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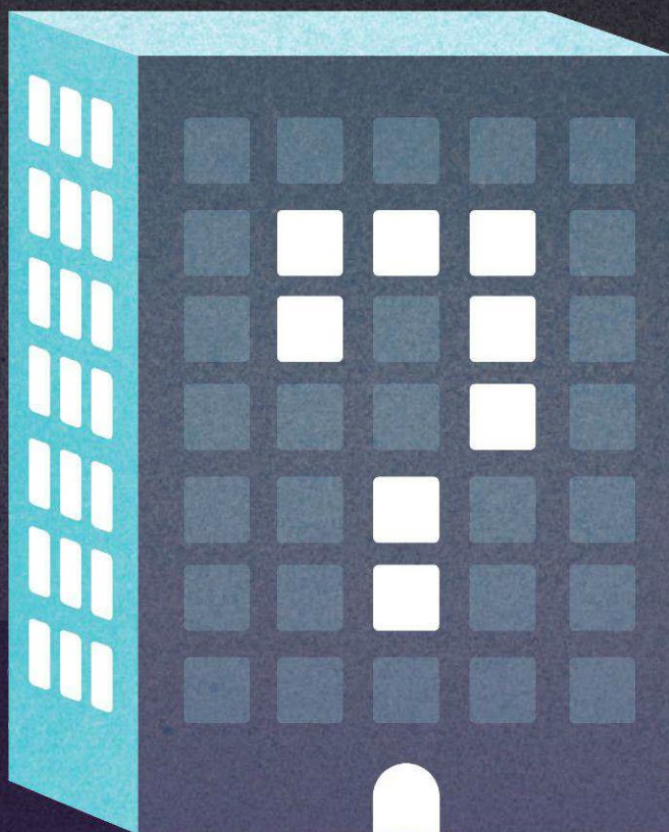
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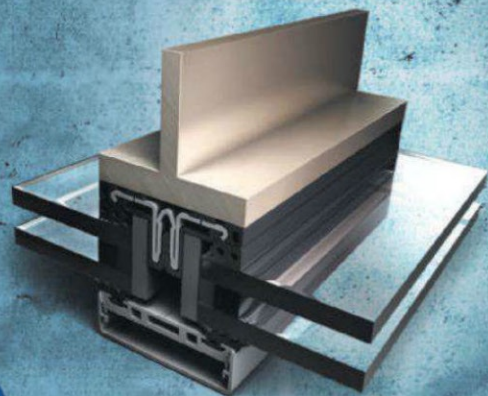
A photograph of the Dallas City Performance Hall at night. The building features a large, curved glass curtain wall that is brightly lit from within, revealing a multi-level interior with wooden slatted ceilings and balconies. The building is set against a dark blue night sky. In the foreground, there are several young trees planted in a paved plaza. In the background, another tall building with a glowing circular logo is visible.

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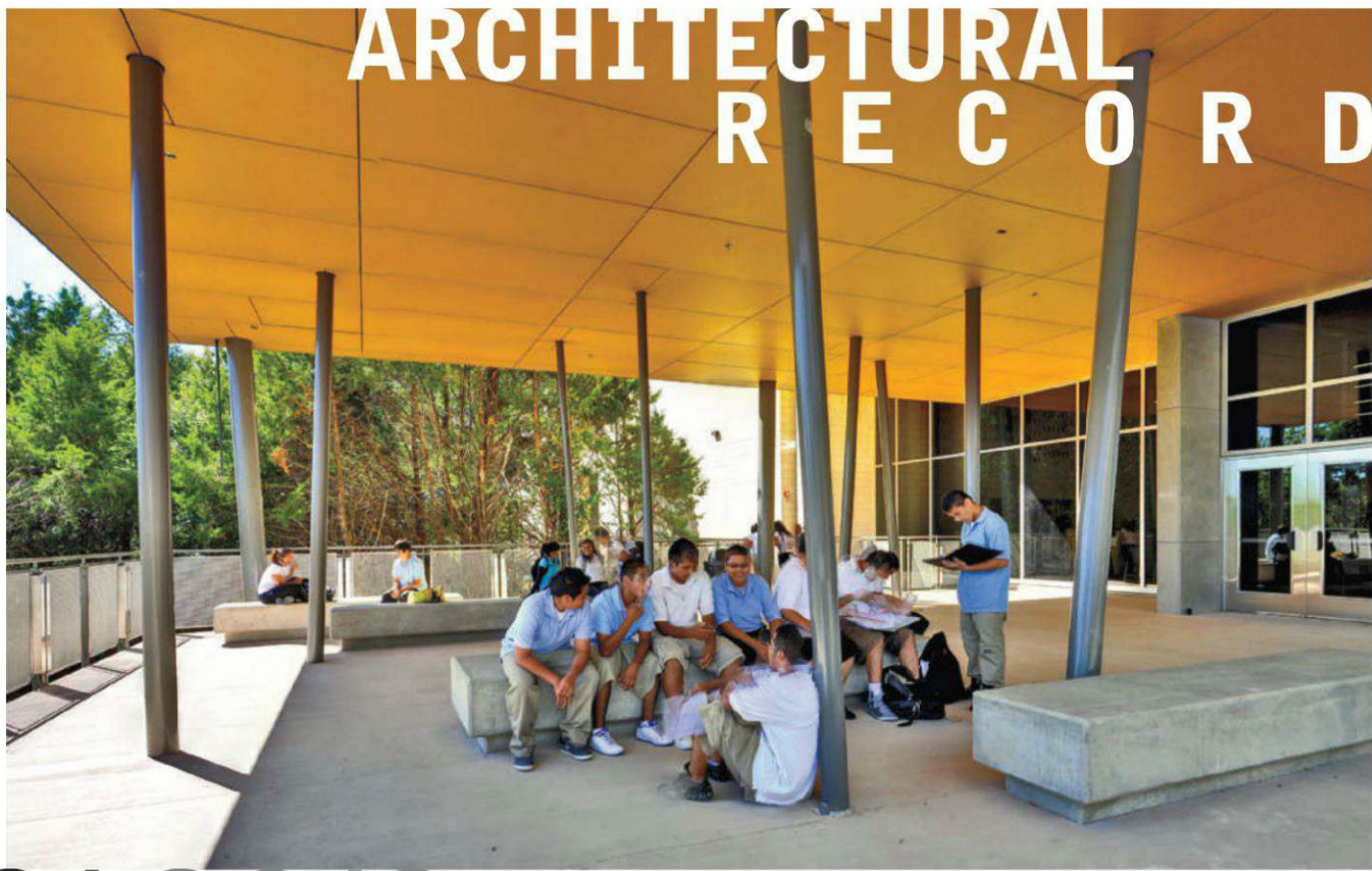


