manager; Jason Pytko, Gretchen Stoecker, Kody Kellogg, project team

**ENGINEERS:** LeMessurier (structural); Exergen (mechanical); RW Sullivan (plumbing/fire protection)

**ASSOCIATE ARCHITECT:** RODE Architects – Kevin Deabler, principal

**SOURCES**  
**LIGHTING:** Lithonia (T5 custom fixtures)  
**CEILING:** Gordon Allpro (perforated panels)

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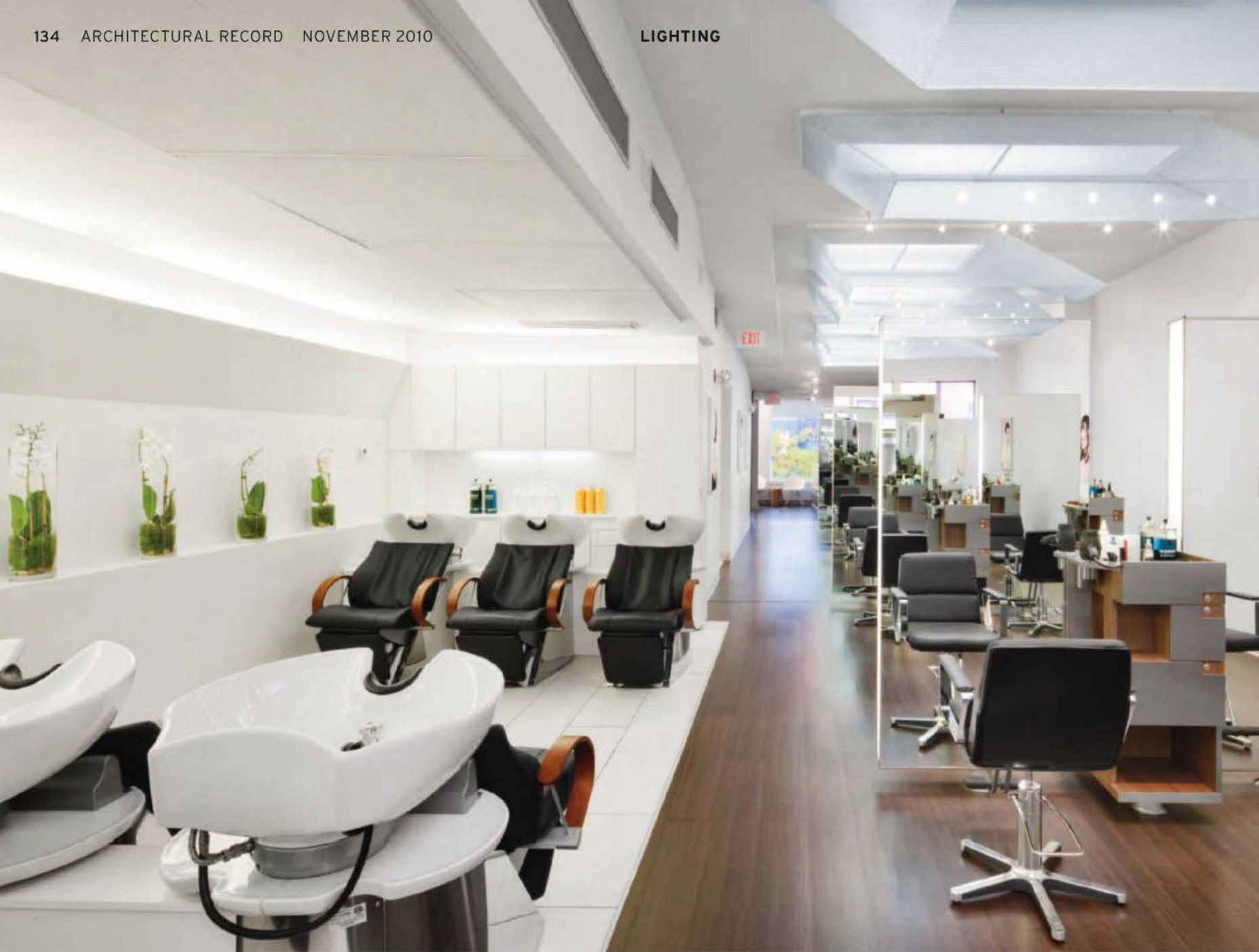


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## Bradley & Diegel Salon Boston Architect Studio Luz Architects

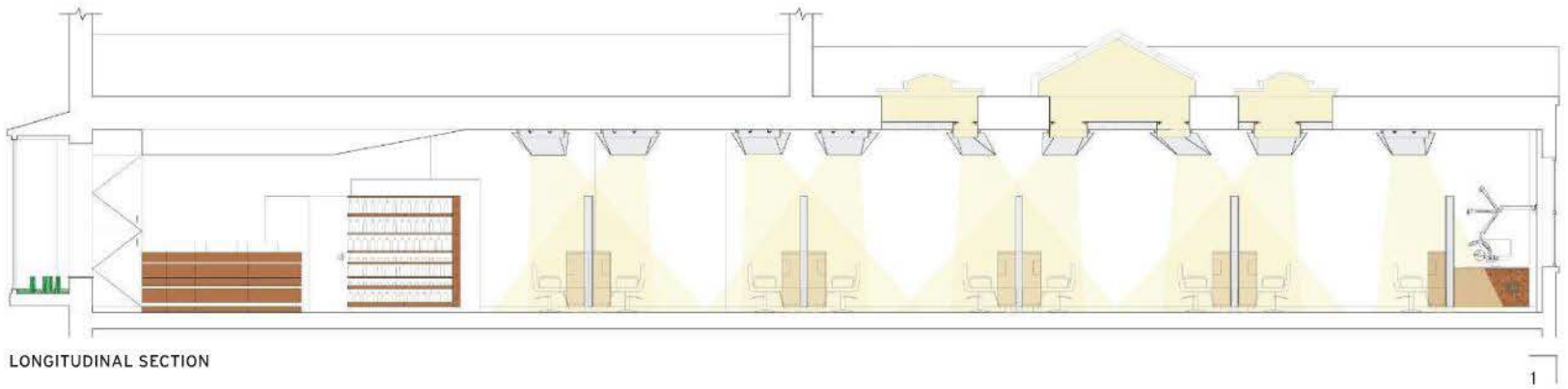
**AFTER MORE THAN** 20 years at Vidal Sassoon, styling hair and managing operations in London and North America, Peter Bradley teamed with Sassoon colleague Dirk Diegel to launch an upscale establishment in Boston, where the German-born Diegel had been based for 14 years. Dubbed “a salon that transcends trends and celebrates individual beauty,” the pair’s two-year-old eponymous business makes its home on the second floor of a typical row house in the city’s tony Back Bay neighborhood. The spare yet comfortable space, designed by Studio Luz Architects, not only communicates the owners’ mission; it provides a well-lighted, functional arena for the precision haircuts and meticulous color treatments performed by the shop’s numerous stylists.

Gallery-quality, shadow-free illumination with accurate color rendering was among the clients’ top priorities. Architects Hansy Better Barraza and Anthony Piermarini, Studio Luz coprincipals, anticipated a challenge when they first saw the 1,200-square-foot floor-through site, a former spa that had been sectioned into a warren of closed rooms. But as the interior was being demolished, they discovered three skylights blocked off by the existing ceiling in the back half of the 92-foot-long space, which becomes the building’s top floor at that point. (The front of the shop has two floors above it.) “It was a great discovery!” notes Piermarini – one that would define the overall design strategy.

Once the work crew cleared the debris, Barraza and Piermarini devised an open, gallerylike setting divided by function, layering it with a finely detailed yet subtle palette of materials and light. Style stations feature floating, edge-lit mirrored partitions that provide gentle ambient light via T8 fluorescent tubes behind milky polycarbonate panels. MR16 track fixtures wash poster-size photos and luminous white walls. Undershelf LED strips highlight artfully packaged beauty products on custom wood display cases, and T8s, now concealed in coving, brighten the pristine wash/massage area without glaring into customers’ eyes.

The architects kept window walls unobstructed so daylight streams into both ends of the space,



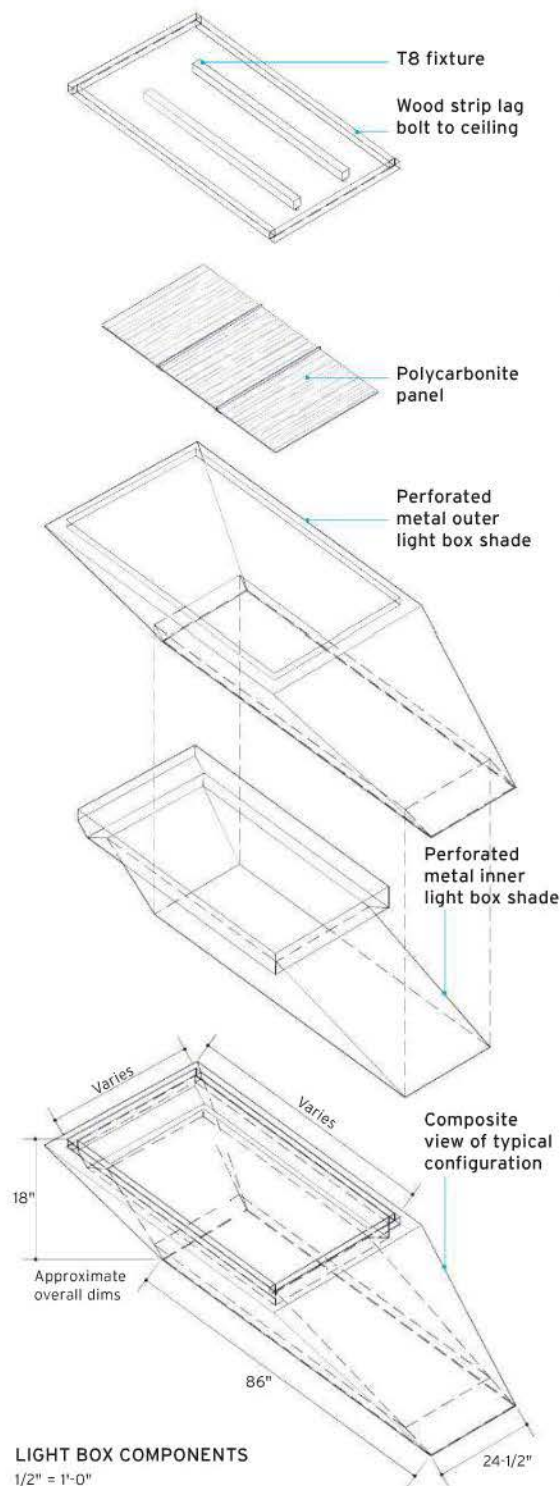


enhanced in the rear by the newly exposed skylights. To maintain a balanced quality of light throughout the long, narrow expanse – and into evening hours – they worked with a local fabricator to develop a series of nine analogous light boxes measuring approximately 3 by 5 feet that adapt to the quirky configuration of the skylights, as well as to the housing for T8 fluorescent fixtures – blurring the distinction between the two.

According to Piermarini, these hybrid luminaires installed above the style stations are meant to create the perception that there is a skylight above each one, although only four actually benefit from the real thing. The success of the illusion is in part due to the imperceptible blending of the sun's rays with the 4000 Kelvin color temperature of the lamps positioned across or to either side of 1/8-inch frosted polycarbonate diffusers (and housed in the faux and actual skylight boxes, respectively). It is also the result of the architects' flair for texture and incorporating whimsical elements into their work; in this case, 15-inch-high trapezoidal translucent screens that frame the skylight apertures above the work areas. Made of delicately perforated, 16-gauge steel, these scrimlike enclosures – carefully shaped and configured to follow a precise perspective line from the entrance through the gallery's elongated corridor – produce an optical moiré effect as onlookers gaze through them. "They also add a dynamic, sculptural quality to the space," adds Barraza, doubling as visual dividers that obscure hot spots from the track lights around them.

"The lighting in the salon turned out great," notes Bradley. Designed to engage customers immediately upon entering the shop, Studio Luz's seamless integration of architecture and lighting is never overpowering, or gratuitous. Its design for the Bradley & Diegel Salon not only fulfills the clients' desire for an open environment where people can work effectively, but does so with an understated drama and effective illumination scheme that celebrates this unique creative team's stylish oeuvre.

Linda C. Lentz



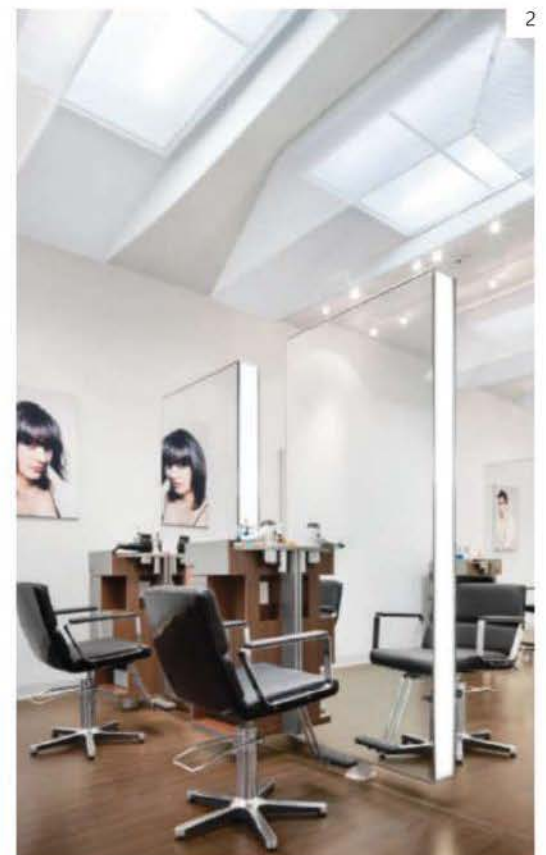
LIGHT BOX COMPONENTS  
1/2" = 1'-0"

OPPOSITE: The salon's style floor is designed to maximize daylight and create full color rendition for proper evaluation of hair color and styling.

1. The longitudinal section reveals the location of the three existing skylights.
2. Edge-lit mirrors emphasize the light, open plan.

#### CREDITS

<p><b>ARCHITECT:</b> Studio Luz Architects – Hansy Better Barraza, AIA, Anthony Piermarini, AIA, principals;</p> <p><b>DESIGNER:</b> James Henry, project designer; Julia Jamrozik, designer</p> <p><b>ENGINEERS:</b> Ibrahim and</p>	<p>Ibrahim (m/e/p); Zerounian Associates (structural)</p> <p><b>SOURCES</b></p> <p><b>LIGHTING:</b> Contrast Lighting (recessed); Columbia Lighting (fluorescent); Juno (task)</p>
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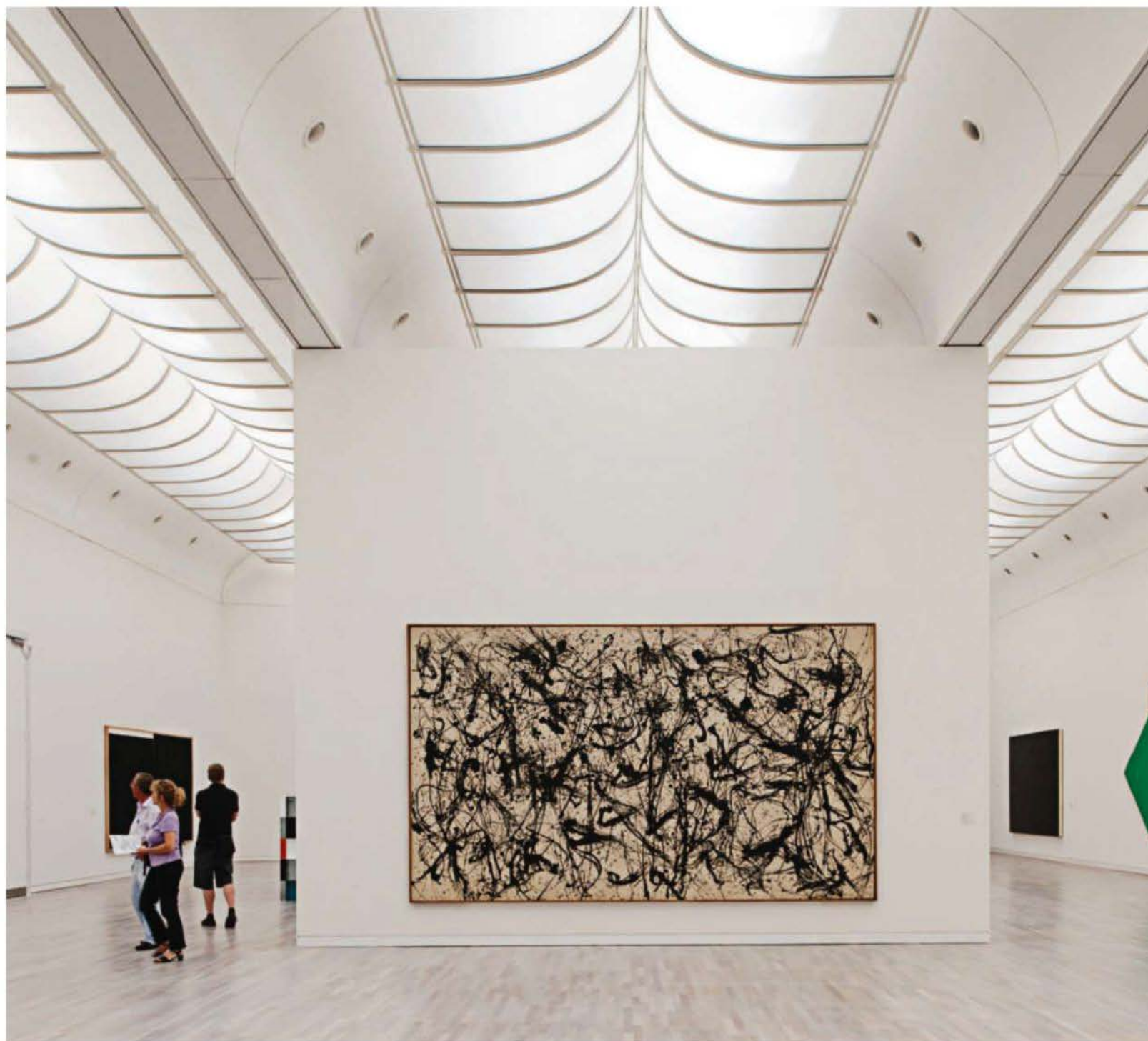
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**K20 Art Collection** Düsseldorf  
 Architect **Dissing+Weitling Architecture**

**THE K20 ART COLLECTION** in Düsseldorf is home of one of Germany’s most important contemporary art collections. When the State Chancellery of North Rhine-Westphalia decided to update and expand its original 1986 home two years ago, the administrators tapped the architects of the existing museum, the late Arne Jacobsen’s Copenhagen-based Dissing+Weitling. As they had to shutter the facility

to execute the renovation and 21,528-square-foot addition, they also called upon the Bonn-based lighting design firm Licht Kunst Licht to overhaul the dated lighting system.

With numerous museums in their portfolio, Licht Kunst Licht principal Andreas Schulz and lighting designer Alexander Rotsch were accustomed to the demands of illuminating light-sensitive works of art

that require shadow-free viewing. Their solution here integrates the architecture and lighting throughout the old and new buildings, seamlessly blending daylight and electric light – fluorescent and halogen – with the structural elements and other mechanical functions, such as ventilation and fire safety.

The lighting designers re-created the original lobby fixtures in a satiny PMMA, a transparent

PHOTOGRAPHY: © THOMAS MAYER



PREVIOUS PAGE: Sail-like ceiling panels conceal skylights and newly installed fluorescent fixtures in the renovated K20 museum, first built in 1986.

1. Tracks support lights and art in the new wing.
2. Recessed T5s line the addition stairway.

glass substitute also known as acrylic glass, using the same elongated oval motif. To upgrade the lamping, they combined T5 fluorescent tubes for diffuse light and low-pressure halogen – both dimmable – for direct downlighting. The lamp types can be used individually or in tandem as desired. By comparison, existing Arne Jacobsen fixtures along the main stair off the lobby, while beautiful, still emit an old-fashioned dingy, yellowish glow.

The lighting revisions in the existing galleries are equally discreet, but vastly improved. Licht Kunst Licht refabricated approximately 950 ceiling “sails” in polyethylene terephthalate (PET), a category B1 fire-resistant plastic. To satisfy the varying illumination requirements of the installed works, Schulz and Rotsch backlit the sails with both daylight from a series of existing skylights and newly installed luminaires. The new linear fixtures feature a special asymmetrical cove reflector fitted with T5 lamps in museum color-rendering quality. Adjustable louvers on the fenestration manage the amount of sunlight entering through the curves of the diffuse ceiling surface into the space.

In the new wing, the first-floor galleries are lined with 3-phase tracks containing adapted projector luminaires generating illuminance levels from 50 to 300 lux, and equipped with a variety of lenses that

control the beam spread. The tracks are integrated with air-conditioning vents and an art-suspension system able to support up to 331 pounds. T5s recessed in coves around the handrails guide visitors up the stairs to the second-floor gallery, where the tracks reappear. Here, however, the lighting designers took advantage of north-facing, shedlike roof windows to configure alternate rows of “luminous” membrane ceilings between the tracks. Similar to the sail-like ceilings in the old building, these are backlit with daylight and reflector-fitted luminaires that use the same museum-quality T5 lamps. Made of low-iron-oxide frosted glass (for good color rendition), the operable windows above the plenum have two layers of remote-controlled shades (in varying opacity) to diffuse the sun’s rays as needed. The actual transparent membrane ceiling comprises 42 panels – half of which automatically lower while the roof windows open, as part of a smoke- and heat-exhaust system designed to protect the gallery’s precious contents in the event of fire.

The fusion of natural and man-made light not only produces a visually comfortable and vital space within which to view art. The shading systems and diffuse ceiling materials also protect the art from damaging ultraviolet rays, and over large portions of the year, the electric backup lighting is often not needed.

Additionally, says Rotsch, “We used high-efficiency sources. Even the halogen is infrared-coated, and we tried to reduce the number of different lamps in order to keep maintenance costs down.”

The K20 Art Collection reopened to the public on July 10 with a flexible lighting system capable of bathing the State of North Rhine-Westphalia’s growing compendium of works with effective, shielded light, as well as tackling the challenges of a public facility in the 21st century. *Tracy Metz*

*Tracy Metz is ARCHITECTURAL RECORD’S Amsterdam-based international correspondent.*

#### CREDITS

##### ARCHITECT:

Dissing+Weitling – Robert Degele, Steen Savery Trojaborg, project architects

##### LIGHTING DESIGN:

Licht Kunst Licht – Andreas Schulz, design principal; Alexander Rotsch, lighting designer

##### SOURCES

**LIGHTING:** Erco (downlights, track lighting); Objekt Leuchten Berlin (custom luminaires, task lighting); Scharkon Lichtkonzepte (ceiling sail backlights)

**CEILING:** der Kluth: GmbH (luminous); Marvel (sails)



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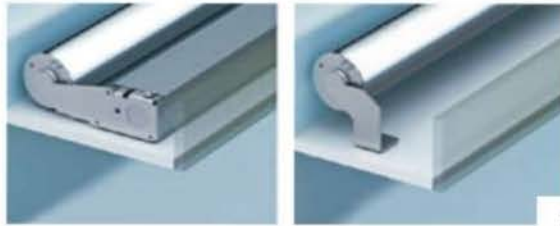
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1 | PRODUCT **fraqtir**  
 MANUFACTURER **The Lighting Quotient**  
 thelightingquotient.com

The manufacturer of Elliptipar and Tambient fixtures has introduced its first architectural LED luminaire featuring the company's fraqtir optical technology. The concealed cove luminaire (shown with and without the driver) throws an even wash of warm white light across broad surfaces from one edge. **CIRCLE 211**



2 | PRODUCT **NanoLumen**  
 MANUFACTURER **USAI**  
 usalighting.com

NanoLumen is a sophisticated recessed fixture that offers 60% efficiency and what is claimed to be the smallest aperture on the market for metal halide lamp sources. Designed around a T4 ceramic metal halide lamp source, NanoLumen's 2.5" aperture fuses seamlessly with interior ceiling planes, allowing for precise yet flexible point source lighting. **CIRCLE 212**



3 | PRODUCT **E-Core LED product**  
 MANUFACTURER **Toshiba International Corporation**  
 toshiba.com/lighting

Toshiba's E-Core LED product line for North America will feature an extensive lamp line (shown) and high-efficiency LED downlight fixture line. The lamp line, which includes six reflector lamps in three colors, and two A19 bulbs in two colors, features high brightness and energy-efficient compact designs. The downlight line includes six models in four colors, the brightest of which reaches a luminous flux of 1250 lumens. **CIRCLE 213**

4 | PRODUCT **Tycoon**  
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5 | PRODUCT **Fiber Evolution and Troag fixture**  
 MANUFACTURER **Foscarini**  
 foscarini.com

Fiber Evolution, developed by Marc Sadler, is a site-specific program to create light sculptures composed of elements from Foscarini's standard product line. The fixtures can be stacked to create tall, undulating towers of light, or arranged in unconventional ways. Also new from Foscarini is the Troag suspension light, shown here in a sculptural grouping. **CIRCLE 215**



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## Fiberglass Fenestration Comes into its Own

Sponsored by **Milgard Windows & Doors**

Page 151



Photo provided by Ron Bowman

Fiberglass goes green. Learn all about the sustainable aspects of fiberglass and how fiberglass frames compare to other materials in terms of life cycle. This informative course will not only detail how fiberglass windows support green building goals, but will also give you the tools you need to specify an effective fiberglass window for your projects.

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## Solar Lighting: Making Steps Off-Grid towards a Sustainable Future

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Page 157

This course shines a new light on the benefits of today's solar powered lighting options. After reading this article, you will be able to identify components of an off-grid solar luminaire, as well as understand the key elements in choosing a light source/luminaire for your building project—from system sizing to assessing which applications are best suited for off-grid solar lighting.

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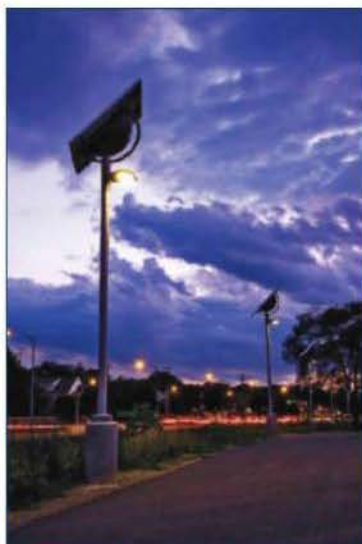


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Dancing House by Frank Gehry  
Photo © Dino Quinzani

## Building Movement Joints and BIM

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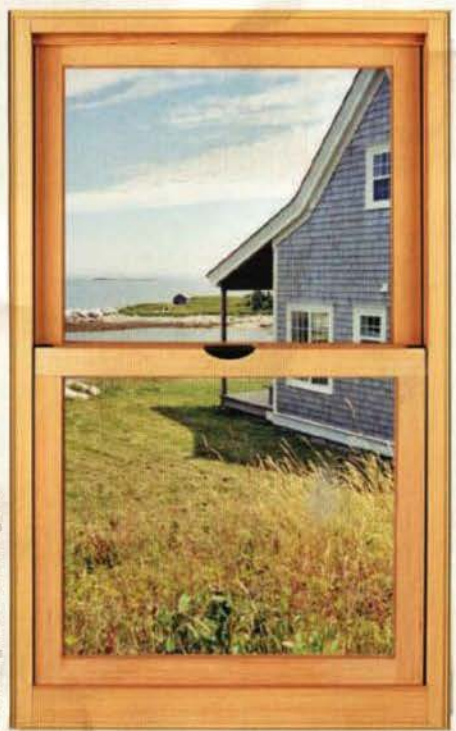
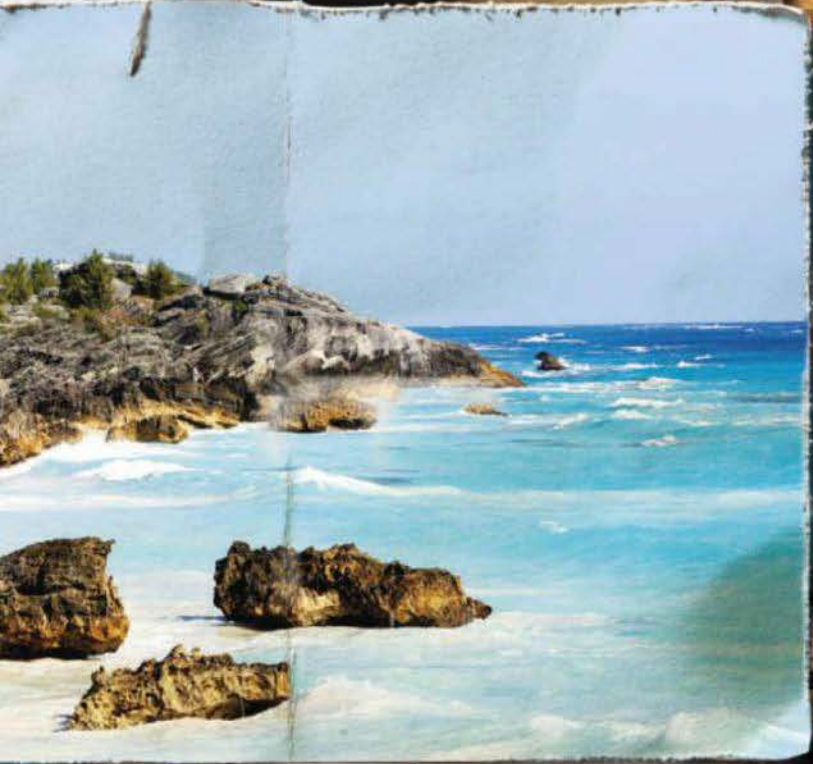
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CONTINUING EDUCATION

# Fiberglass Fenestration Comes into its Own

Ultra-durable frames bring sustainability, energy efficiency and beauty to today's windows.



Photo courtesy of Ron Bowman

Fiberglass windows are an increasingly popular option in the residential market

Provided by Milgard Windows & Doors

It used to be that wood windows were virtually ubiquitous, but technological advances have generated a multitude of alternatives with added benefits. Developed in the late 1980s to meet demand for lower maintenance and higher performance, fiberglass windows are now gaining traction nationwide. The AAMA/WDMA 2009/2010 U.S. Industry Market Studies show that while demand for all types of window units dropped a staggering 44.8 percent during the 2005 to 2009 peak-to-trough economic downturn, market share for fiberglass window units nearly doubled from 1.6 percent to 3.1 percent. That share is expected to reach 4.3 percent in 2013 as the global green building movement spurs ever more demand for sustainable products with low life cycle costs. As more mainstream window and door

manufacturers introduce fiberglass lines for new construction and replacement situations, products have become available in a full range of energy-efficient options including low-E argon-filled insulating glass units and in a variety of styles from casement to single- and double-hung to complex custom profiles. This article will discuss next generation offerings in fiberglass windows and provide a comparative analysis of fiberglass and other framing materials. Also covered will be code and design considerations in specifying an appropriate fiberglass window.

## FIBERGLASS WINDOW OPTIONS

According to Greenerbuilding.org, a non profit website whose sole mission is to encourage the creation of well-built buildings made with sustainable materials, "using fiberglass for a window frame material is, in some cases, preferable to other window frame materials like wood, vinyl, or metal." A relatively young product, fiberglass window frames are available in several versions. Chief among them are the all-fiberglass frame that combines a traditional wood-frame profile with the strength, stability and low maintenance characteristics of fiberglass. These windows resemble traditional painted wood windows with factory-applied exterior colors. Quite recently, manufacturers have also introduced a line of windows in which the fiberglass production process enables complex profiles required for the look of painted wood windows on the exterior, combined with a natural wood interior. Better options in this category feature furniture-grade, clear, vertical-grain Douglas fir, mahogany or other species on the interior unmarred by nail or staple holes, a powder-coated exterior finish and built-in systems to increase both energy efficiency and window longevity.

### CONTINUING EDUCATION



Use the learning objectives below to focus your study as you read **Fiberglass Fenestration Comes into its Own**. To earn one AIA/CES Learning Unit, including one hour of health safety welfare credit and sustainable design, answer the questions on page 155, then follow the reporting instructions or go to [ce.architecturalrecord.com](http://ce.architecturalrecord.com) and follow the reporting instructions.

#### Learning Objectives

After reading this article, you should be able to:

- Describe the sustainable aspects of fiberglass.
- Compare fiberglass window frames to other frame materials in terms of life cycle considerations.
- Explain how fiberglass windows support green building goals.
- Specify an effective fiberglass window.



Photo courtesy of Levi Ellyson

Fiberglass windows add sustainability and beauty to a home.

## FIBERGLASS: WHAT IS IT AND HOW IS IT MADE?

Fiberglass is a composite structural material that consists of fiber reinforcements, typically glass, that are bound together in a resin matrix. Unlike common fiberglass used in pools, boats, and storage tanks, fiberglass frames are produced via pultrusion, a process in which glass rovings and mats are pulled at tremendous force through a resin bath and a series of dies where the resin sets to the desired shape and the materials combine and catalyze to provide high tensile and torsional strength. These dimensionally stable fiberglass lineals are then assembled into window frames, which can be filled with foam insulation and glazed with high-performance low-E insulating glass for higher performance. Fiberglass window frames are produced similarly to vinyl, however where fiberglass is pultruded, or pulled, vinyl is extruded, or pushed, through a form to create a similar shape.

## ATTRIBUTES OF FRAMING MATERIALS

The window frame, which makes up some 20 percent of the total window area, is an important factor in a window's total performance.

### Wood

Wood is a readily available frame material, and the most common choice for homes. Strong and easy to work with, wood is a natural insulator and complements many forms of traditional home architecture. It can either be painted a solid color or stained and sealed to show off the wood grain.

Some significant downsides to wood windows have driven a switch to other frame materials. Wood frames require considerable maintenance to the exterior, with frequent touchups and occasional refurbishing, sanding and applying new coats of paint on a regular basis. Wood windows are also prone to rot, which can damage their integrity and make it difficult for the frames to hold paint. Some manufacturers of wood windows will offer cladding. However, some cladding materials can conduct heat and cold while others offer limited color options and cannot be painted. In addition to the inherent problems caused by varying expansion rates of two dissimilar materials, the wood beneath all cladding is susceptible to water damage that seeps behind the cladding material and rots the wood.

Wood's characteristics include:

- Available in custom colors and designs
- Provides excellent insulation
- Traditional look fits many home styles
- Susceptible to rot and water damage
- Requires maintenance

### Vinyl

A vinyl window can be inexpensive, durable and energy-efficient when designed properly to minimize thermal transfer. While early vinyl windows had problems with thermal expansion (the vinyl sash would expand or contract at a different rate from the glass and cause leaks) and stability in very hot environments, modern vinyl windows are much more durable and dimensionally stable. Vinyl window frames with heat-welded joints are stiffer than mechanically joined vinyl frames and thus provide better resistance to temperature stresses. Interior webs also strengthen the frame and improve its thermal performance.

Vinyl windows are made primarily from polyvinyl chloride (PVC) which is virtually maintenance-free. Vinyl frames can't easily be painted, but are often available in white and various neutral colors that complement many design schemes. Because the color permeates the material, scratches and dings are nearly impossible to see. New technologies have enabled some vinyl window manufacturers to paint vinyl, however, they must choose from a limited color palette and have the correct paint formulation in order to prevent deformation of the vinyl due to heat buildup.