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THIS PAGE: KATHLYN JOY GILLIAM COLLEGIATE ACADEMY, BY SHW GROUP. PHOTO BY LUIS AYALA.

ON THE COVER: PEROT MUSEUM OF NATURE AND SCIENCE, BY MORPHOSIS ARCHITECTS. PHOTO BY IWAN BAAN.

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The Best for the New Year

Honoring architects for inspiring work—and for work that inspires change.

IT IS AWARDS season, the time of year for top lists, best-ofs, and nominations for prizes not yet won. The American Institute of Architects announced its own version of the Oscars, and we want to offer a shout-out to Thom Mayne, the 2013 AIA Gold Medalist, and to Tod Williams Billie Tsien Architects, for winning the 2013 AIA Architecture Firm Award. These designers have produced exemplary work that we've been proud to publish in the pages of this magazine for many years.

In fact, as you've already noticed, we're featuring in this issue the latest project from Mayne's firm, Morphosis: the Perot Museum of Nature and Science in Dallas. Mayne once told me that he suffered from anxiety dreams about figures of authority—clearly the nightmare of a California rebel designer, whose innovative and aggressive aesthetic only gradually won the hearts of major patrons. The General Services Administration and other key government and institutional clients caught up with his edgy ideas—and maybe Mayne has mellowed a bit, too. The architect of such iconic civic buildings as the Caltrans District 7 Headquarters in Los Angeles (RECORD, January 2005) and the San Francisco Federal Building (RECORD, August 2007), he found himself revising his initial sprawling, angular design for the Perot Museum into a cube, in response to the client's wishes for stackable, more conventional galleries. Still, the building is full of elements that are, blessedly, way out there, including an angled glass box that carries an escalator, and an exterior wrapped in tissue-like shirred concrete—think Issey Miyake on speed.

The building is the firm's first museum, and we're showing it alongside two other new American museums designed by Mayne's fellow Pritzker laureates Zaha Hadid and Herzog & de Meuron. Given the architects' outsize reputations, these projects are surprisingly modest—Hadid's Broad Museum in Michigan in scale, and Herzog & de Meuron's Parrish Art Museum on Long Island in scope (after the recession kicked in, the Swiss misters cleverly reworked their original design and slashed the budget by two-thirds). Yet neither project scrimps on material craftsmanship, whether in the knife-edged steel louvers of the Broad or the beautifully scarred concrete of the Parrish's exterior walls.

But it is Williams and Tsien who are particularly revered for raising material craftsmanship to a high art in their work. The small 27-person office has completed a number of projects in the last year or so—most notably the Barnes Foundation in Philadelphia (RECORD, June 2012). In our special issue "Building for Social Change" (RECORD, March 2012), we published their Center for the Advancement of Public Action, in Vermont. We're also big fans of their new Logan Center for the Arts, at the University of Chicago, and the Asia Society, in Hong Kong. The husband-and-wife team is known not for a signature style but for an



architecture of deeply embedded values: Their work expresses the beauty of making, with a strong sense of purpose and place.

This month, too, in our annual feature "Schools of the 21st Century," we look at the work of designers committed to rethinking the environments in which children learn best: flexible interior spaces that are filled with daylight. Sadly, in the wake of the tragic shooting at Sandy Hook Elementary School in Connecticut, we also are thinking more about security, but in ways that don't compromise an open learning experience.

Designing great schools is just one way architects honor the profession. As we enter 2013, we at RECORD will continue to search for projects that are innovative and compelling—and that contribute significantly to the public realm and to improving human welfare all over the world.

In their first monograph, *Work/Life* (2000), Williams and Tsien wrote, "We see architecture as an act of profound optimism." We could not say it better ourselves. ■

Cathleen McGuigan

Cathleen McGuigan, Editor in Chief

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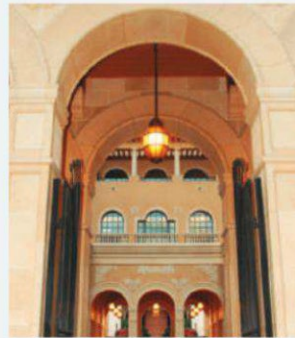


School Hallway Lockers Made of High-Density Polyethylene (HDPE)