Quality varies by manufacturer and composition of the vinyl compound, which will dictate its performance over time. Each additive to a vinyl recipe helps determine the long-term characteristics of the final product, such as its weather and impact resistance; for example, titanium dioxide allows the product to weather better, thus preventing it from yellowing. Differences in the vinyl recipe used and how vinyl parts are formed will determine the structural strength and insulation performance.

Vinyl's characteristics include:

- Energy-efficient
- Durable
- Non-corroding
- Maintenance-free
- Available in a wide range of styles and shapes
- Cost-effective
- Easy-to-install

Table 1 - Comparison of Frame Material Physical Properties

Property	Units	Vinyl <sup>2</sup>	Aluminum <sup>3</sup> (non-thermally broken)	Aluminum <sup>3</sup> (non-thermally broken)	Fiberglass <sup>2</sup>
Modulus	PSI	4.1 x 10 <sup>5</sup>	1.1 x 10 <sup>7</sup>	1.1 x 10 <sup>7</sup>	6.5 x 10 <sup>6</sup> **
Yield Stress	PSI	8,000	35,000	35,000	60,000
Thermal Conductivity (k)	BTu/hr-ft-°F	0.110	140	140	0.11
Coefficient of Expansion	in./in. °F	29 x 10 <sup>-6</sup>	12.3 x 10 <sup>-6</sup>	12.3 x 10 <sup>-6</sup>	4.4 x 10 <sup>-6</sup>
Heat Deflection Temperature	°F	135	N/A	N/A	280
U Value <sup>1</sup>	None	0.30	0.55	0.45	0.30

<sup>1</sup>Based on comparison of like-sized casement windows with double low-E (low solar gain) glazing

<sup>2</sup>Maximum practically achievable properties - values vary linearly with fiber volume fraction

Source 1: Residential Windows: A Guide to New Technology and Energy Performance, Second Edition, J. Carmody, S. Selkowitz, & L. Heschong, Oct. 2000.

Source 2: Principles of Polymer Engineering, McCrum, Buckley & Bucknall, Oxford University Press, Oxnard 1990.

Source 3: Perry's Chemical Engineer's Handbook, Sixth Edition, D. Green, McGraw-Hill, New York

### Aluminum

Because of their rigidity, durability and narrow frames, aluminum windows can be configured into a wide variety of combinations that maximize views. Aluminum windows are low-maintenance options, and will not rust or rot. They are available with tough anodized or baked-on finishes. The downside of aluminum windows in the past was the lack of energy efficiency. Aluminum readily conducts heat and cold. In cold weather, a building's heat seeps out through the sash and frame. Better quality aluminum windows are now available, equipped with thermal breaks that separate the interior and exterior surfaces of the window to improve energy efficiency.

Aluminum's characteristics include:

- Long-lasting, reliable operation
- Strong and durable
- Resists deterioration
- Narrow sight lines maximize view
- Slim frames complement modern architectural styles
- Durable factory-applied color options

### Fiberglass

Used in marine and industrial applications for years, it is only recently that manufacturers have been able to produce the complex profiles required for window designs. As a window frame material, fiberglass is known for its strength, durability and performance. It is inherently chemical-resistant and impervious to water, cold, heat, insects, the corrosive effectives of salt air and pollutants and deterioration due to ultraviolet rays, moisture, rot, oxidation, rust—all the traditional enemies of windows and doors. While wood, and to a lesser extent, vinyl and aluminum windows, can result in problems with warping, rotting, cracking, bowing and shrinking, fiberglass has a lack of brittleness, deterioration of surface finish and the highest resistance to warping and twisting. Throughout any climatic environment, fiberglass stays rigid, stable, and practically maintenance-free. Unlike wood, fiberglass frames won't crack from dryness, swell, peel or warp.

**Strength.** Fiberglass provides the strongest window material, with experts maintaining it is some three times stronger than aluminum and nine times stronger than vinyl. According to the American Architectural Manufacturers Association (AAMA), fiberglass profiles have roughly the same strength as steel (based on tensile strength). Its strength enables fiberglass to be fabricated in large sizes, accommodating large expanses of glass without requiring added support or reinforcement, making large picture windows possible and energy-efficient.

**High strength-to-weight ratio.** Its light weight gives fiberglass a high strength-to-weight ratio, adding to its suitability for large, complex profiles—benefits in both maximizing daylighting and enhancing historical accuracy in restoration projects.

## Cannery Row Hotel Gets Fiberglass Window Treatment

At California's InterContinental Clement Monterey Hotel, which opened in May 2008, fiberglass windows provided a variety of benefits. Comprised of two four-story buildings connected by an enclosed bridge over thriving tourist destination Cannery Row, the hotel features 208 guest rooms and suites luxuriously appointed with natural wood, marble and glass. Many of the rooms offer ocean views with some rooms directly over the water with panoramic views of Monterey Bay. Fiberglass sliding patio doors, single-hung and picture windows were specified to withstand the corrosive and moisture-laden air over many years of service—and were custom designed to recreate the aesthetic of vintage wood windows prevalent in the historic Cannery Row district.

Photo courtesy of Tom Rider



A coastal California Hotel is an ideal environment for fiberglass windows.

**Stiffness.** The high modulus of elasticity means fiberglass windows can withstand deformation or bending under load, which enables smooth operation over a long service life. Because it is strong and stiff,

fiberglass is easy to install. Fiberglass windows remain square and level and resist warping and twisting during installation, a common problem during installation with other types of windows. It is extremely hard and thus highly scratch, dent and impact-resistant, and its strength is unaffected by time or temperature.

**Compatible thermal expansion.** Because fiberglass frames are essentially glass fibers and resin, the frames expand and contract very little and at approximately the same rate as glass itself. If there is any expansion and contraction, the components expand and contract as a unit, unlike most window and door frames which have an interface of different materials: glass on wood, glass on aluminum or glass on vinyl. Aluminum is said to expand and contract three times as much as fiberglass and vinyl over seven times more. The minimal expansion and contraction of fiberglass puts less stress on the seals and frame-to-seal connection is maintained during temperature changes throughout the day and the seasons, thereby reducing the potential for air infiltration, a major cause of a building's loss of energy efficiency.

### Fiberglass Windows for a Historic Renovation

Reed College in Portland, Oregon, features Tudor-Gothic architecture and a forested canyon wilderness preserve at its center. When the school's Administration Building underwent a general upgrade and restoration, phase 1 included replacement of 200 windows. Pultruded fiberglass double-hung retrofit frames were installed. Because the requirements exceeded the usual height limitation for this line of windows, units were custom designed to match the historic references. The brick and granite fascia had to be equipped with dividers across the center of the middle and top story windows. On the interior, the clear vertical fir grain was easily matched with the existing finish. Fiberglass windows, which were also selected because of high energy efficiency and low environmental impact, replaced single-pane double-hung windows that had virtually no insulating value. The windows came with a ten-year commercial warranty. "This is an ideal product and a natural transition in the window industry to the next generation of products. It is a great looking window with many different configurations," noted General Contractor, Glenn Sheppard.



Custom-designed fiberglass replacement windows grace the campus of Reed College.



Fiberglass windows are virtually maintenance free.

**Natural insulation.** Fiberglass is a superior insulator as it is made from a simple polymer reinforced with thin strands of pulled glass. Air is trapped inside, and it will not conduct heat or cold, so that its temperature should be neutral to the touch. Because the insulation of fiberglass is so effective, and because the temperature outside will not warm or cool the actual fiberglass in the window itself, excess condensation will not form. Fiberglass' high condensation resistance helps keep humidity within a suitable range and limits the growth of mold and mildew.

**Low thermal transmittance.** Fiberglass' low U-factor, the ultimate determinant of energy efficiency, helps lower building operating costs and increase occupant comfort. Filling the fiberglass frames with foam insulation and glazing the windows with high-efficiency insulating glass adds substantially to window performance and to energy-efficient window strategies including passive heating and cooling and maximum daylighting to dramatically cut energy load and increase occupant comfort.

**Decorative options.** Fiberglass is eminently paintable, and takes paint easily with excellent adhesion. Fiberglass can accommodate liquid coatings such as water- and solvent-based acrylic enamels and polyurethanes as well as dry powder coatings; alternatively, pigment can be added to the resin. With low conduction of heat, and the stability in fiberglass, it can also be painted in a variety of dark colors.

**Cost.** One downside of fiberglass windows has been the cost, with prices running 20 percent to 30 percent more than the average vinyl window. A key factor here is the complicated pultrusion process, which is not as fast as the extrusion process used to fabricate vinyl or aluminum frames. However, with fiberglass manufacturers incorporating advancements in pultrusion, die design, fabrication, and assembly, larger quantities of fiberglass are being produced faster, with a corresponding drop in prices. In addition, while upfront costs of a fiberglass window may be higher than other window types, because of their durability, fiberglass windows may be a better value over time.

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Program title: "Fiberglass Fenestration Comes into its Own" (11/10, page 151). AIA/CES Credit: This article will earn you one AIA/CES LU hour of health, safety, and welfare/sustainable design (HSW/SD) credit. (Valid for credit through November 2012). **Directions:** Refer to the Learning Objectives for this program. Select one answer for each question in the exam and fill in the box by the appropriate letter. A minimum score of 80% is required to earn credit. **To take this test online and avoid handling charge, go to [ce.architecturalrecord.com](http://ce.architecturalrecord.com)**

1. Most recently, manufacturers have introduced a line of windows that have:
  - a. fiberglass frames.
  - b. wood exteriors and fiberglass interiors.
  - c. fiberglass exteriors and wood interiors.
  - d. combination fiberglass vinyl frames.
2. Fiberglass frames are produced via:
  - a. extrusion.
  - b. pultrusion.
  - c. casting.
  - d. machining.
3. The wood beneath all cladding is:
  - a. susceptible to water damage.
  - b. airtight.
  - c. rot proof.
  - d. a poor insulation.
4. Vinyl window frames with heat-welded joints:
  - a. fail when subjected to temperature stresses.
  - b. are weaker than mechanically joined vinyl frames.
  - c. provide better resistance to temperature stresses.
  - d. are impervious to temperature changes.
5. Better quality aluminum windows are equipped with thermal breaks that:
  - a. eliminate space between the interior and exterior surfaces of the window.
  - b. maximize daylighting potential.
  - c. enhance views.
  - d. separate the interior and exterior surfaces of the window.
6. According to the AAMA, fiberglass profiles have roughly the same strength as:
  - a. steel.
  - b. aluminum.
  - c. wood.
  - d. vinyl.
7. The minimum expansion and contraction of fiberglass ultimately:
  - a. results in better views.
  - b. increases the U factor.
  - c. reduces the potential for air infiltration.
  - d. represents a drawback vs. aluminum windows.
8. Window systems should be impervious to water, yet a common window problem is:
  - a. penetration of moisture.
  - b. condensation.
  - c. heat transfer.
  - d. structural integrity of the glass.
9. On fiberglass frames, powder-coated exterior finishes provide:
  - a. questionable color stability.
  - b. a finish prone to sagging.
  - c. better color stability.
  - d. increased scratches and gouges.
10. Fiberglass windows easily exceed the new ENERGY STAR® requirements.
  - a. True
  - b. False

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# Solar Lighting: Making Steps Off-Grid towards a Sustainable Future

New tools provide design professionals with cleaner alternatives to fossil fuel.

Provided by SELUX Corporation

By James Brigagliano

Providing sustainable, energy-efficient lighting systems, while maintaining performance and aesthetically pleasing forms, is sure to be one of the greatest challenges for architects and design professionals in the 21st century.

Global attention to climate change and environmental disasters, such as “The Gulf Oil Spill,” has intensified the spotlight on environmentally conscious design and the use of renewable energies. According to the U.S. Department of Energy (DOE), residential and commercial buildings consume more than one third of the energy used in the United States each year. Lighting for commercial buildings accounts for 25 percent of this energy usage. LEED, ASHRAE/IESNA 90.1 and California Title 24 have helped drive design professionals to respond with innovative solutions to achieve their design intent. Manufacturers are challenged with providing energy-efficient and environmentally friendly products to meet market demands while evaluating their own carbon footprint in the process.

Photovoltaics (PV) is a solar energy technology that uses semi-conductors to directly convert solar radiation to electricity. Charge controlled stand-alone PV exterior lighting systems will be discussed to provide the knowledge needed to successfully specify and apply this new technology.

## BENEFITS OF USING SOLAR-POWERED LIGHTING

**Cost savings.** The decreasing cost of PV modules and increasing costs of electricity only strengthen the existing benefits of using



Solar lighting extends usability of a popular bike path in Madison, WI.

solar-powered lighting. Possibly the greatest benefit of solar lighting is the ability of the system to operate without the presence of an electrical infrastructure. As the distance from a project site to a source of electricity increases, the time it will take to pay off a solar-powered lighting system will decrease. In addition to eliminating the need to trench, backfill and route conduit and wire, electrical distribution equipment such as transformers, circuit breakers and controls are no longer needed, and therefore a solar lighting system requires less man hours to install compared to traditional lighting systems. Not having to verify underground utilities, obtain electrical permits or schedule electrical inspections simplifies project coordination. Along with the above mentioned cost savings, an owner or municipality will not pay an electricity bill for the life of the system.

**Convenience/flexibility.** Installing traditional electric lighting in sensitive project sites with existing hardscape and landscape features may be prohibitive due to the high cost of restoring the site to its original condition (e.g., memorial sites, registered historic landmarks, and areas densely packed with underground utilities). Examples

### CONTINUING EDUCATION



Use the learning objectives below to focus your study as you read **Solar Lighting: Making Steps Off-Grid towards a Sustainable Future.**

To earn one AIA/CES Learning Unit, including one hour of health safety welfare credit and sustainable design, answer the questions on page 161, then follow the reporting instructions or go to [ce.architecturalrecord.com](http://ce.architecturalrecord.com) and follow the reporting instructions.

#### Learning Objectives

After reading this article, you should be able to:

- Explain the benefits of using solar-powered lighting.
- Identify the components of an off-grid solar luminaire.
- Discuss how to choose a light source/luminaire.
- Describe how systems are sized to meet clients' needs.
- Assess which applications are best suited for off-grid solar lighting.

like this point out how off grid solar lighting can add convenience when lighting is required, even if electricity is present on site. Another convenience may be realized during utility power outages. The off-grid lighting will continue to operate allowing the owner of the system to experience first hand the benefits of their investment at work.

**Environmental impact.** Design professionals and owners who want to minimize their impact on the natural environment have plenty of reasons to go solar. Using a renewable energy source, such as the sun, to power lighting eliminates the need to burn additional fossil fuels for power generation and reduces the production of carbon dioxide released into the atmosphere. Solar lighting systems by design are sustainable long-life products. Most solar panel manufacturers offer warranties on power output of their modules from 15 to 25 years. For this reason solar-powered lighting manufacturers attempt to engineer systems with components and finishes that will perform as long as possible. Low wattage optimized lighting distribution ensures that every lumen generated by the lamp is directed to the specific task at hand. This affects the environment by preventing any stray light from polluting the night sky, reducing light trespass onto neighboring properties and controlling high angle brightness to improve visual comfort and performance.

**Design professionals and owners who want to minimize their impact on the natural environment have plenty of reasons to go solar.**

**Meeting design guidelines and energy codes.** Today, design professionals are often required to meet strict Lighting Power Densities for exterior lighting as outlined in ASHRAE/IESNA 90.1. This is a clear advantage for solar lighting which uses zero watts per square foot of utility electric. Lighting performance criteria is usually outlined in some form by ordinance, code or guideline. Light output and distribution of solar-powered luminaires today have the ability to meet challenging criteria being enforced by project mandates and municipalities.

### COMPONENTS USED IN OFF-GRID SOLAR-POWERED LUMINAIRES

All off-grid solar-powered lighting systems use five basic parts including a charge controller, battery, panel, luminaire and balance of system (BOS). Miscellaneous parts such as wiring, pole, enclosure, mounting, etc. are all included in the BOS.

**Charge controller.** The charge controller is a critical component of an off grid solar lighting system. Some of the key tasks of a charge controller are to regulate battery charge from the PV modules, maintain the batteries at their highest state of charge and prevent overcharging or over discharging. All of these features help to maximize the battery performance and life. Charge controllers with load control also manage energy flow



Innovative design for a large parking facility in AL

between modules, batteries and the load. In this case, the load is the luminaire which can be programmed to operate on a specific time schedule (e.g., a luminaire may turn on for 8 hours after sunset, turn off for 4 hours and then turn on again until sunrise). The latest innovations in charge controller technology are Maximum Power Point Tracking (MPPT) and Pulse Width Modulation (PWM). Voltage and current produced by a PV module change independently depending on temperature and irradiance conditions. Irradiance refers to the intensity of available solar resource. MPPT controllers use electronics to increase the total watts produced by taking advantage of the maximum voltage and current values generated by the module during actual operating conditions. Colder climates tend to see the largest boost in performance by this technology with efficiency increases up to 30 percent. PWM is a technology that can be used for battery charging or switching LED-based lighting. The technology switches a series device on and off at a high frequency and for variable lengths of time. PWM charging can maintain a higher battery state of charge and increase the life of the battery. A PWM output can cycle LEDs on and off at such high frequencies that no visual change is noticed while energy consumption is reduced.

**Batteries.** Valve Regulated Lead Acid (VRLA) deep-cycle batteries are the most common battery technology used in PV systems. Gel and Absorbed Glass Matt (AGM) are both VRLA batteries commonly used for their many advantages. These batteries have the ability to handle deep discharge cycles and have low self discharge rates. They are also fast to recharge, require no maintenance and have low to no off gassing. Being of the non-spill and low off-gassing type allows Gel and AGM batteries to be transported by air; a big advantage for distribution. Operating temperature of a battery affects the internal resistance and its ability to hold a charge. A multiplier can be applied to batteries operating at temperatures below 80 °F to determine reduced capacity. The capacity of a battery is measured in Amp-hours (Ah) and is typically specified at a 20-hour rate. This



means a battery with a 100Ah capacity will operate at a discharge rate of 5 Amps for 20 hours. ( $5A \times 20h = 100Ah$ ). If the battery is operated at a higher discharge rate, it will produce less than the rated capacity. For example, a 100Ah battery operated at a 10-hour rate (10A) will produce approximately 60Ah of capacity. Warranties offered for some VRLA Gel and AGM batteries can range up to five years, but years can be added to the overall life when operating conditions are favorable.

**Panels.** PV modules typically utilize one of three main cell technologies, mono-crystalline, poly-crystalline and ribbon silicon. These cell types convert solar radiation to electricity with an efficiency of approximately 11 percent to 18 percent. Efficiency and cost tend to go up together and forces other factors such as available area and application of the module to determine which technology should be used. Mono-crystalline modules offer the highest efficiency at 14 percent to 18 percent but also have the highest manufacturing cost. Poly-crystalline modules are 11.5 percent to 14 percent efficient and they tend to have the best balance of cost, efficiency and size. Ribbon silicon otherwise known as amorphous thin film has the lowest efficiency at 11 percent to 13 percent and requires a larger area to produce the same amount of power versus mono-crystalline and poly-crystalline. Amorphous thin film does however have some unique performance advantages making it desirable for specific applications such as when primarily diffuse sun light is available. Utilizing diffuse sunlight better allows this cell technology to tolerate shading and produce more power from early morning and late day sunlight. New technologies such as bi-facial cells and total internal reflection modules are being developed but have not been studied in practice long enough to break into the mainstream.

**Luminaire.** In order to make the most of the power generated by the power source an efficient and effective luminaire must be used. A luminaire is a light fixture complete with a lamp, voltage regulator (electronic ballast), luminous opening with or without a lens and a connection to a power source.

**Balance of System (BOS).** Electrical and structural components, aside from the major components make up the Balance of System.

Mounting rack for solar panels, housing of the batteries, pole and all inter-wiring are examples of the BOS for an off grid solar lighting unit. Quality of these parts is important to the overall life of the system. Aesthetics are also dependant on the parts and pieces selected to integrate the major components into a single package. Currently available systems range from very basic raw parts and pieces to architecturally attractive forms.

Explanation of Lighting Metrics

Term	Basic Explanation	Measurement
Luminous Flux	Amount of light emitted in all directions	lumens (lm)
Luminous Intensity	Intensity of light in a specific direction	candelas (cd)
Illuminance	Total luminous flux incident on a surface	lux or footcandles
Luminance	Amount of light reaching the eye after reflecting off a surface.	candelas/m squared

Source: IESNA Lighting Handbook, 9th Edition

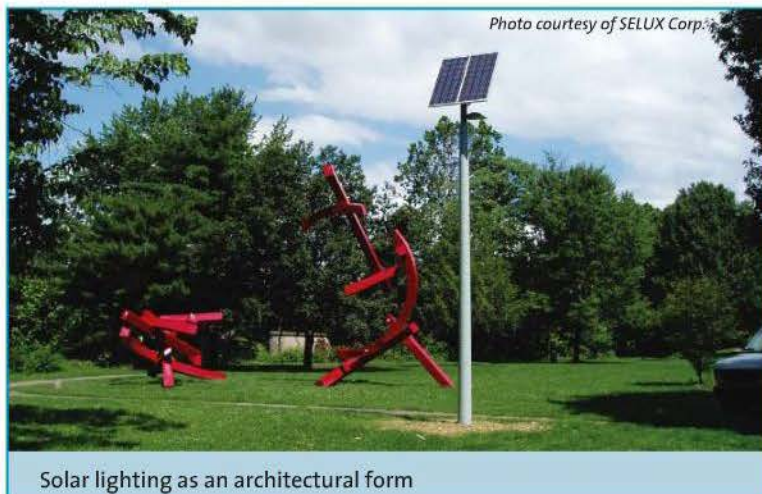
## CHOOSING THE RIGHT LUMINAIRE

**Identify the lighting needs.** With the cost of solar lighting systems ranging widely depending on size, it is best to identify how much light is really needed for an application. In addition to the quantity of light, the amount of hours the system must provide a specific light level each night has a big impact on system size and, therefore, cost. Review the use of your project site; will there be pedestrian activity all hours of the night, or only until a certain time? If lighting can be dimmed or turned off after that time the size and cost of the system will decrease. If security is a concern and illuminance must be maintained at a high level from dusk until dawn the system size and cost may increase significantly. Attention to these considerations when specifying solar lighting will ensure that the owner of the system pays for only the performance that the project will require.

In 1997 the Commission Internationale de l'Eclairage (CIE) defined lighting zones that would typically have different lighting requirements. The IESNA and LEED rating system have both adopted this method of classifying a project site into one of four zones. Environmental Zones E1 – E4 provide descriptions of each zone and recommended maximum illuminance levels for each.

Environmental Zone E1, for example, is described as an area that is intrinsically dark, such as a park or residential area where controlling light pollution is a high priority. Areas classified as E1 will allow lower maximum illuminance levels compared to a project site classified as an environmental zone E2, E3, E4. Environmental Zone E4 allows the highest maximum illuminance levels and is described as areas of high ambient brightness such as an urban environment or areas experiencing high levels of nighttime activity (Source: IESNA – RP-33-99 *Lighting for the Exterior Environment*).

Recommended illuminance levels, uniformity levels and other important lighting criteria are published by the Illuminating Engineering Society of North America. This is a good basis for selecting illuminance levels if no lighting criteria are specified by the local municipality or project.



Solar lighting as an architectural form

**Choosing a light source.** Choosing the best light source or lamp type for an application has an impact on security, maintenance, public acceptance and aesthetics. At night this is the component of the system that will receive the most attention, positive or negative. Some lamp types used in solar lighting are Compact Fluorescent (CFL), Induction Lamps, High Pressure Sodium (HPS), Metal Halide (MH) and Light Emitting Diodes (LED). LED sources will be discussed in more detail when we compare LED luminaires to luminaires using traditional lamping.

Key lamp characteristics for solar lighting are Lamp Efficacy, Correlated Color Temperature (CCT), Color Rendering Index (CRI), Rated Life and Lumen Maintenance. Lamp efficacy in basic terms is how many lumens are produced by a lamp divided by the wattage used to operate that lamp. Correlated Color Temperature is stated as degrees Kelvin and generally describes the hue of the light. Incandescent lamps have a CCT value of 2700K (warm reds-yellows-pinks) and natural daylight is more in the range of 6500K (cool blues-whites). CRI uses a scale 1 to 100 and rates the ability of a light source to render color of an object faithfully compared to a full spectrum natural light source. Rated Life is determined by testing a group of lamps under specified conditions until 50 percent of the lamps burn out. This is considered the average rated life of the lamp. Lumen Maintenance varies by source type; all light sources have depreciation in light output over time. By dividing the mean lumens of a lamp (output at mean life of lamp) by the initial lumens you can determine the lamp lumen depreciation for that source. Now that we know which lamp characteristics are most important to compare we can begin to analyze the different sources to see where they may be best applied. The information below is based on specific lamps and generally represents the performance of their group.

At the top of the lamp comparison chart we see information for a Metal Halide T6 lamp. T6 is a small, point source type of Metal Halide lamp. The small burner or “point source” of the T6 lamp is easier to control than a larger diffuse source which allows for a more precise distribution. Ranked highest for its superb CRI value the Metal Halide T6 lamp provides accurate color representation which can be an advantage when security is a concern or when crisp accurate color is your priority. Efficacy of this lamp is also something to note. It is producing more lumens per watt than any other lamp group, making it a great match for use with a solar lighting system when every watt counts. Metal Halide T6 lamps do not respond well to dimming. This lamp type also has the shortest life at about 3 years if operated for an average of 12 hours per day, per year.

The next lamp group in our chart is the Compact Fluorescent Lamp (CFL). Once scrutinized during early commercialization, Compact Fluorescent lamps have improved dramatically and are now well accepted by the public and design professionals alike. A good

balance of lumen maintenance, color, efficacy and life make the CFL a good choice for a variety of applications. Compact Fluorescent lamps do go through a warm up period to reach full brightness and color stability. This will be more noticeable in cold climates.

Induction lamps are less commonly used but certainly have their place for specific applications. The large diffuse source and associated generator can provide an impressive 100,000 hours of operation. Best applications for induction lamps are areas difficult to access or areas that demand the longest possible operating life. Color, efficacy and lumen maintenance are all adequate for most exterior lighting environments. The size of the lamp and generator make these lamps difficult to integrate into small forms and precision optical systems.

High Pressure Sodium (HPS) lamps are commonly used in street lighting for their excellent lumen maintenance and long life. This lamp group is easy to identify at night due to the pinkish color of light and low color rendering abilities. These attributes can make it difficult to identify approaching people or even your car in a parking lot. For these reasons HPS lamps should not be used when security is the overriding factor of a project.

### Choosing the best light source or lamp type for an application has an impact on security, maintenance, public acceptance and aesthetics.

Light Emitting Diodes (LED) as a technology is not new, but the use of LEDs in commercial and residential lighting is. Similar to the introduction and commercialization of compact fluorescent lamps, there is a learning curve taking place for consumers, specifiers and manufacturers. Testing procedures and standards for LED lighting are still being created and adjusted as research continues and performance improves. Being an electronics-based technology much of the lighting world has had to retrain staff and gather new skill sets to become experts in the field. Such excitement about the technology has influenced many to make the leap to LED lighting without doing their homework. There is a wide variety of quality in LED lamps and luminaires available today. Due to varying quality, exaggerated claims and the fear that public acceptance may be harmed has spurred the U.S. Department of Energy (DOE) and the Next Generation Lighting Industry Alliance (NGLIA) to create the Lighting Facts Program. Lighting Facts is a voluntary pledge program to assure that LED lighting products are represented accurately in the market. The program requires submission of independent testing results from certified labs; upon approval the certified specifications are compiled into a label that can be used for marketing purposes. Having the label will not only provide vital performance information but will also allow the consumer to be confident that they are getting the performance claimed. Comparing solar lighting systems involves understanding performance and distribution of the luminaire, quality of components, as well as achievable runtimes and light levels. As with many technical products it is wise to consult with manufacturers to get answers to these questions in order to make the most appropriate selection for a project and ensure successful implementation of the technology.

Continues at [ce.architecturalrecord.com](http://ce.architecturalrecord.com).

Light Source Technology Comparison

Lamp Group	Watts	Initial Lumens	Lumen Maintenance	CCT	CRI	Efficacy	Life
Metal Halide (T6)	39	3300	80%	4200K	90	85	12,000
CFL	32	2400	85%	4200K	82	75	16,000
Induction	55	3500	80%	4000K	80	64	100,000
HPS	35	2250	90%	2100K	21	64	24,000
LED*	N/A	N/A	85%	5000K	82	64	50,000

Source: SELUX Corporation

\* Installed performance of typical LED light engine

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Program title: "Solar Lighting: Making Steps Off-Grid towards a Sustainable Future" (11/10, page 157). AIA/CES Credit: This article will earn you one AIA/CES LU hour of health, safety, and welfare/sustainable design (HSW/SD) credit. (Valid for credit through November 2012). **Directions:** Refer to the Learning Objectives for this program. Select one answer for each question in the exam and fill in the box by the appropriate letter. A minimum score of 80% is required to earn credit. **To take this test online and avoid handling charge, go to [ce.architecturalrecord.com](http://ce.architecturalrecord.com)**

1. Maximum Power Point Tracking (MPPT) charge controllers provide the biggest benefit to system performance in what kind of conditions?
  - a. Hot and sunny environments
  - b. Locations closest to the equator
  - c. Colder climates
  - d. Areas with diffuse sunlight
2. According to the IESNA Environmental Zones E1, E2, E3, and E4, what type of site would be considered an environmental zone E1?
  - a. Intrinsically dark areas, such as parks
  - b. Areas of high ambient brightness, such as urban environments
  - c. Areas with the coldest night time temperatures
  - d. Both a. and c.
3. The testing method developed specifically for LED luminaires is called:
  - a. relative photometry method.
  - b. electroluminescence photometry method.
  - c. LED photometry method.
  - d. absolute photometry method.
4. A light source with a CCT value of 6500K could be described as:
  - a. warm with reds, yellows and pinks.
  - b. darker looking.
  - c. cool with blues and whites.
  - d. both b. and c.
5. The IESNA luminaire classification system evaluates luminaires based on:
  - a. full cut off, cut off, semi cut off and not-cut off ratings.
  - b. lumen values in 10 different solid angles.
  - c. Type I, Type II, Type III, Type IV and Type V distributions.
  - d. light source used in the luminaire.
6. A good solar-powered luminaire will:
  - a. eliminate stray light in the night sky.
  - b. reduce light trespass.
  - c. control high angle brightness.
  - d. all of the above.
7. What are the three pieces of information needed to size a Solar Lighting System?
  - a. Input watts, run time, elevation
  - b. Days of autonomy, run time, location
  - c. Input watts, mounting height, location
  - d. Location, input watts, run time
8. Solar radiation data sets are generated from \_\_\_\_ years of collected data.
  - a. 10
  - b. 30
  - c. 50
  - d. 60
9. What program by the U.S. Department of Energy and Next Generation Lighting Industry Alliance was introduced to support the commercialization of LED lamps/luminaires?
  - a. The International Dark Sky Program
  - b. The Lighting Facts Program
  - c. The BUG Rating Program
  - d. NGLIA LED Program
10. Which PV cell technology has the highest efficiency?
  - a. Ribbon silicon
  - b. Poly-crystalline
  - c. Amorphous thin film
  - d. Mono-crystalline

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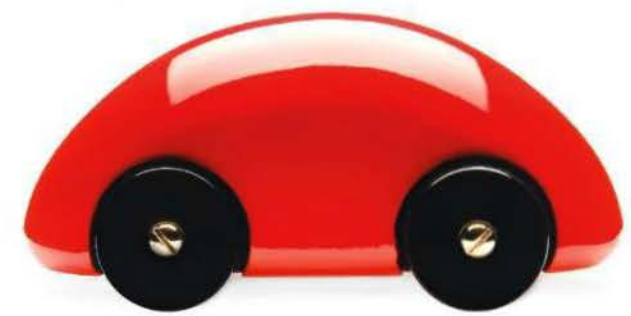
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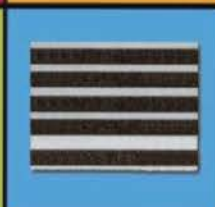
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# Building Movement Joints and BIM

Computer modeling allows greater visualization, functionality, and design success in creating buildings that are allowed to move safely.

Provided by Nystrom, Inc.

By Peter J. Arsenault, FAIA, NCARB, LEED-AP

Most of us learned in school that, contrary to public perception, buildings move. Specifically, different portions and parts of buildings move relative to each other and in so doing create forces and stresses on building materials. This is a fairly straightforward concept to comprehend in theory, but in practice there are many variables and differing conditions to consider. Nonetheless, textbooks and trade publications tell us that every designer of buildings must develop a sure sense of where movement joints are needed and a feel for how to design them. Examples are often given of numerous buildings that are built each year designed by professionals who have not acquired this intuition. The result is that many of these buildings are filled with cracks even before they have been completed. Worse, some develop significant material and structural failures that require costly retrofit approaches that could have been avoided if the design were proper in the first place. This article will look at some of the science and the art of incorporating appropriate movement joints into buildings and how to use Building Information Modeling (BIM) as an effective tool in the process.

## SOURCES OF FORCES

The movements within a building are recognized in a number of standards, mostly as they relate to materials and civil/structural engineering. For example, the American Society of Civil Engineers (ASCE) publication 7-02 titled “Minimum Design Loads for Buildings and Other Structures” states, “Dimensional changes in a structure and its elements due to variations in temperature, relative humidity, or other effects shall not impair the serviceability of the structure.”



This statement first recognizes that there are a number of potential causes of internal forces that must be taken into account in the building design. It goes on to point out that it is the serviceability of the structure that is being protected. Such serviceability might include things like the integrity of a material, the overall structural system, the use of the building, or its ability to remain weather-tight. In essence, there is recognition here that buildings that do not contain appropriate movement joints will inevitably create their own at the points of maximum stress such that cracks, spalling, or outright breaks or failure of a material can occur.

There are at least six generally recognized forces that cause movement in buildings along with potential problems as identified below:

**Thermal expansion and contraction.** It is well documented and understood that heat causes solid materials to expand and cold causes them to contract. In situations where materials are unrestricted on at least one end, then there is really no problem—they will grow

## CONTINUING EDUCATION



Use the learning objectives below to focus your study as you read **Building Movement Joints and BIM**. To earn one AIA/CES Learning Unit, including one hour of health safety welfare credit, answer the questions on page 169, then follow the reporting instructions or go to [ce.architecturalrecord.com](http://ce.architecturalrecord.com) and follow the reporting instructions.

### Learning Objectives

After reading this article, you should be able to:

- Identify the stresses that are imposed on buildings which require the use of expansion joints.
- Differentiate and distinguish among standard types of expansion joint systems.
- Investigate different expansion joint applications, particularly through the use of Building Information Modeling (BIM).
- Specify and design appropriate expansion joints into architectural projects.

and shrink without impact on things around them. However, when the materials are rigidly connected to other materials, the expansion and contraction pushes or pulls on the adjacent connecting materials causing structural forces of stress and strain. How much movement and how much force will depend on at least two variables: the material itself and the variation in the amount of heat or cold.