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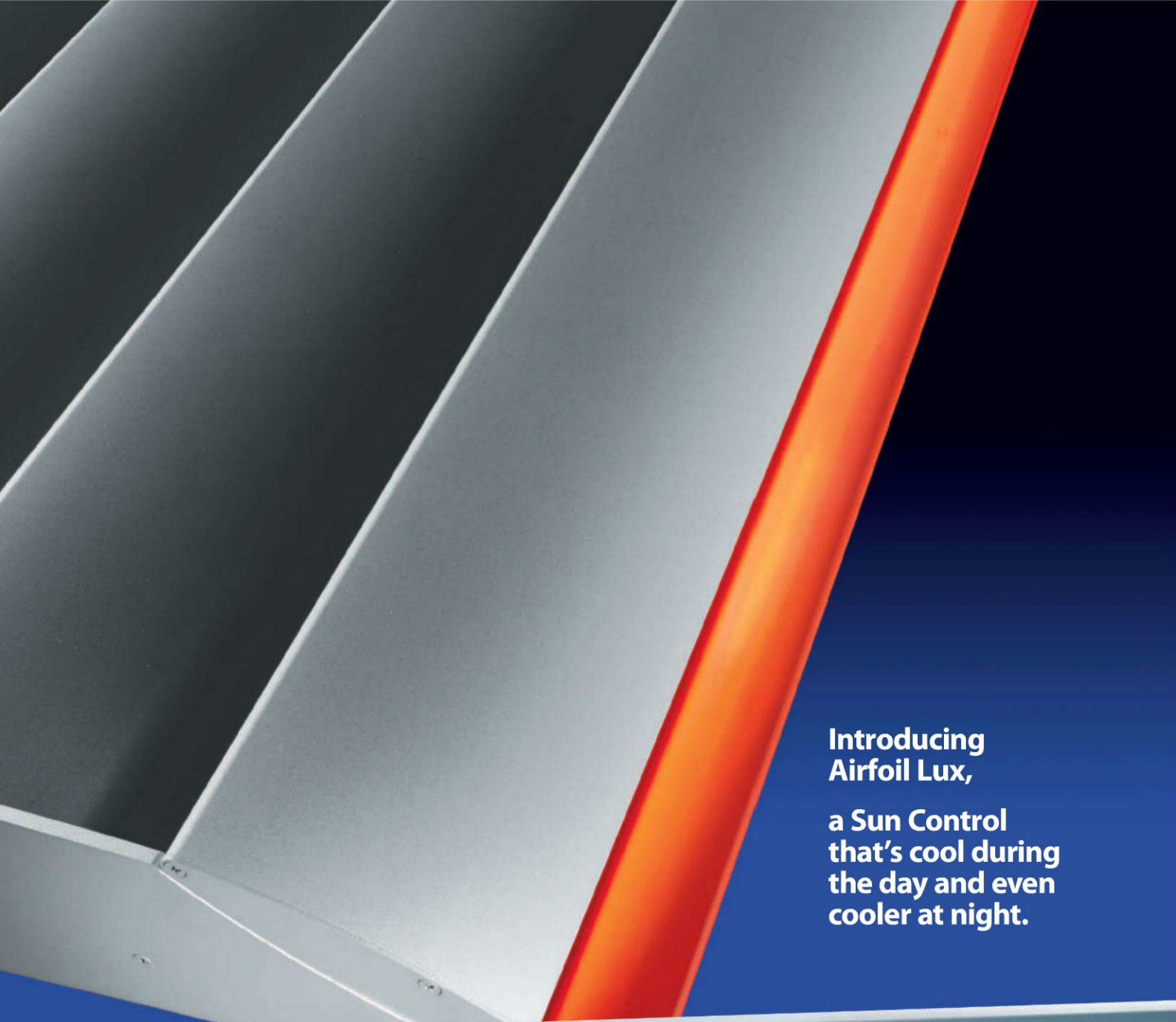
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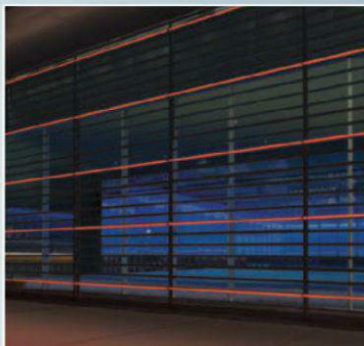
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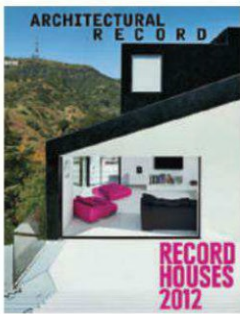
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E-mail questions to arcallforentries@mcgraw-hill.com.

Please indicate **Record Houses** as the subject of your e-mail. **SUBMISSION DEADLINE: 1/15/2013.**

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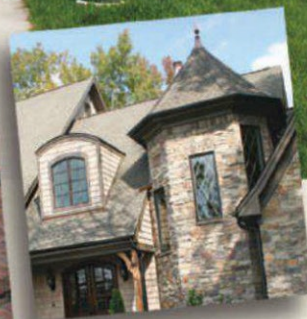
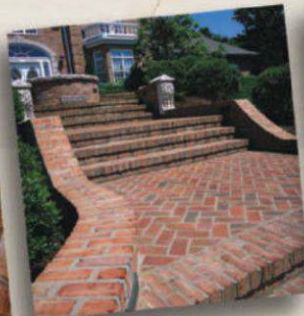
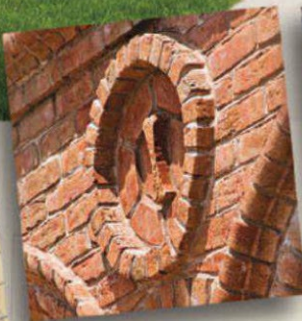
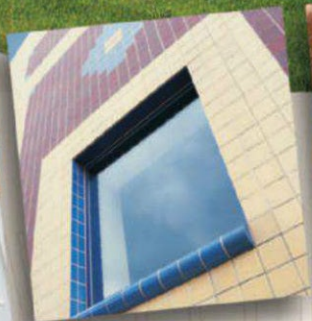
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The editors of **ARCHITECTURAL RECORD** are currently accepting submissions for the **2013 ARCHITECTURAL RECORD GOOD DESIGN IS GOOD BUSINESS** awards program (formerly the BusinessWeek/Architectural Record Awards). Good design is a priority for leaders of business and industry looking to boost productivity, rebrand, and attract customers. The Good Design Is Good Business awards honor architects and clients who best utilize design to achieve such strategic objectives. Winners will be published in the June 2013 issue.

The fee is US\$150 per entry and \$50 for each additional project. Download the official entry form at architecturalrecord.com/call4entries. E-mail questions to arcallforentries@mcgraw-hill.com. Please indicate **GDGB** as the subject of your e-mail. **SUBMISSION DEADLINE: 2/15/2013.**



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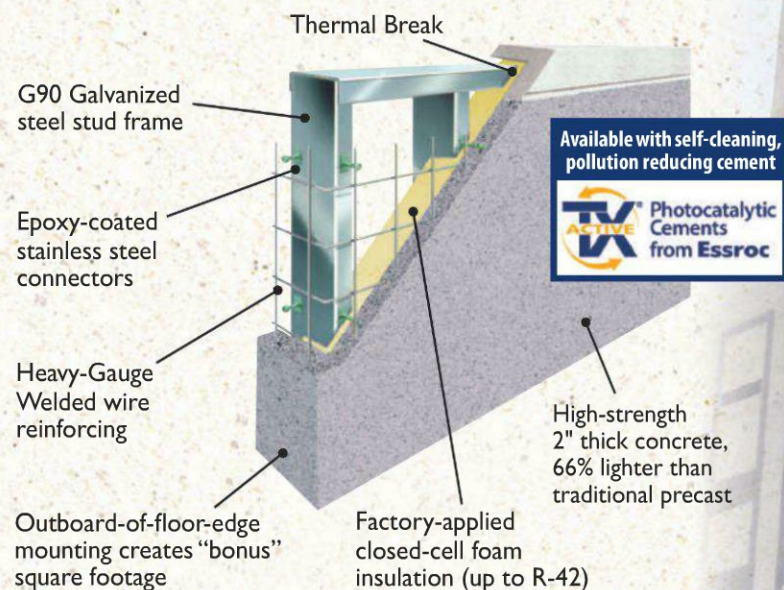
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perspective

Architecture is not a profession for the faint-hearted, the weak-willed, or the short-lived. — Critic **Martin Filler**

in The New York Review of Books, September 27, 2012

U.S. Raises Bar for Diplomatic Design

BY JAYNE MERKEL



SOM's U.S. Embassy in Beijing, completed in 2008, represents a new era of design for diplomatic buildings.

THE U.S. Department of State has named the architects selected to compete for commissions in its new Design Excellence program. The Bureau of Overseas Buildings Operations (OBO), under the direction of Lydia Muniz, chose 11 very different firms from among 88 applicants to design new embassies, consulates, and diplomatic buildings. Nine others were chosen for renovation and rehabilitation projects. Two firms, BNIM and Weiss/Manfredi, made both lists.

Aside from those two, others being considered for new buildings are Ennead Architects; SHoP Architects; Steven Holl Architects; the Miller Hull Partnership; Mack Scogin Merrill Elam Architects; Moore Ruble Yudell Architects and Planners; Rich&rd+Bauer; Skidmore, Owings & Merrill's San Francisco office; and Studio Gang Architects.

The other firms selected to compete for rehabilitation and renovation projects are Architecture Research Office; Beyer Blinder Belle Architects & Planners; CO Architects; Clive Wilkinson Architects; Goody Clancy; Krueck+Sexton Architects; and Zimmer Gunsul Frasca Architects.

For nearly three decades after the Iran

hostage crisis of 1979–81 and a series of embassy bombings in Africa and the Middle East, the State Department constructed one-size-fits-all buildings in fortified exurban areas. Security, economy, and speed trumped design.

But a new era was signaled by such choices as Skidmore, Owings & Merrill (SOM) to design the U.S. Embassy in Beijing. The ambitious Design Excellence program, similar to the one at the General Services Administration and, like it, under the directorship of Casey Jones, was launched to symbolize the American values that prevailed after World War II, when embassies were designed by Eero Saarinen, Walter Gropius, Marcel Breuer, and Edward Durell Stone.

"We are honored to have the potential of extending this legacy," says Marion Weiss, cofounder of Weiss/Manfredi. "Our ambition is to amplify the identity of a site that already has a life of its own."

The State Department's priorities are evident in the embassy under construction in London by KieranTimberlake. Davis Brody Bond is working on an embassy in Jakarta and is designing another in Mexico City with Tod Williams Billie Tsien Architects. ■

Surreal Shapes for Chinese Village

Beijing-based MAD Architects has broken ground on an ambitious development of low-rise residences in Anhui province, China, that complement the sloping curves of the surrounding Huangshan Mountains.

The new village will have 700 luxury and market-rate apartments, a hotel, and communal amenities. Its design will channel the natural setting and limestone cliffs that have long inspired painters and made the region a UNESCO heritage site. "We hope that residents will not just look at the scenery, but see themselves in relation to this environment," says architect Ma Yansong. The village, along the banks of Lake Taiping, is scheduled to be completed by 2014. Kit Gillet



MAD's design for the village includes 700 apartments (top). The entrance to the apartment building shown above is at the top of the structure.

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Haitian Formation

BY LAURA RASKIN

CARLOS ZAPATA, who designed Chicago's Soldier Field football stadium with Benjamin Wood in 2003, has just unveiled his design for a pro bono stadium in Cité Soleil, Haiti. The 12,000-seat soccer stadium will include an attached school and sports complex in a phased development.