Coefficients of linear expansion for different materials. Table 1

Materials	Coefficient of Expansion (in/in/°F)
Wood	$3.0 \times 10^{-6}$
Clay or Shale Brick Masonry	$3.6 \times 10^{-6}$
Lightweight Concrete Masonry	$4.3 \times 10^{-6}$
Glass	$4.4 \times 10^{-6}$
Limestone	$4.4 \times 10^{-6}$
Granite	$4.7 \times 10^{-6}$
Normal Weight Concrete Masonry	$5.2 \times 10^{-6}$
Concrete	$6.0 \times 10^{-6}$
Cast Iron	$6.1 \times 10^{-6}$
Structural Steel	$6.5 \times 10^{-6}$
Wrought Iron	$6.7 \times 10^{-6}$
Marble	$7.3 \times 10^{-6}$
Copper	$9.3 \times 10^{-6}$
Bronze	$10.0 \times 10^{-6}$
Brass	$10.4 \times 10^{-6}$
Aluminum	$12.8 \times 10^{-6}$

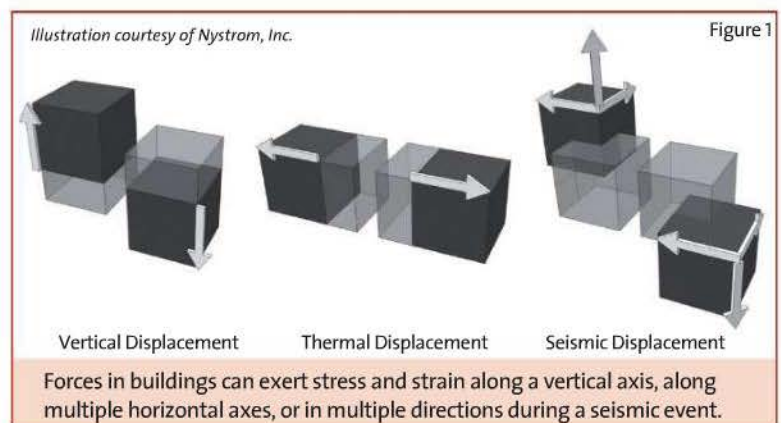
The smaller the number, the less thermal expansion per degree Fahrenheit  
 Courtesy of Nystrom, Inc.; compiled from various data.

Every material has, among its other physical properties, a thermal sensitivity factor that is expressed as a coefficient of linear expansion. Because this physical property is so well known, virtually all common building engineering materials have been tested and coefficients of expansion (contraction) have been determined. These coefficients are expressed in terms of very small fractions of an inch for each degree Fahrenheit of temperature change (see Table 1). At the low end of the scale, wood and glass tend to expand and contract the least when subjected to temperature changes while metals such as bronze, brass, and aluminum tend to move the most.

The amount of heat or cold that affects a material depends on its source. Materials exposed to the weather throughout the year will experience the cyclical daily, weekly, monthly, and annual changes relevant to the local climate. That means that the materials could be exposed to temperature swings of up 100 degrees or more in some locations over the course of a year with instances of 30 to 40 degrees of temperature swings possible within 24 hours. Materials that are kept inside a heated and cooled space may experience very little temperature change, perhaps 20 degrees or so. In addition to the air temperatures, there may also be isolated sources of heating and cooling that occur both inside and outside such as direct sun exposure, mechanical equipment proximity, industrial processes, etc. Since the amount of movement of a material is a direct result of the difference between the starting temperature and the ending temperature that is experienced, planning for the correct range is significant.

**Water impact.** Water in the form of vapor, rain, or other precipitation can cause materials to expand and contract if they are porous or if their water protection is compromised. In normal temperatures, water can soak into certain materials, including many masonry products, causing them to swell. As the water evaporates, the material will shrink back. Either form of movement may cause forces on the material affected or on adjacent materials. In freezing climates, the presence of water takes on an additional concern. Water is one of the few materials that performs inversely to most materials, meaning that it expands as it gets colder (freezes) and contracts as it gets warmer (unfreezes). Hence, water that seeps into a crack or opening in a building might harmlessly drain away or evaporate. However, if it gets trapped inside a material and freezes, it will expand and cause significant force on that material. This force is one of the chief causes of spalling in masonry and concrete work.

**Vertical displacement.** It is important to realize that buildings can move in all directions (see Figure 1). Movement of a building in the vertical direction might occur from thermal or moisture impacts as described above, but it is likely to be more significant if differing soil and foundation conditions are encountered across a building. Different portions or wings of a building may be of different heights and sizes and therefore will likely have different types of foundation designs. Where these different foundations meet, there may be a difference in the rate or amount of settlement that occurs on between the two. This condition might also apply or be exacerbated by different soil conditions that respond differently to the building loads imposed on them. The differences are usually calculable and can be accommodated in the design, but allowing for the vertical displacement that may occur regardless of the compensating design, is obviously more prudent.



**Lateral shear.** Horizontal forces on a building can come from things such as wind loading or external building attachments. These forces can be accounted for in the basic structural design, but it may well be within normal tolerances to allow for some level of movement, particularly at extreme “worst case” conditions.

**Seismic forces.** Designing a building to survive the multiple forces of an earthquake is clearly more involved than a single directional force. Seismic forces can affect a building in any direction along multiple horizontal and vertical axes. The degree of these forces that need to be



addressed are mandated by codes and good structural system design standards. Allowing portions of a building to move independently from one another during an earthquake is a proven method to address the impact of those seismic forces.

**Construction forces.** Certain materials may experience or exert particular forces during construction. For example, the chemical process of concrete curing causes it to shrink and possibly crack. Masonry may swell and shrink during installation and set up. Materials that are designed to be used in spaces that are heated and cooled may be subject to weather conditions during construction that they weren't otherwise designed for. All of these potential construction forces need to be taken into account.

**DEGREES OF SEPARATION**

The fundamental approach of separating a material, a building system, or the building itself into independent portions or sections is the starting point for all movement joint discussions. This requires a basic understanding of different types of joints, their general impact on the building, and where they are used. BIM can be an incredibly useful and important tool not only to locate key areas where different joints should be used, but also to detail and integrate the joints into the rest of the construction. Full three dimensional modeling of a building will demonstrate critical areas for joints to occur between the structural system and other materials and building systems. Integration of the details of these joints will necessarily need to be cross discipline affecting the design of the structure, architecture, interiors, roofing, and in some cases, the mechanical systems. Hence the cross-discipline capabilities of BIM will prove highly valuable in correctly locating and coordinating the design of building joints of all types. It is important to acknowledge that the joint must be calculated and sized in terms of its minimum and maximum opening, with the average opening often being its nominal size (see Figure 2). The common types of joints are described below in terms of the type of gap or separation that is needed. In the subsequent section we will discuss how to fill, cover, or otherwise treat these joints.

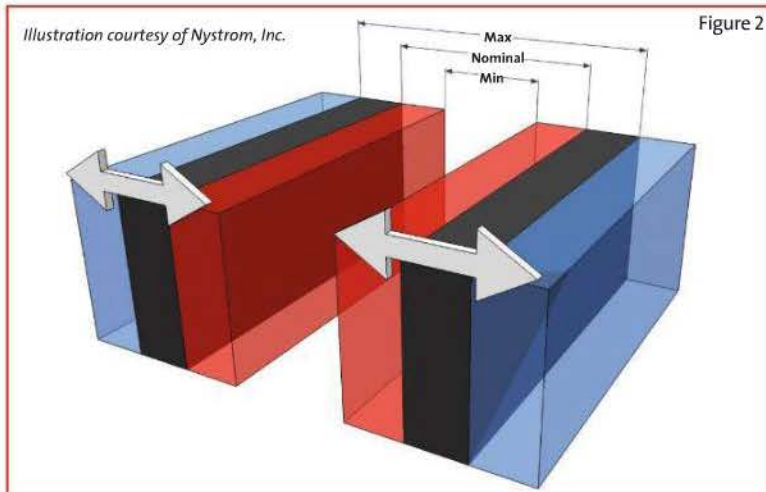
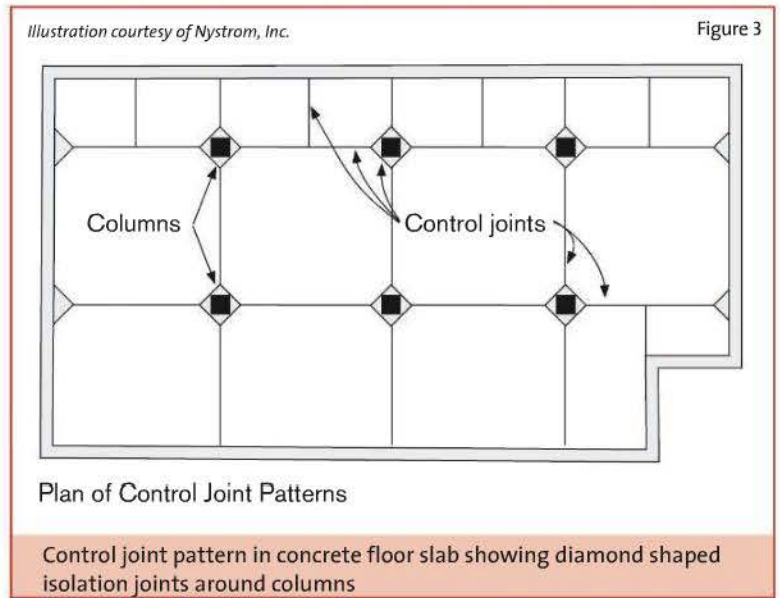


Figure 2

The use of BIM can help determine the nominal, minimum and maximum joint size and show the impact of expansion and contraction on building systems.

**Control joints (also called construction joints).** This is one of the most common types of joints and is typically described as an intentional line or break that is created in the surface of a material. Its role is to encourage and direct anticipated cracking in an orderly manner instead of random, uncontrolled cracking. Control joints are almost always used in concrete floor and wall surfaces which are prone to cracking due to shrinkage during curing (see Figure 3). They may also be used in masonry construction to absorb other forces. In any case, they typically are spaced fairly close together meaning that the amount of force that each control joint is absorbing is relatively small. As such, they do not usually fully penetrate all layers of a structure, rather are cut about 25 percent or so into the depth of the material. The spacing of control joints across a smooth plane such as a wall, floor, or roof surface will vary and depend on the material used as shown in Table 2.



Plan of Control Joint Patterns

Control joint pattern in concrete floor slab showing diamond shaped isolation joints around columns

Recommended control joint spacing for various materials

Table 2

Materials	Control Joint Spacing
Concrete Slabs on grade	24 times slab thickness - rectangular sections should restrict longer side to 1.5 times shorter side
Concrete exterior walls	Every 20 feet
Type I Concrete masonry walls	
Unreinforced:	The lesser of 40 feet or twice the wall height
Reinforced:	The lesser of 50 feet or three times the wall height
Type II Concrete masonry walls	
Unreinforced:	The lesser of 20 feet or twice the wall height
Reinforced:	The lesser of 25 feet or three times the wall height
Stucco Walls	10 feet

Some general "rules of thumb" are shown, but should be verified for particular projects based on specific project conditions.

Courtesy of Nystrom, Inc. ; compiled from various data.

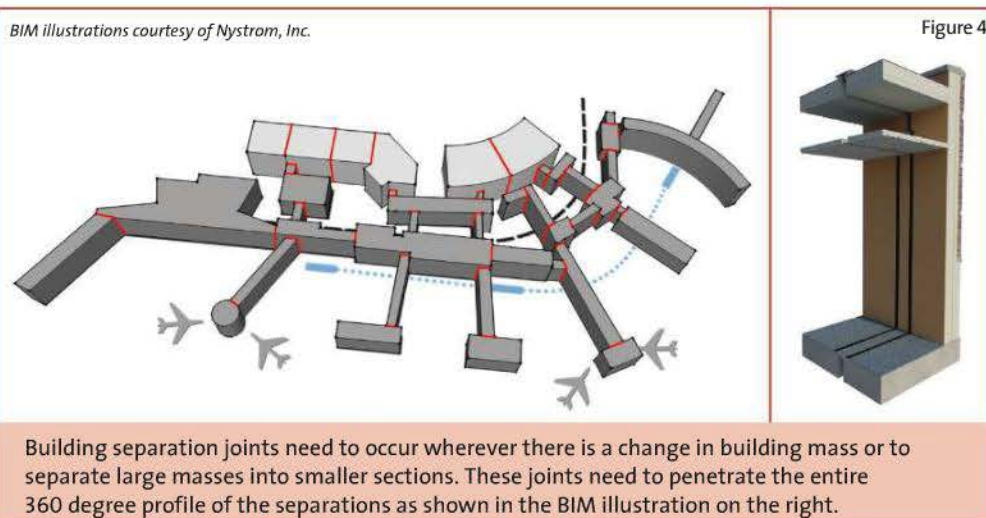
**Structure/enclosure joints (sometimes called isolation joints).** Any place in a building where a non-structural component meets a structural component the potential exists for an unwanted transfer of forces. Hence, a full-depth joint or separation between these

components is needed. Examples of this type of joint would include the top of a non-load bearing partition that connects to the underside of a structural floor slab or a non-structural exterior wall or spandrel panel that connects to a structural frame. When the different components are comprised of different materials, the rate of expansion or contraction will be different even though they are exposed to the same conditions. Hence the separation is intended to allow the resulting differences in movement instead of transferring a structural force onto a non-structural component. This might be accomplished by the use of a combination of rigid and flexible anchors along with gaps between the sections of

non-structural components to allow each piece to float or move independently from the other. In some cases, such as a concrete slab on grade adjacent to a concrete foundation wall, a separation is warranted even though the materials are the same. The reason here is due to the fact that the two components will settle (vertical displacement) differently due to the different loading conditions that each are subject to—the wall carrying significantly more weight in the form of structural building loads while the slab on grade is typically carrying only its own weight and any live loads. The differences between the forces transferred to the soil could cause different settlement conditions over time, causing cracking or failure if not isolated. Around columns, it is common to use diamond-shaped isolation joints that meet with concrete control joints to cleanly address multiple forces.

**Abutment joints.** In building situations where two different types of construction meet or abut each other, a full depth joint is needed. This is common in cases where, for example, a framed wall system abuts a brick or masonry wall system. Each system can be expected to move at different rates due to the same or different forces that each one is subjected to. Hence, the separation is made wide enough (typically 1/2 inch or less) to allow the movement based on the size of the abutting systems and the spacing of other types of joints in each system. Abutment joints are also needed wherever new construction abuts with older construction, even if the materials are the same. New masonry mortar will typically shrink as it sets, so if it is tied in or interleaved with existing mortar, it will cause cracking and breaking. Instead, a continuous, flexible separation that completely separates the old from the new will prevent this from happening. Regardless of material or construction types, abutment joints are also appropriate wherever a building portion that is heated or cooled abuts a portion that is not similarly heated or cooled such as a warehouse or canopy. The different temperature conditions will result in different amounts of thermal expansion and contraction which need to be accounted for.

**Building separation joints.** In large buildings or buildings with multiple wings, towers, or other distinct sections, particular attention needs to be paid to separating these sections to avoid the transfer of



forces from one section to another. While these building separation joints are sometimes referred to as expansion joints, in reality they are intended to separate a large building into smaller discreet sections that can act independently from one another (see Figure 4). In so doing, they can then handle a variety of movement types beyond the large-scale thermal expansion and contraction described above. Other forces such as vertical displacement or settlement of foundations, large-scale material shrinkage or creep, and seismic activity can be accommodated by using this design approach of creating structurally separate building portions. In these cases, the full three dimensional section needs to be separated such that a continuous break is formed along walls, floors, roof, and other building elements. Each section needs a distinct structural system on either side of this continuous break, such that, for example, two columns and beams may be required where only one would otherwise be provided. The structural systems must not span across the joint or the purpose of the joint is lost.

Given the multipurpose nature of these joints, they should be considered early in the design process by all disciplines involved including architects, structural engineers, soils engineers, seismic consultants, etc. The locations of building separation joints will in large part be determined by the final architectural massing of the building and may be a consideration in that process. Keep in mind that sections that can be identified vertically (e.g., a tower adjacent to a lower section) are as important as sections that can be identified horizontally (e.g., wings off of a central core). As with pure expansion joints, large sections over 150 to 200 feet long will require additional joints to be located in concert with the rest of the building design.

Continues at [ce.architecturalrecord.com](http://ce.architecturalrecord.com).