The project, dubbed Phoenix Stadium, will be used by underprivileged youth—and eventually a new professional team seeded, in part, by the best of them—in what is considered to be Haiti's poorest and most dangerous slum. It is being spearheaded by Morad Fareed, a former player for the Palestinian national soccer team and now a real-estate developer in New York City, and Bobby Duval, a former soccer player for Haiti and the founder and director of the Cité Soleil nonprofit L'Athlétique d'Haïti.

The stadium is a longtime dream of Duval's. Through his nonprofit, on a field he and the organization own, Duval has been providing sports training, education, and meals to more than 1,500 young people since 1995.

Now, on about 16 acres of what was once waterlogged land near his current field, Duval

has been diverting rubble from the 2010 earthquake to raise the new field by about 6 feet. This has compacted the soil underneath, making it a suitable surface on which to build the new stadium, says Zapata. Some of the rubble will be pushed aside to create hills that will support concrete planks for seating.

The project is expected to be completed in three phases, based on fundraising (organized by the nonprofit Fareed established for this purpose, Project Phoenix), and will also function as a home for L'Athlétique d'Haïti.



Carlos Zapata's design for a 12,000-seat soccer stadium in Cité Soleil, Haiti.

The first phase, consisting of an artificial-turf field, some seating, and field lights, will break ground in 2013. The second phase will include the construction of the soccer academy, school, dormitories, and classrooms for roughly 2,000 kids. During the third phase, the seating will expand to include press and other boxes and will be covered by a swooping, winglike roof made of textile stretched over concrete ribs. This enclosed portion will also include community spaces and a basketball court.

Zapata says that when Duval and Fareed

approached him to design the stadium, he agreed on the condition that it "shouldn't be non-architecture." He explains: "I just didn't want to do something that ends up compromised. The [youth] don't have the best deal." It should be a "beautiful piece of architecture. The program is fantastic." ■

IMAGE: COURTESY CARLOS ZAPATA STUDIO

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[ANALYSIS]

Rhino 5 Revs It Up

BY MICHAEL LEIGHTON BEAMAN

IN NOVEMBER, Robert McNeel & Associates released the fifth version of Rhinoceros (Rhino), a 3-D-modeling program for Windows. Rhino, which began as a program for naval design 20 years ago, gained a foothold among architecture students and young designers in the early 2000s by offering a low-cost and intuitive platform. That user base has grown substantially in recent years with the introduction of Grasshopper, a computational design plug-in that allows designers to code visually. Today those students have moved into practice, but much of what made Rhino attractive has been retained in this new version, including its affordable price: \$995 (\$195 for students).

Rhino 5 has several noteworthy improvements for architects. Since the release of the last version, in 2007, the software has been rebuilt for 64-bit processing, allowing users to work with larger models. Other enhancements include a tabbed toolbar layout, work-session capabilities, and better layer and block management. It also features improved drafting tools, which allow designers to hatch, annotate, dimension, convert 3-D models to 2-D drawings,

and create page layouts—all from a single toolbar. A new clipping plane and view options aid drafting, allowing for the creation of sections and plans that can be viewed with various line and shading displays.

Product manager Brian Gillespie explains that because Rhino 5 relies on more “light-weight,” or data-efficient, 3-D objects, it can handle larger, more complex models. Although some of these functions are informed by AEC-specific software, Rhino won’t replace programs for detailed construction drawings. But the new features make Rhino 5 an even stronger 3-D tool for early phases of architectural-project design. Grasshopper, which has made parametric modeling much more accessible, will now be supported only in Rhino 5.

Along with the ability to write custom codes in Python programming language, this makes Rhino an extremely useful cross-disciplinary platform. The feedback from more than 40,000 beta testers over five years (of whom I was one) has helped McNeel make this version of the software more attuned to the needs of a variety of designers, including architects. ■



SHINE Architecture and TAarquitectura used Rhino 5 to help retrofit a university building in León, Mexico.

PHOTOGRAPHY: COURTESY SHINE ARCHITECTURE

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[OBITUARY]

Oscar Niemeyer, 1907-2012

BY RAUL BARRENECHE

OSCAR NIEMEYER died in Rio de Janeiro on December 5, just 10 days shy of his 105th birthday. One of the last links to the founding generation of Modernist architects, Niemeyer indelibly shaped Brazil's architectural identity, immortalized in the monumental government buildings he created for the new capital, Brasília. He became a household name there, if not a national hero. As a young draftsman he met Le Corbusier, who went to Rio in the 1930s to work with Lúcio Costa and others on the seminal Ministry of Education and Health. Later Niemeyer was on the team—which included Le Corbusier—that designed the United Nations headquarters (1950).

Niemeyer reinvigorated Modernism by taking the chill off its rigid, dogmatic Bauhaus approach, imbuing its rationality with sensuality, optimism, and a *joie de vivre* that struck a chord with the Latin American psyche. His buildings opened themselves to the light, warmth, and lushness of Brazil. To experience the exquisite *brises-soleil* of the Ministry of Education and Health (completed in 1943), the ribbon windows of the architect's home in the hills above Rio (1953), and the dance of pilotis and balustrades in his Bienal de São Paulo pavilion (1951) was to understand how Niemeyer brought to life the elements of Le Corbusier's "Five Points." His work was not just photogenic, it was transporting.

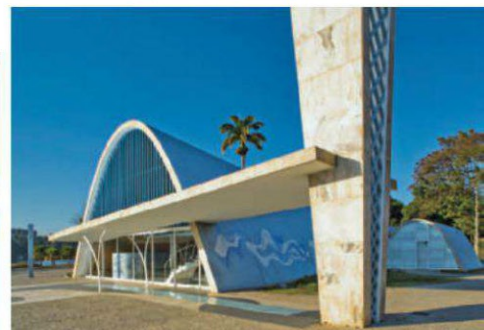
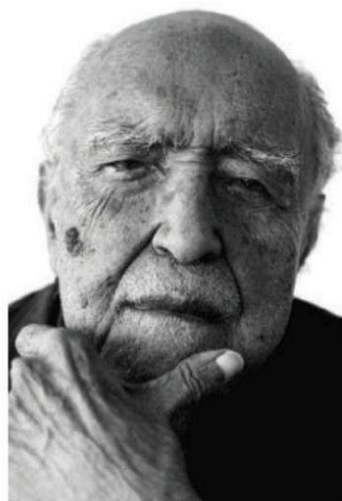
Those aspects of Niemeyer's architecture that set him apart from the mainstream also clouded his legacy. In the preface to his 2000 memoir, *The Curves of Time*, he avowed, "I am not attracted to the straight angle or the straight line, hard and inflexible, created by

man. I am attracted to free-flowing, sensual curves." In the book, the curves of his buildings are interspersed with his sketches of frolicking nudes. (He was married to his first wife, Annita Balo, for 76 years; after her death in 2004, he wed his assistant Vera Lucia Cabreira, 39 years his junior.)

Niemeyer's commitment to communism was more detrimental to his career than his penchant for feminine curves. His Communist Party membership halted visas to teach at Harvard and Yale in the 1940s, derailed his nomination as dean of Harvard's Graduate School of Design in 1953, and cost him jobs at home and abroad during the Cold War. But he did design the exquisite French Communist Party headquarters in Paris (1981), where he lived in exile in the 1960s and '70s during Brazil's right-wing military dictatorship.

The architect worked until a few days before his death at his studio overlooking Avenida Atlântica and the sinuous Copacabana beachfront. "Form follows beauty," Niemeyer declared. His architecture made the world, especially Brazil, a more beautiful place. ■

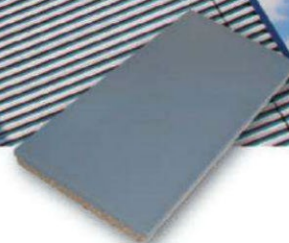
Raul Barreneche is a New York City-based designer and author of 11 books on architecture and design.



Clockwise from top: Niemeyer in 2007; his Church of Saint Francis of Assisi at Pampulha in Belo Horizonte, Brazil (1943); the Oscar Niemeyer International Cultural Centre in Avilés, Spain (2010); the Copan Building in São Paulo (1966); the National Congress in Brasília (1960).

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CIRCLE 74

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[INTERVIEW]

Unbuilt But Not Forgotten

BY FRED A. BERNSTEIN

UNMADE IN CHINA, an exhibition about projects for Chinese clients that were never built, debuted at Shanghai's ide@s Gallery in April, was seen at Beijing Design Week in October, and is now headed to several U.S. cities. The show's progenitor is Mike Tunkey, a Harvard-trained architect who opened Cannon Design's Shanghai office in 2006. In 2008 he traveled to Ordos, in Inner Mongolia, with the firm's plans for a performing arts-center, expected to

be seen as critical of Chinese clients?

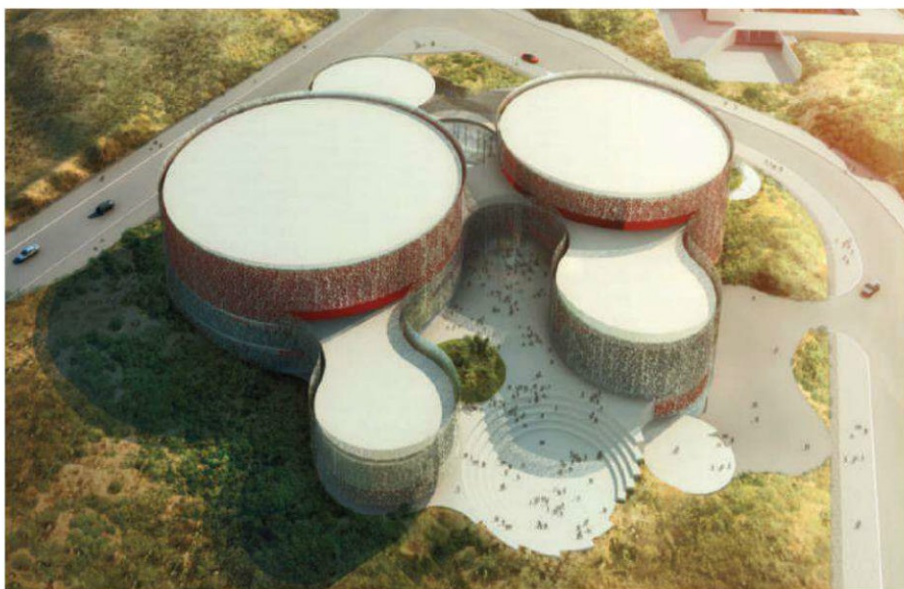
We tried to focus on the positives. Most of the architects in the show have actually gone on to do other projects here.

There are no Chinese architects in the show.

I have a lot of friends in the younger generation of Chinese architects. None of them would participate. I spent a lot of time lobbying and talking to Chinese architects, explaining that unbuilt projects are a substantial part of the dialogue, but they weren't having any of it.

Why do you think that is?

They don't want the client to lose face. **So is China a land of opportunity for Western architects?**



Cannon Design's scheme for the Ordos Performing Arts Center in Ordos, China. The center was never built.

anchor a new arts district in the provincial Chinese boomtown. The building was never constructed, which is the fate of many other buildings by Western architects in Ordos, and countless more in other parts of China. Two years ago, Tunkey began planning an exhibition about such buildings, with the support of Cannon Design. He spoke with *RECORD* from his office in Shanghai.

How did the exhibition come about?