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See Quiz on the Next Page

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Program title: "Building Movement Joints and BIM" (11/10, page 165). AIA/CES Credit: This article will earn you one AIA/CES LU hour of health, safety, and welfare (HSW) credit. (Valid for credit through November 2012). **Directions:** Refer to the Learning Objectives for this program. Select one answer for each question in the exam and fill in the box by the appropriate letter. A minimum score of 80% is required to earn credit. **To take this test online and avoid handling charge, go to [ce.architecturalrecord.com](http://ce.architecturalrecord.com)**

- The amount of movement of a material due to thermal expansion or contraction is a direct result of:
  - a. the time of year.
  - b. the difference between the starting temperature and the ending temperature that is experienced.
  - c. the color of the material.
  - d. the documented testing of that material.
- Forces that can affect a building in any direction along multiple horizontal and vertical axes are:
  - a. seismic forces.
  - b. lateral shear.
  - c. vertical displacement.
  - d. construction forces.
- The common types of joints that create a full-depth joint or separation include all of the following EXCEPT:
  - a. abutment joints.
  - b. structure/enclosure joints.
  - c. control joints.
  - d. expansion joints.
- A building movement joint must be calculated and sized in terms of its minimum and maximum opening, with the average opening often being its nominal size.
  - a. True
  - b. False
- The design approach of creating structurally separate building portions through the use of building separation joints can accommodate:
  - a. vertical displacement or settlement of foundations.
  - b. large-scale material shrinkage or creep.
  - c. seismic activity.
  - d. all of the above.
- To get to the finish stage of a building, the intentional gaps caused by building movement joints need to be dealt with in order to address all of the following EXCEPT:
  - a. creating a weathertight building envelope.
  - b. maintaining fire separations.
  - c. maintaining the gap or separation.
  - d. providing a finished surface consistent with the aesthetics of the rest of the building.
- Depending on the size of the building joint, filler material choices include:
  - a. backer rod and sealant.
  - b. solid-shaped compressible material.
  - c. extruded material in a multiple bellows form.
  - d. all of the above.
- Metal joint covers, whether exposed or partially concealed, work because:
  - a. each metal plate is secured on only one side allowing the overlapping sections to move or slide by each other.
  - b. they have filler material inside.
  - c. the building doesn't move around the covers.
  - d. the metal resists the movement.
- In order to achieve a consistent, unified appearance and design when selecting and specifying building movement joint covers or fillers, the designer should:
  - a. specify the same size joint everywhere.
  - b. choose only one color.
  - c. select a coordinated system from the same manufacturer that includes the floor, wall, and ceiling joint.
  - d. cover over the joints with finish material.
- In the event that any of the above joint systems penetrated a wall, floor, ceiling, or roof that is also fire-rated, an additional fire barrier product will need to be added to the joint system to achieve a fire rating.
  - a. True
  - b. False

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## DATES &amp; EVENTS

## New and Upcoming Exhibitions

## ABOUT

Los Angeles

*November 3, 2010–December 12, 2010*

The Southern California Institute of Architecture presents this exhibition by Paris-based architecture firm Jakob + MacFarlane, featuring drawings, renderings, and photographs of two projects currently under construction in France: the Orange Box in Lyon, and the FRAC Centre in Orléans. The architectural sensibility of each derives from two distinct circumstances: one relating to histories and invisible conditions becoming visible, and the other designed for local climatic variability. Visit [www.sciarc.edu](http://www.sciarc.edu).

**Global Ends: Towards the Beginning**

Tokyo

*November 9, 2010–**February 26, 2011*

Toto Gallery Ma celebrates its 25th anniversary with an exhibition featuring seven architectural practices from five continents whose work is uniquely rooted in local regions, cultures, and environments. Tom Kundig, of Seattle's Olson Kundig Architects, is the exhibition's sole North American representative. He will participate in a panel discussion at the gallery on Friday, November 19, moderated by curator and historian

Ken Tadashi Oshima. For more info, visit [www.toto.co.jp/gallerma](http://www.toto.co.jp/gallerma).

**Building Collections: Recent Acquisitions of Architecture**

New York City

*November 10, 2010–May 30, 2011*

Presenting a selection of models and drawings acquired by MoMA's Department of Architecture and Design since 2005 – the vast majority on view here for the first time – this exhibition's themes include ornament and abstraction, Modernist urbanism and utopias, Latin American Modernism, the revival of Berlin architecture since reunification, and the role of process in architecture since the digital revolution. It features works from 1890 to the present. For more information, visit [www.moma.org](http://www.moma.org).

**The Global Africa Project**

New York City

*November 17, 2010*

This exhibition at the Museum of Arts and Design explores the versatile artistic output emerging from the African continent and its impact on artists and designers working around the world. The show actively challenges the notion of a singular African aesthetic or identity and reflects on the integration of African art and design on a global scale. Visit [madmuseum.org](http://madmuseum.org).

**Alessi: Ethical and Radical**

Philadelphia

*Opening November 20, 2010*

Combining elements of past, present, and future, and focusing on Alessi's design roots, with particular attention to the new directions in which the company is moving, this exhibition features such well-known Alessi projects as the Tea and Coffee Towers and the Michael Graves tea kettle, and introduces new projects by the Bouroullec Brothers and Naoto Fukasawa. At the Philadelphia Museum. Visit [www.philamuseum.org](http://www.philamuseum.org).

**Belgium Is Design. Design for Mankind**

Hornu, Belgium

*November 21, 2010–February 27, 2011*

This show will neither present an inventory nor show the latest products, but will instead examine how the impact of design can influence the lifestyles of ordinary people. There will be a focus on such concepts as service design, social design, user-centered design, and sustainability and quality of life. At Site du Grand-Hornu. For more information, visit [www.belgiumisdesign.be](http://www.belgiumisdesign.be).

**Neapolitan Presepio**

Pittsburgh

*November 26, 2010–January 6, 2011*

Handcrafted between 1700 and 1830, the annual *presepio* teems with lifelike figures and colorful details that re-create the Nativity within a vibrant and detailed panorama of 18th-century Italian village life. More than 100 superbly modeled human and angelic figures, along with

animals, accessories, and architectural elements, are displayed over 250 square feet and create a memorable depiction of the Nativity. At the Carnegie Museum of Art. Visit [www.carnegiemuseums.org](http://www.carnegiemuseums.org).

**I Saloni Milano in New York**

New York City

*November 29, 2010–January 8, 2011*

Special exhibitions and events kick off a worldwide celebration of Italian design in honor of the 50th anniversary of the Milan Furniture Fair. The six-week program includes Peter Greenaway's multimedia installation "Leonardo's Last Supper" at the Park Avenue Armory, a self-guided tour of 20 Italian furniture showrooms in the city, and Robert Wilson's exhibition "Perchance to Dream" at Center 548 in Chelsea.

## Ongoing Exhibits

**Everywhere Is the Best Seat**

Montclair, New Jersey

*Through November 14, 2010*

This unique sound-and-light installation created by architect and composer Christopher Janney is the latest edition to his "Urban Musical Instruments" series. The public is invited to interact with the work by passing a hand in front of the "handprints" on any of the 30 columns. Composed of both melodic and environmental sounds, the sound-score changes over both time of day and activity in the space. Visit [peakperfs.org](http://peakperfs.org).

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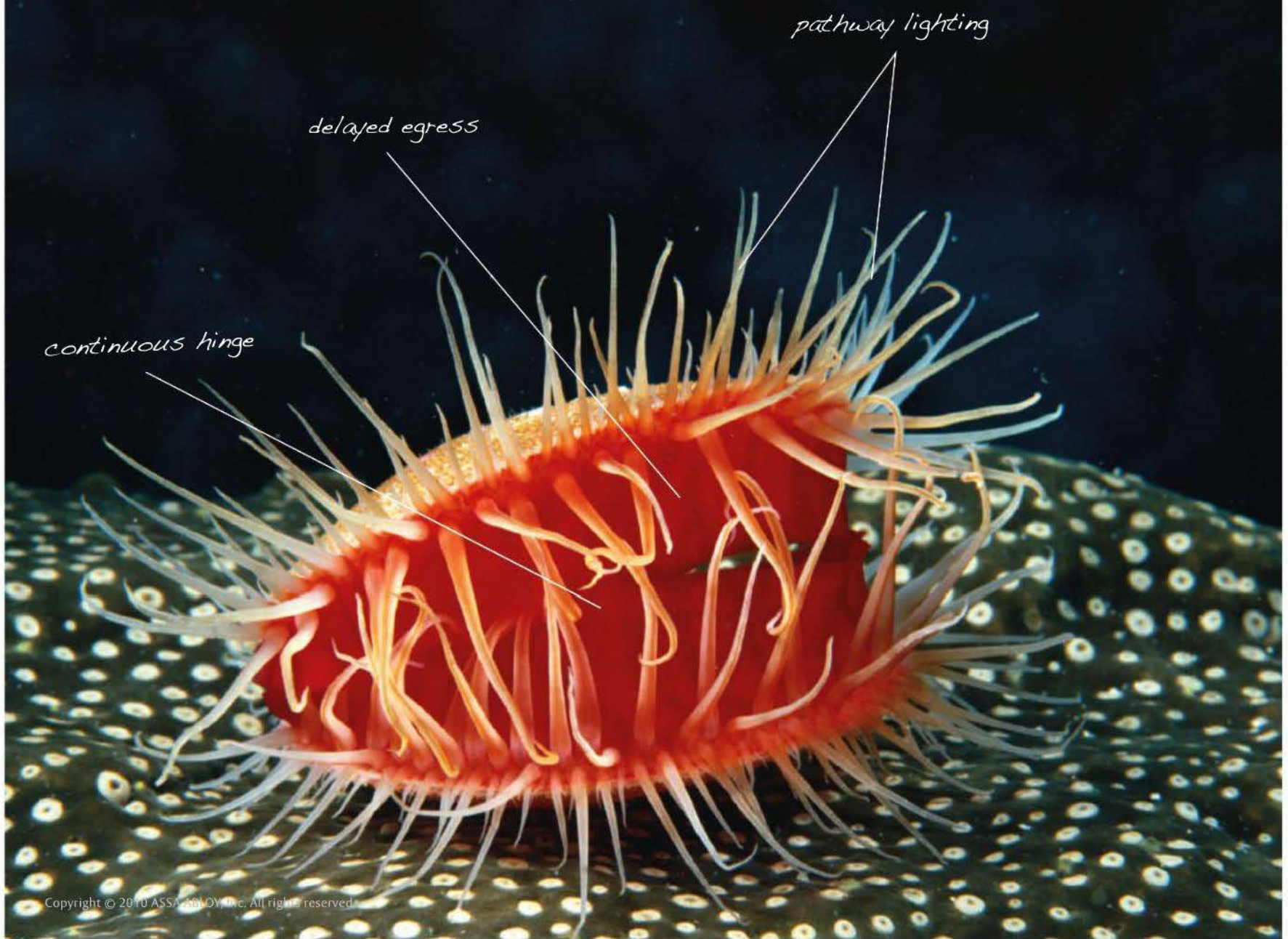
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**Paul Rudolph: Lower Manhattan Expressway**

New York City

*Through November 14, 2010*

Presenting the only record of Rudolph's visionary proposal, this exhibition, at the Cooper Union, will illuminate Rudolph's unique approach to architectural drawing and highlight the fundamental importance of drawing in his overall practice. Approximately 30 full-scale reproductions of drawings, prints, and photographs dating from 1967–72 are on view. These works, from the Paul Rudolph archive at the Library of Congress, will be shown together with a reconstruction of Rudolph's model of the expressway project created by students of the School of Architecture. Visit [www.cooper.edu](http://www.cooper.edu).

**Venice Biennale: 12th International Architecture Exhibition**

Venice, Italy

*Through November 21, 2010*

This year's architecture exhibition – titled *People Meet in Architecture* – is directed by Kazuyo Sejima, the first woman to direct the architecture sector of the Biennale. The show is laid out in the Palazzo delle Esposizioni della Biennale (Giardini) and in the Arsenale, forming a single itinerary, with 48 participants: firms, architects, engineers, and artists from around the world. The 2010 Architecture Biennale is a reflection on the radical changes that are taking

place in the 21st century and explores how architecture can clarify new values and new lifestyles for the present. For more information, visit [www.labiennale.org/en/architecture](http://www.labiennale.org/en/architecture).

**Brasilia**

New York City

*Through November 27, 2010*

The architectural, figurative, and photojournalistic images in 1500 Gallery's group exhibition celebrate the 50th anniversary of the capital of Brazil. The photos highlight the idealism of Juscelino Kubitschek's socialist government and its team of visionary urban planners, architects, and landscape designers, including Lucio Costa, Oscar Niemeyer, and Roberto Burle Marx. Visit [www.1500gallery.com](http://www.1500gallery.com).

**A Perfect Home: The Bridge Project**

New York City

*Through December 7, 2010*

Over the past two years, Do Ho Suh and his team of researchers, architects, and designers have generated four fantastical bridge designs that propose ways to connect Seoul, South Korea, and New York City. The newest chapter in this conceptual project proposes to build a bridge that joins two homes into one, connecting the spatial, temporal, psychological, and cultural distance between Seoul and New York. Visit [www.storefrontnews.org](http://www.storefrontnews.org).

**Small Scale, Big Change: New Architectures of Social Engagement**

New York City

*Through January 3, 2011*

This exhibition focuses on 11 architectural projects in underserved communities located around the world, including the U.S., Bangladesh, Brazil, Burkina Faso, Chile, Lebanon, France, South Africa, and Venezuela. Confronting inequality via the tools of design, these architectural projects engage social, economic, and political conditions by developing architectural interventions that begin with an understanding of a community. For more information, visit [www.moma.org](http://www.moma.org).

**Notes from the Archive:****James Frazer Stirling, Architect and Teacher**

New Haven, Connecticut

*Through January 2, 2011*

Featuring more than 300 original architectural drawings, models, and photographs drawn from the James Stirling/Michael Wilford fonds at the Canadian Centre for Architecture, this show reveals Stirling's wide-ranging approach to architectural composition and language, as well as the fundamental importance of British architecture to his work. Visit [www.ycba.yale.edu](http://www.ycba.yale.edu).

**Innovate: Integrate – Building Better Together**

New York City

*Through January 15, 2011*

This show presents the finalists of the AIA New York Chapter's open call for "Innovative Curtain-Wall Design," alongside a selection of projects that demonstrate the latest construction methodologies. The first part of the show highlights three priorities in building technology: material performance, energy harvesting, and daylight optimization. The second gives a behind-the-scenes look at construction technologies, management, and logistics. For more info, visit [www.aiany.org](http://www.aiany.org).

**New Pictures 3: James Welling, Glass House**

Minneapolis

*Through March 7, 2011*

This exhibition focuses on the innovative work of Los Angeles photographer James Welling. Welling's atmospheric images include Philip Johnson's Glass House. Welling reveals the ambiguity between the interior built space and exterior natural space evoked by Johnson's home. At the Minneapolis Institute of Arts. Visit [www.artsmia.org](http://www.artsmia.org).

**Lectures, Conferences, and Symposia****Strolling on 7th Street**

Los Angeles

*November 7, 2010*

On one day only, the Los Angeles Conservancy will offer guided tours of historic spots along 7th between Figueroa and Los Angeles Streets.

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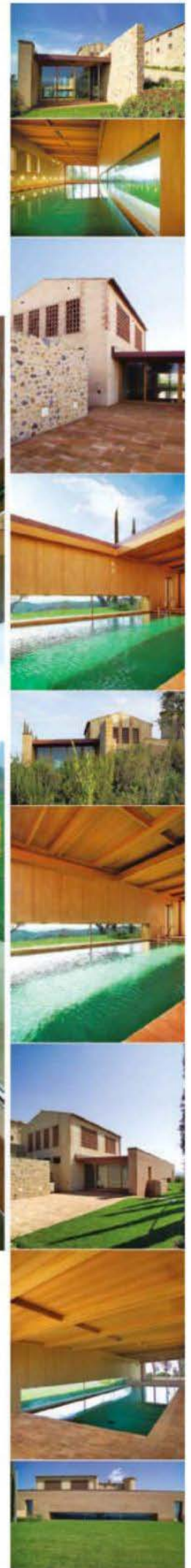
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**CIRCLE 15**





From its storied past to its present vitality, downtown L.A.'s 7th Street is a kaleidoscope of architecture and history. The main shopping destination for Angelinos for half a century, the area is finding new life with loft-style residential conversions, restaurants, and bars. Visit [laconservancy.org](http://laconservancy.org).

**Vincent Scully Prize:  
Adele Chatfield-Taylor**

Washington, D.C.  
November 8, 2010

The National Building Museum selected Adele Chatfield-Taylor to receive its prestigious Vincent Scully Prize for her notable work encouraging excellence in the design world while ensuring that planning, architecture, and preservation remain relevant and connected to the public. During the presentation, Chatfield-Taylor will give a talk on historic preservation at the American Academy of Rome in the 21st century. For more info, visit [www.nbm.org](http://www.nbm.org).

**South of East-West:  
Post-Colonial Planning,  
Global Technology Transfer,  
and the Cold War**

Utrecht  
November 9–10, 2010

This symposium at the Berlage Institute will address the transfer of knowledge in architecture, urbanism, engineering, and building technology from the socialist East and the capitalist West to the postcolonial

South during the cold war. Lecturers include Akos Moravánszky, Duanfang Lu, and Bogdan Wyporek. Visit [www.south-of-eastwest.net](http://www.south-of-eastwest.net).

**Nordic Design Now**

New York City  
November 10–11, 2010

This symposium consists of two panel discussions, "Social Awareness & Sustainability" and "Design Policy: Lessons Learned," copresented by Cooper-Hewitt, National Design Museum and the American-Scandinavian Foundation. The first panel features leading Nordic designers discussing their stance on sustainability and social responsibility in their work and current design practices. The second panel is moderated by Bradford McKee, editor in chief of *Landscape Architecture Magazine*. Visit [www.scandinaviahouse.org](http://www.scandinaviahouse.org).

**TEDxEast Interconnectivity  
Conference**

New York City  
November 11, 2010

This conference features a select group of influential thought leaders speaking about ways in which knowledge and experience are connected, including architect Shohei Shigematsu, FourSquare founder Dennis Crowley, chef Thomas Keller, and Gavin Starks, founder of carbon data site AMEE. For more info, visit [www.tedxeast.com](http://www.tedxeast.com).

**Territories of Urbanism:  
Urban Design at 50**

Cambridge, Massachusetts  
November 12, 2010

Organized as a series of moderated discussions, this event will be led by some of the world's foremost thinkers and practitioners in urban design around the themes of reflections, challenges, experiments, and positions. It will address many of the challenges and opportunities that face the field. Speakers include Mohsen Mostafavi, Rahul Mehrotra, Adele Santos, and more. Visit [www.gsd.harvard.edu](http://www.gsd.harvard.edu).

**Modernism + ART20**

New York City  
November 12–15, 2010

This November, Sanford L. Smith & Associates will once again present two fall art and design favorites: the 25th Anniversary of Modernism and the 9th Annual ART20. Both fairs focus on the 20th century – Modernism, with decorative arts; and ART20, with fine art. At the Park Avenue Armory. For more information, visit [www.sanfordsmith.com](http://www.sanfordsmith.com).