When Cannon asked me to establish the Shanghai office, part of the mandate was to do things that contribute to the larger dialogue. **You ended up with some provocative material, about how architects were left hanging by Chinese clients.**

Some of the architects in the videos are more blunt than even I would have been. **Was it risky to mount an exhibition that could**

Certainly the economy has been significantly better since 2007 in China than it has been in the U.S. When I go back to the U.S., I see my friends just struggling to do anything, and we've got some very large projects. Still, the economy is cooling here, so you have to be pretty specific about which sectors you're engaged in. For example, if you're trying to do residential projects, or speculative office projects, I almost feel sorry for you.

If China's infatuation with Western architects is ending, aren't the architects partly at fault?

Up until the Olympics, in 2008, the Chinese clients, including the government, were looking for buildings that were more spectacular than functional. And architects were willing to play along. Even architects who are very sensitive when they build in their own communities came here to do buildings that have been described as "vast, fast, and naughty." ■



For the complete interview, visit architecturalrecord/news.com.

noted

AIA Lauds Thom Mayne, Tod Williams, and Billie Tsien

The American Institute of Architects (AIA) awarded the 2013 Gold Medal to Thom Mayne, of the Los Angeles-based Morphosis Architects, on December 6. He is the 69th recipient of the award. New York City-based Tod Williams Billie Tsien Architects received the 2013 firm award.

Bing Thom to Design Hong Kong District's First Building

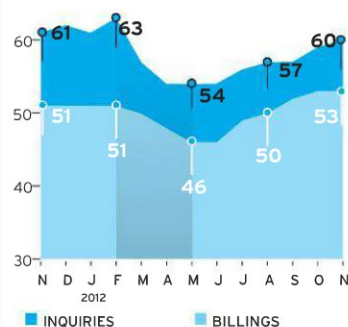
The West Kowloon Cultural District Authority announced on December 10 that Vancouver-based, Hong Kong-born architect Bing Thom and Hong Kong-based Ronald Lu will design the Chinese Opera Centre, set to open in 2016. It will be the first of 17 buildings to anchor the new district.

UC Davis Names Three Teams to Compete for Museum Bid

The University of California, Davis, named three teams that will have four months to prepare a design-build bid for its new \$30 million art museum: WORKac and Westlake Reed Leskosky; Henning Larsen Architects and Gould Evans; and SO-IL and Bohlin Cywinski Jackson.

Master Jury Announced for 2013 Aga Khan Award

The nine jurors who will select the recipients of the \$1 million 2013 Aga Khan Award for Architecture were announced in late November and include David Adjaye, Toshiko Mori, and Wang Shu. The jury will decide the winners after site visits to shortlisted projects in June. The award is given every three years.



ABI on the Up and Up

The Architectural Billings Index score rose in November to 53.2. "If the federal budget situation gets cleared up, [it] will likely lead to the greenlighting of numerous projects," said AIA chief economist Kermit Baker. "If we do end up going off the 'fiscal cliff,' then we can expect a significant setback for the entire design and construction industry."

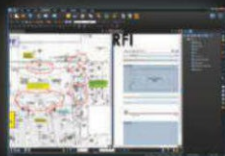
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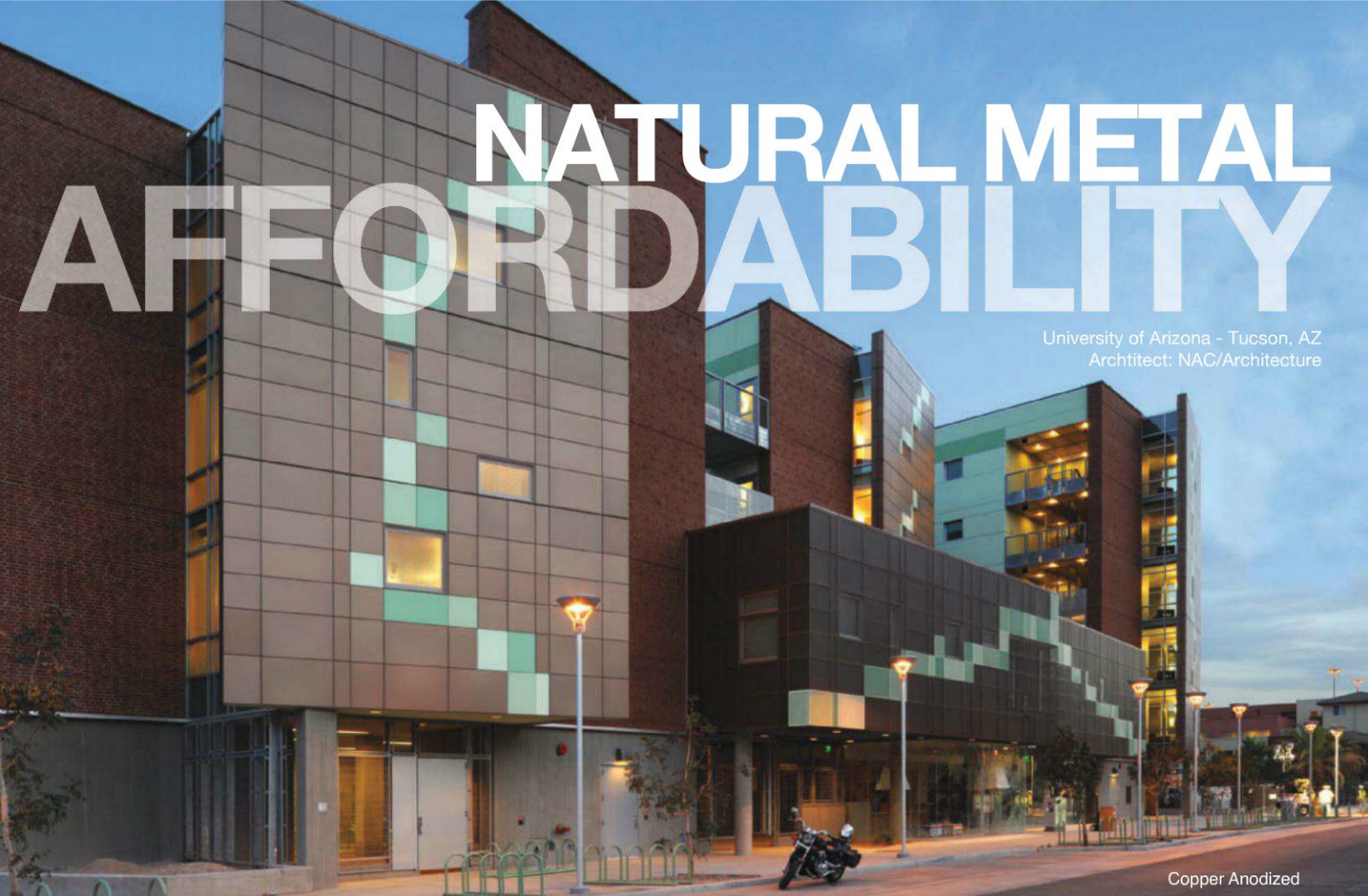
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Project Shown: St. Rose Dominican Hospital; Las Vegas, Nevada