**Healthcare Design**

Las Vegas  
November 13–16, 2010

This four-day, multifaceted learning and networking experience is focused on the delivery and discussion of innovations in health-care facilities

now and into the future. Attendees will discuss the challenges facing the industry and gain the necessary tools to confront them. For more info, visit [www.hcd10.com](http://www.hcd10.com).

**Factory Cities**

New York City  
November 15, 2010

As part of The Skyscraper Museum's exhibition *Vertical Urban Factory*, Pratt will host a symposium moderated by Nina Rappaport, a professor at Yale University, with guest Emmanuel Picardo, the documentary filmmaker, and Andrew Ross, a professor at New York University. Visit [www.pratt.edu](http://www.pratt.edu).

**Spotlight on Shrinking Cities  
with Reed Kroloff**

Chicago  
November 16, 2010

In the past 50 years, the number of shrinking cities has increased faster than the number of expanding ones. A huge media debate is now raging on how to reconfigure cities to best adapt to smaller populations, smaller economies, and different demands on the built environment. Reed Kroloff, director of the Cranbrook Academy of Art and Art Museum, discusses this trend and evaluates various solutions with a team of innovative thinkers and experts in the field. At Chicago Architecture Foundation. Visit <http://caf.architecture.org>.



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CIRCLE 57

### Pilar Viladas: Words and Pictures

New York City  
November 16, 2010

Pilar Viladas will discuss her work as a magazine editor and writer. She will show examples of stories she has done in her 13 years at *The New York Times*, and how they illustrate the orchestration of storytelling by verbal and visual means. For more information, visit [www.dcrit.sva.edu](http://www.dcrit.sva.edu).

### Global Power City Index 2010

New York City  
November 15, 2010

The latest results of the GPCI index, a strategic tool for assessment of urban competitiveness, will be presented at this lecture at Columbia University. New York, London, Paris, Tokyo, Singapore, Hong Kong, Seoul, Shanghai, and other cities are included in the analysis. Visit [www.arch.columbia.edu](http://www.arch.columbia.edu).

### Greenbuild 2010

Chicago  
November 17–19, 2010

The world's largest conference and expo dedicated to green building brings together thousands of building professionals from all over the world for three days of educational sessions, renowned speakers, green-building tours, special seminars, and networking events. For more info, visit [www.greenbuildexpo.org](http://www.greenbuildexpo.org).

### Julian Wekel: Berlin – Planning for the Urban Renaissance of a European Metropolis

Berkeley  
November 18, 2010

This presentation, by Julian Wekel, professor and chair of Urban Design and Regional Planning at Darmstadt University of Technology, Germany, will give an overview of 20 years of urban development in the reunited German capital. It will include a discussion of strategic visions, goals, instruments, and procedures of urban design and planning. Future plans and projects will be highlighted. For more info, visit [www.arch.ced.berkeley.edu](http://www.arch.ced.berkeley.edu).

### Mosette Broderick on McKim, Mead & White

New York City  
November 30, 2010

Historian Broderick talks about her new book, *Triumvirate: McKim, Mead & White: Art, Architecture, Scandal, and Class in America's Gilded Age*. The book details the dazzling rise of Charles McKim, William Mead, and Stanford White, three powerful figures who created many of America's major monuments, including New York's Pennsylvania Station, Columbia University campus and Low Memorial Library, and Brooklyn Museum, as well as the Boston Public Library, among many others. At The Skyscraper Museum. Visit [www.skyscraper.org](http://www.skyscraper.org).

### Beijing Design Week

Beijing  
September 28, 2011–October 3, 2011

Taking the theme "Design Landing," the new Beijing Design Week aims to put the city's design ambitions into action while solidifying China's growing awareness of, and commitment to, design. The 6-day affair will feature a Global Design Summit alongside exhibitions, events, and installations throughout the city, including in Tiananmen Square during China's October 1 National Day celebrations. For more info, visit [www.bjdw.org](http://www.bjdw.org).

## Competitions

### Design for Decades

Deadline: November 12, 2010

Design for Decades is open to American Institute of Architects members' projects from every facet of the architectural design arena. The purpose of this undertaking is to feature projects of all scales and types that represent the scope and quality of work being done by AIA members. For more information, visit [www.aia.org](http://www.aia.org).

### 2011 Sustainable Design Assessment Team Program

Deadline: November 19, 2010

The American Institute of Architects Center for Communities by Design is seeking community applicants for the 2011 Sustainable Design Assessment Team Program (SDAT). The SDAT is an innovative program that brings together multidisciplinary teams of professionals to work with community stakeholders and decision makers through an intensive planning process. The mission is to provide technical assistance and process expertise to help communities develop a vision and framework for a sustainable future. For more information, visit [www.aia.org/about/initiatives/AIAS075425](http://www.aia.org/about/initiatives/AIAS075425).

### PROJECT: Green

Deadline: January 14, 2011

*Environmental Design + Construction* magazine and Coverings, the trade fair and expo showcasing the newest in ceramic tile and natural stone, are calling for tile and stone projects where sustainability was a chief mission. "PROJECT: Green" is open to both domestic and international projects in one of the following categories: Residential New, Residential Remodel, Commercial New, Commercial Remodel, Institutional New, Institutional Remodel. Only projects completed between January 2009 and December 2010 will be considered. Honorees will be showcased at Coverings in March 2011 at The Sands Expo and Convention Center in Las Vegas, and will receive a feature in a 2011 issue of *Environmental Design + Construction*.

E-mail information two months in advance to [recordevents@mcgraw-hill.com](mailto:recordevents@mcgraw-hill.com). For more listings, visit [architecturalrecord.com/news/events](http://architecturalrecord.com/news/events).



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Circle 150

### DOORS, WINDOWS

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Circle 151

### DOORS, WINDOWS

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▲ Perko Power™ concealed door closers deliver benefits in aesthetics, performance, and safety for hotel, healthcare, education, and other applications.

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Circle 152

### DOORS, WINDOWS

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▲ Custom-designed Guardian 275® translucent panel daylighting systems block damaging UV rays and eliminate hot-spots and glare.

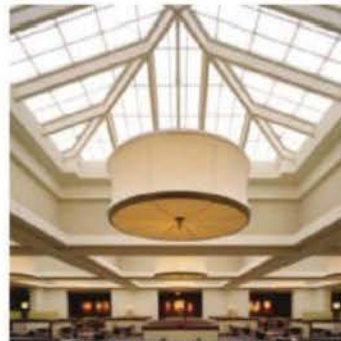
##### Product Application:

- Lightweight and versatile for retrofit applications
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- Skylight and curtain wall configurations available

##### Performance Data:

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### DOORS, WINDOWS

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- Hurricane- and tornado-prone regions
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- Architectural large missile impact resistant
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- New and existing buildings
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### DOORS, WINDOWS

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- Unfading Green Slate roofing

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Circle 165

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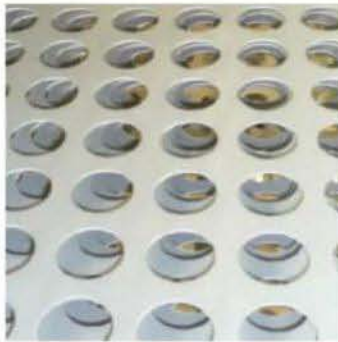
▲ Accurate is a leader in providing custom perforated metal components to the construction industry.

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Circle 166

### MATERIALS

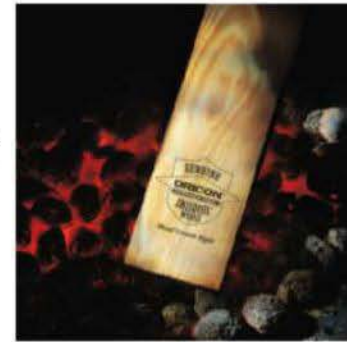
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▲ Drexel Metals LLC is a leading supplier of equipment, materials, and technical support for the regional manufacturing of metal roofing.

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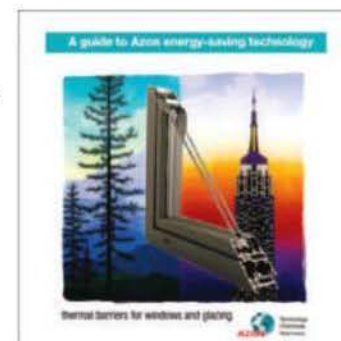
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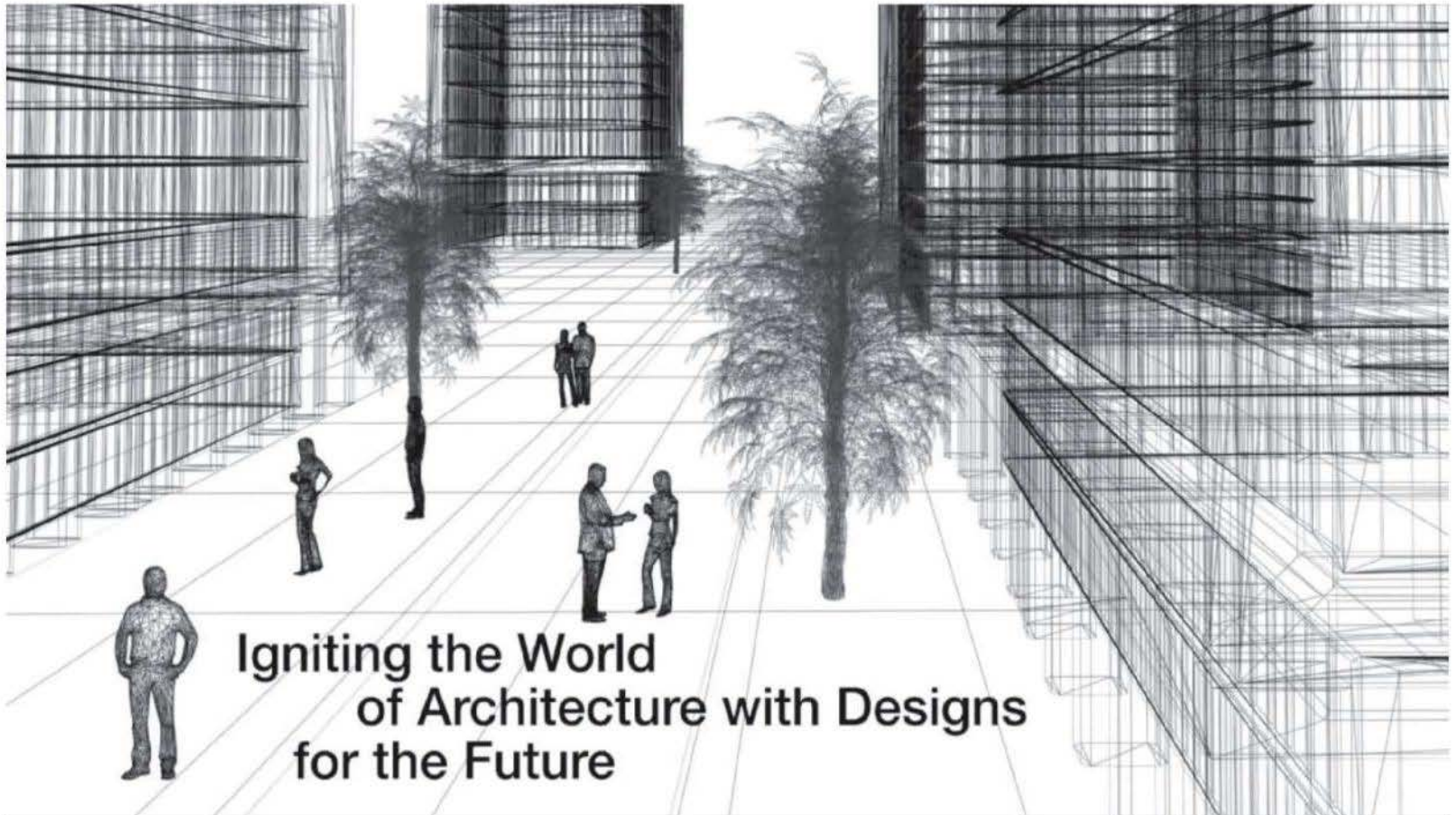
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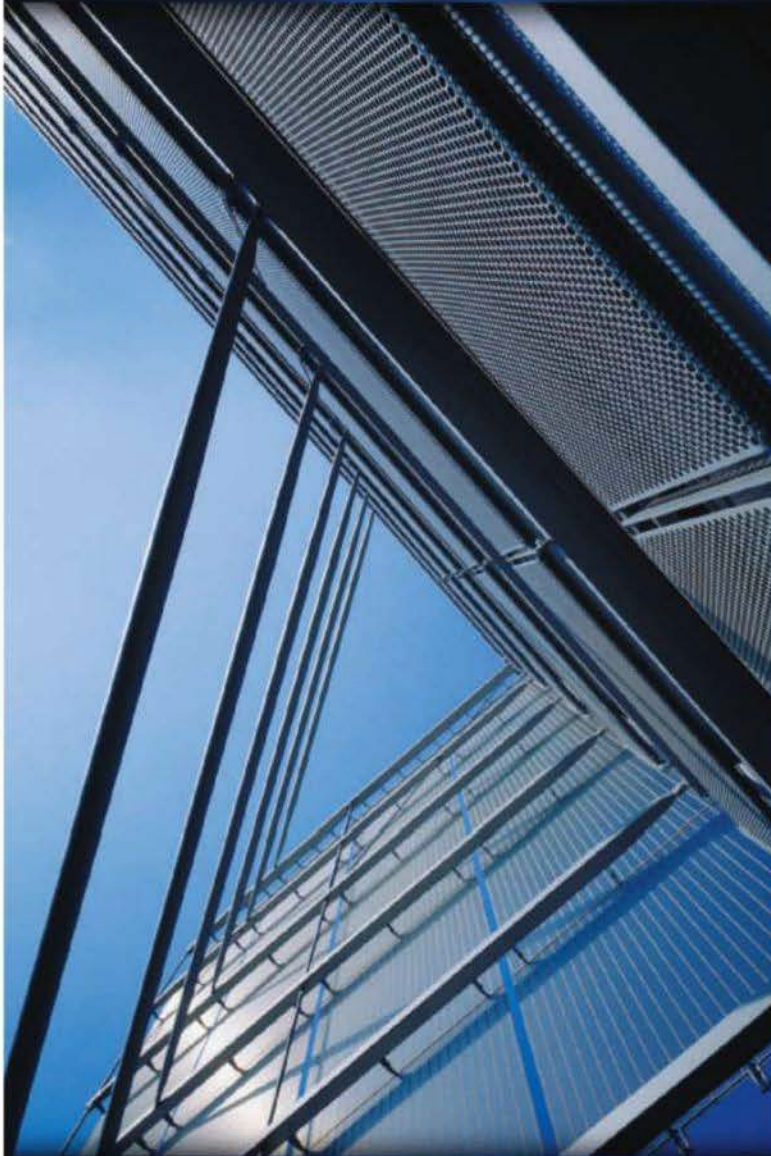
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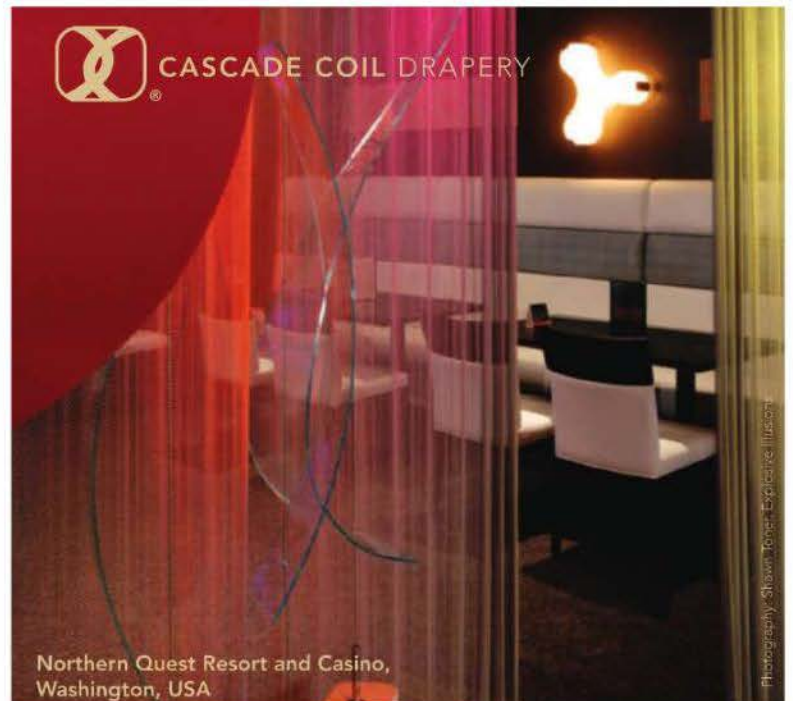
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## Advertisers Index

Reader Service #	Advertiser	Page	Reader Service #	Advertiser	Page	Reader Service #	Advertiser	Page
2	3form <a href="http://3-form.com">3-form.com</a>	37	30	Georgia-Pacific <a href="http://GPDens.com">GPDens.com</a>	74	64	Pilkington <a href="http://pilkington.com">pilkington.com</a>	146
	AIA <a href="http://aia.org">aia.org</a>	148,162 188,194	31	Glidden Professional <a href="http://gliddenprofessional.com">gliddenprofessional.com</a>	78	65	Pine Hall Brick Co. <a href="http://americaspremierpaver.com">americaspremierpaver.com</a>	4
3	AISC/American Inst of Steel Construction <a href="http://aisc.org">aisc.org</a>	178	32	Gordon Incorporated <a href="http://gordonceiling.com">gordonceiling.com</a>	191	66	Pinecrest Doors <a href="http://pinecrestinc.com">pinecrestinc.com</a>	195
1	Alcan Composites <a href="http://www.alucobond.com">www.alucobond.com</a>	68	33	Guardian SunGuard <a href="http://sunguardglass.com">sunguardglass.com</a>	33	67	PPG Industries, Inc. <a href="http://ppgideasclapes.com">ppgideasclapes.com</a>	42,43
	American Express <a href="http://plumcard.com">plumcard.com</a>	73	34	HDI Railing Systems <a href="http://hdirailings.com">hdirailings.com</a>	6	68	PPG Industries, Inc. <a href="http://ppgideasclapes.com">ppgideasclapes.com</a>	179
4	American Galvanizers Association <a href="http://galvanizeit.org/protection.com">galvanizeit.org/protection.com</a>	189	35	Headwaters Resources <a href="http://flyash.com">flyash.com</a>	189	69	PPG Industries, Inc. <a href="http://ppgideasclapes.com">ppgideasclapes.com</a>	171
5	American Hydrotech, Inc. <a href="http://hydrotechusa.com">hydrotechusa.com</a>	190	36	Hendrick Manufacturing Co. <a href="http://hendrickarchproducts.com">hendrickarchproducts.com</a>	189	70	PPG Industries, Inc. <a href="http://ppgideasclapes.com">ppgideasclapes.com</a>	173
6	Armstrong World Industries <a href="http://armstrong.com">armstrong.com</a>	1,Cov2	37	Henry Company <a href="http://henry.com">henry.com</a>	129	71	PPG Industries, Inc. <a href="http://ppgideasclapes.com">ppgideasclapes.com</a>	175
7,8	ASSA ABLOY Door Security Solutions <a href="http://assaabloydss.com">assaabloydss.com</a>	172, 44-45	38	Hewlett-Packard <a href="http://hp.com">hp.com</a>	19	72	Rakks <a href="http://rakks.com">rakks.com</a>	195
9	Aztec Galvanizing Services <a href="http://azzgalvanizing.com">azzgalvanizing.com</a>	186	39	Holcim (US) Inc. <a href="http://holcim.us">holcim.us</a>	112	73	Rejuvenation Inc <a href="http://rejuvenation.com">rejuvenation.com</a>	197
149	BEGA <a href="http://bega-us.com">bega-us.com</a>	7	40	Horton Automatics <a href="http://hortondoors.com">hortondoors.com</a>	24	74	RITE HITE <a href="http://ritehitefans.com">ritehitefans.com</a>	76
10	Belden Brick <a href="http://beldenbrick.com">beldenbrick.com</a>	187	146	Hunter Douglas Contract <a href="http://hunterdouglas.com">hunterdouglas.com</a>	Cov3	75	Rocky Mountain Hardware <a href="http://rockymountainhardware.com">rockymountainhardware.com</a>	30
11	Bilco Company, The <a href="http://bilco.com">bilco.com</a>	197	41	Hunza Lighting <a href="http://hunzausa.com">hunzausa.com</a>	196	76	Rulon Company <a href="http://rulonco.com">rulonco.com</a>	10,11
12	Bobrick <a href="http://bobrick.com">bobrick.com</a>	41	42	InterEdge Technologies LLC <a href="http://firesafe-glass.com">firesafe-glass.com</a>	136	77	SAFTI Fire Rated Glass <a href="http://safti.com">safti.com</a>	140
13	Boston Architectural College <a href="http://the-bac.edu">the-bac.edu</a>	186	43	Invisible Structures Inc. <a href="http://invisiblestructures.com">invisiblestructures.com</a>	196	78,79	Selux <a href="http://selux.com/usa">selux.com/usa</a>	156-161
	Brick Industry Association <a href="http://brickinfo.org">brickinfo.org</a>	176A-B	44	Julius Blum & Co Inc. <a href="http://juliusblum.com">juliusblum.com</a>	144	80	Sherwin-Williams Co. <a href="http://sherwin-williams.com">sherwin-williams.com</a>	66
14	Cambridge Architectural <a href="http://architecturalmesh.com">architecturalmesh.com</a>	67	45	Kawneer <a href="http://kawneer.com">kawneer.com</a>	52	81	Simpson Strong-Tie Company Inc. <a href="http://simpsonstrongwall.com">simpsonstrongwall.com</a>	5
15	Capoferri Serramenti <a href="http://capoferri.it">capoferri.it</a>	174	46	Kolbe & Kolbe Millwork Co., Inc. <a href="http://kolbe-kolbe.com">kolbe-kolbe.com</a>	50		Skyscraper Museum, The <a href="http://skyscraper.org">skyscraper.org</a>	199
16	Cascade Coil Drapery <a href="http://cascadecoil.com">cascadecoil.com</a>	186	47	L. & J. G. Stickley, Inc. <a href="http://stickley.com">stickley.com</a>	22	82	Sloan Valve Company <a href="http://sloanvalve.com">sloanvalve.com</a>	62
17	CENTRIA Architectural Systems <a href="http://centria.com">centria.com</a>	57	48	Lamin-Art <a href="http://laminart.com">laminart.com</a>	145	83	Soil Retention <a href="http://soilretention.com">soilretention.com</a>	197
18	Chamberlain Group, Inc. <a href="http://liftmaster.com">liftmaster.com</a>	143	49	Lincoln / Ford <a href="http://lincoln.com">lincoln.com</a>	8,9	84	Sota Glazing <a href="http://sotawall.com">sotawall.com</a>	63
	Dell <a href="http://dell.com">dell.com</a>	39	50	Lindner USA, Inc. <a href="http://LinderUSA.com">LinderUSA.com</a>	147	85	Steelscape <a href="http://steelscape.com">steelscape.com</a>	65
19	Doug Mockett & Company Inc. <a href="http://mockett.com">mockett.com</a>	40	51	Lutron Electronics Co., Inc. <a href="http://lutron.com">lutron.com</a>	Cov4	86	Syska Hennessy Group <a href="http://syska.com">syska.com</a>	77
20	Dri-Design <a href="http://dri-design.com">dri-design.com</a>	21		McGraw-Hill Construction <a href="http://construction.com">construction.com</a>	198	87	Technical Glass Products <a href="http://fireglass.com">fireglass.com</a>	12,13
21	E Dillon & Company <a href="http://edillon.com">edillon.com</a>	109	52	MechoShade Systems, Inc. <a href="http://MechoShadeSystems.com">MechoShadeSystems.com</a>	14	88	The Travelers Companies Inc. <a href="http://powdercoating.org/101">powdercoating.org/101</a>	35
22	ECOsurfaces <a href="http://ecosurfaces.com">ecosurfaces.com</a>	195	53,54	Milgard Windows & Doors <a href="http://pro.milgard.com">pro.milgard.com</a>	151-155 150		The Wood Products Council <a href="http://woodworks.org">woodworks.org</a>	112A-B
23	EDICER s.p.a. (Ceramic Tile of Italy) <a href="http://italiatiles.com">italiatiles.com</a>	177	55	Mitsubishi - Apolic / The Ludlow Group <a href="http://alpolic-northamerica.com">alpolic-northamerica.com</a>	49	89	Timely <a href="http://timelyframes/ar.com">timelyframes/ar.com</a>	111
24	Engineered Lighting Products <a href="http://elighting.com">elighting.com</a>	190	56	Modern Fan Co, The <a href="http://modernfan.com">modernfan.com</a>	196	90	Toto USA <a href="http://totousa.com">totousa.com</a>	108
144	Eventscape <a href="http://eventscape.net">eventscape.net</a>	59	57	modularArts <a href="http://modulararts.com">modulararts.com</a>	176	92	Trespa <a href="http://trespanorthamerica.com">trespanorthamerica.com</a>	110
25	Fiberweb Inc <a href="http://tpar.com">tpar.com</a>	142	58	Nana Wall Systems, Inc. <a href="http://NanaWallSystems.com">NanaWallSystems.com</a>	46	93	Underwriters Laboratories Inc. <a href="http://ul.com">ul.com</a>	17
26	Forestry Innovation Investment Ltd. <a href="http://naturallywood.com">naturallywood.com</a>	170	91	National Building Museum <a href="http://nbm.org">nbm.org</a>	199	94	Velcro <a href="http://velcroconstruction.com">velcroconstruction.com</a>	114
27	Forms & Surfaces <a href="http://forms-surfaces.com">forms-surfaces.com</a>	64		NJ SmartStart Buildings <a href="http://njsmartstartbuildings.com">njsmartstartbuildings.com</a>	193	95	VT Industries, Inc. <a href="http://vtindustries.com">vtindustries.com</a>	75
28	FSB <a href="http://fsbusa.com">fsbusa.com</a>	60,61	59-61	Nystrom <a href="http://nystrom.com">nystrom.com</a>	163-169	96,97	Western Red Cedar Lumber Association <a href="http://realcedar.org">realcedar.org</a>	25-29
29	Gardco Lighting <a href="http://sitelighting.com">sitelighting.com</a>	139	62	Oldcastle BuildingEnvelope® <a href="http://oldcastlebe.com">oldcastlebe.com</a>	2, 3	98	Xypex <a href="http://xypex.com">xypex.com</a>	113
			63	Petersen Aluminum <a href="http://pac-clad.com">pac-clad.com</a>	54	99	Zumtobel Lighting, Inc. <a href="http://zumtobel.us">zumtobel.us</a>	133

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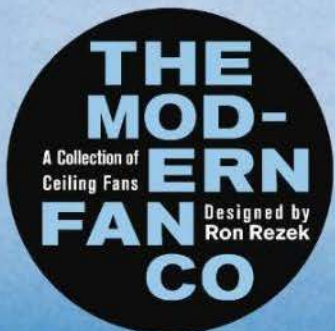


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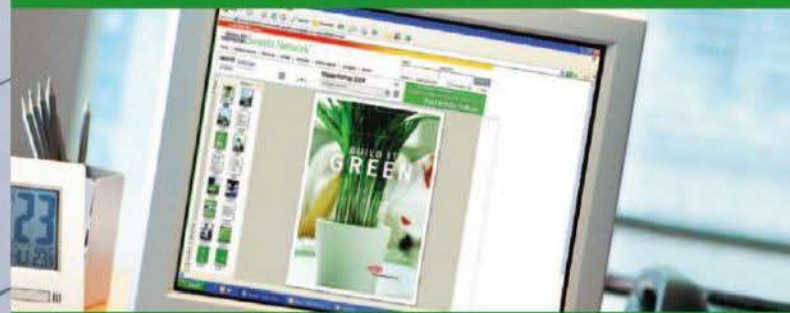
Conceptualize



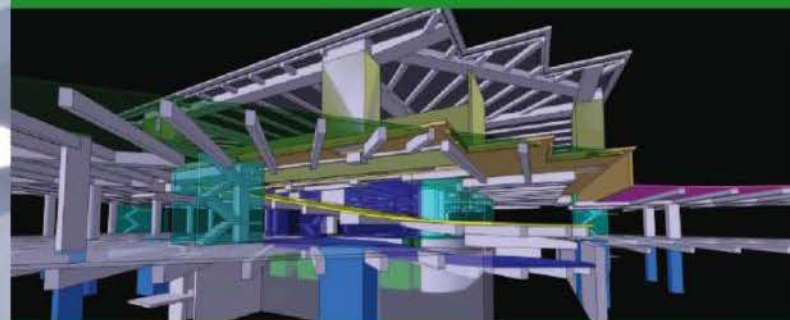
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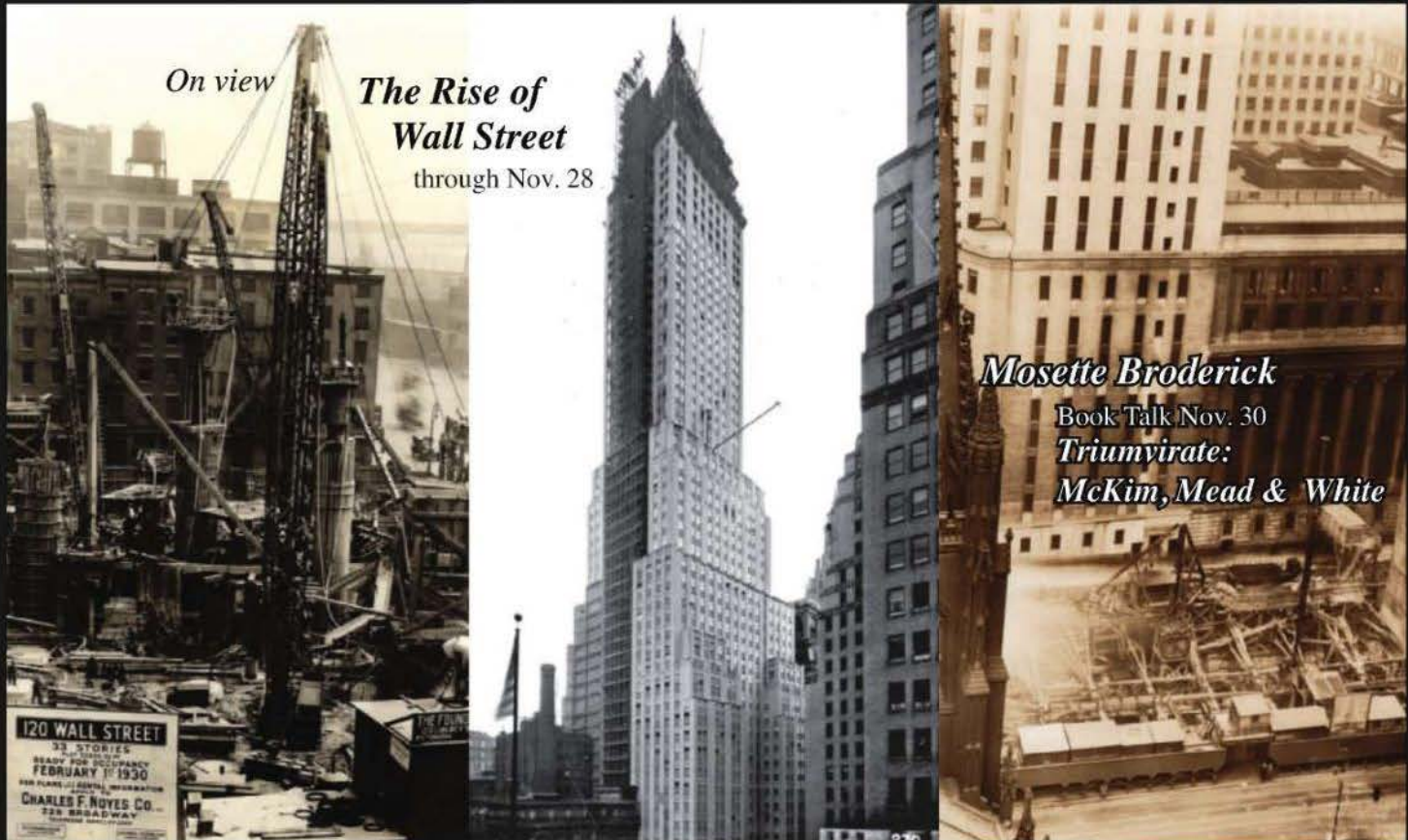
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IN A CLEARING NEAR the elm, oak, and walnut trees of the Brooklyn Botanic Garden's Plant Family Collection, five anthropomorphic shelters made of woven saplings bend into each other for conspiratorial conversation, twigs whorled as if frozen in a permanent gust of wind. The prolific Chapel Hill, North Carolina-based artist Patrick Dougherty – he has created more than 200 sculptures around the world since the late 1980s – along with his assistants, spent three weeks this past summer building *Natural History*. Dougherty, inspired by animal lairs, spun the pieces from nonnative willow saplings collected from Ocean Breeze Park on Staten Island. First he anchored larger saplings into holes drilled in the ground. He then worked with smaller saplings to fill in details from scaffolding, which acted as a temporary “exoskeleton.” “At that point, I stop even considering a drawing and I start looking at a piece,” he says. The sticks become his pencil, and the resulting forms, which dramatize the quiet lawn, resemble three-dimensional illustrations. “Someone suggested that I make a more architectural piece,” says Dougherty, who spent a large part of his childhood playing in North Carolina woods. “What came to my mind is that’s the last thing that New York City needs. What it needs is a place for feral children and wayward adults.” Clarifying his fairy tale, Dougherty explains that he wants city dwellers to feel, stepping in and around his installation, that they have been cast back to the beginning of time. *Natural History* will be on view at the Brooklyn Botanic Garden through August 31, 2011. *Laura Raskin*



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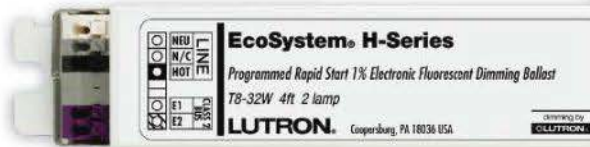
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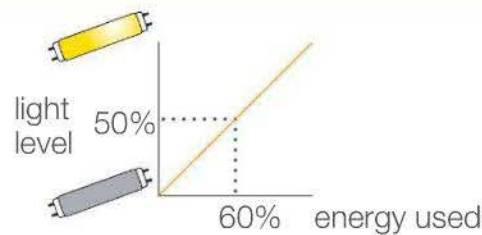
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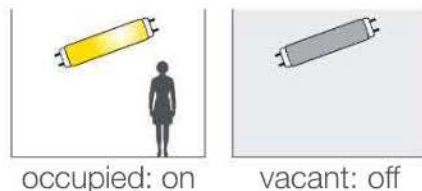
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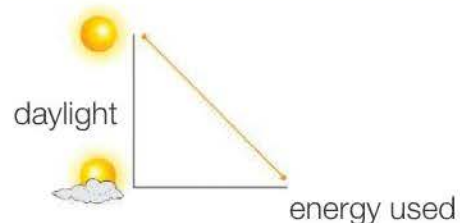
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