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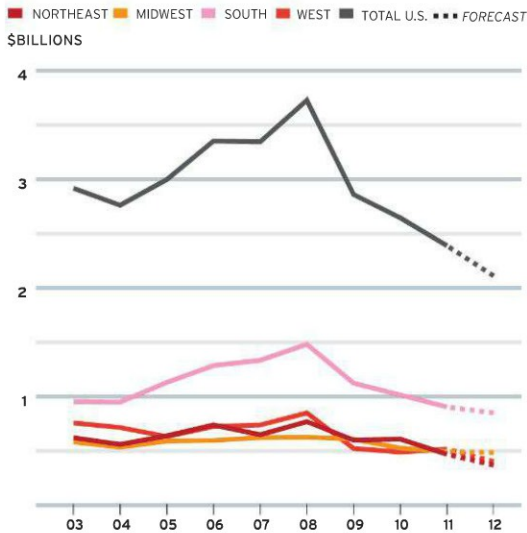
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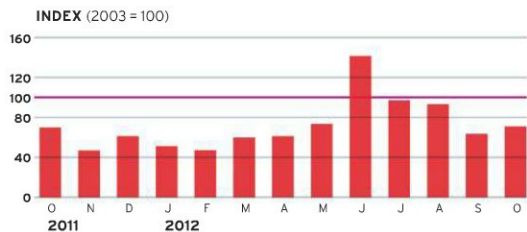
K-12 CONSTRUCTION

K-12 Starts by Region

In addition to U.S. total and 2012 forecast figures



The Dodge Index for K-12 Construction 10/2011-10/2012

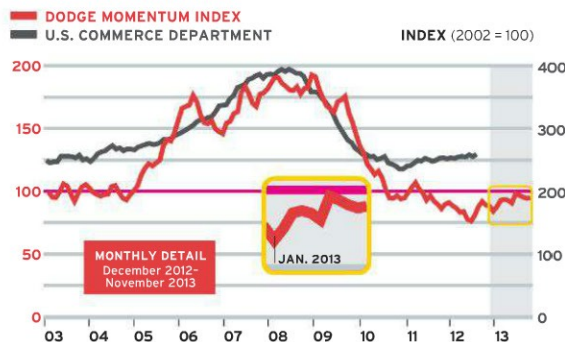


The index is based on data for K-12 construction starts that has not been seasonally adjusted. The average dollar value of projects in 2003 serves as the index baseline.

MOMENTUM INDEX IN HOLDING PATTERN

In November, the Dodge Momentum Index inched up 0.5% to 92.5. After it reached a low point in mid-2011, the turnaround has been halting, with monthly gains often followed by a decline.

The Dodge Momentum Index is a leading indicator of construction spending. The information is derived from first-issued planning reports in McGraw-Hill Construction's Dodge Reports database. The data leads the U.S. Commerce Department's nonresidential spending by a full year. In the graph to the right, the index has been shifted forward 12 months to reflect its relationship with the census data.



Construction of K-12 facilities continues to suffer from the poor fiscal condition of state and local governments. It will take time for the market to rebound despite the continued need for new schools and renovations.

Top Metro-Area Markets

Ranked by total K-12 starts 1/2011 through 10/2012

REGION	\$MILLIONS
1 NEW YORK CITY	2,441
2 CHICAGO	1,434
3 DALLAS	1,393
4 BOSTON	1,333
5 HOUSTON	1,314



Top 5 Design Firms

Ranked by K-12 construction starts 1/2011 through 10/2012

- 1 Ai3 Architects
- 2 PBK Architects
- 3 Perkins+Will
- 4 SHW Group
- 5 Corgan

Top 5 K-12 Projects

Ranked by K-12 construction starts 1/2012 through 10/2012

\$136 MILLION

PROJECT: San Marcos High School Reconstruction
ARCHITECT: LPA
LOCATION: San Marcos, CA

\$105 MILLION

PROJECT: Duxbury Middle & High School
ARCHITECT: Mount Vernon Group Architects
LOCATION: Duxbury, MA

\$101 MILLION

PROJECT: Essex North Shore Agricultural and Technical High School
ARCHITECTS: Design Partnership of Cambridge; Wiles and Associates Architects
LOCATION: Danvers, MA

\$100 MILLION

PROJECT: Lake Central High School Addition/Renovation
ARCHITECT: Schmidt Associates
LOCATION: St. John, IN

\$88 MILLION

PROJECT: Beacon High School
ARCHITECT: John Ciardullo Associates
LOCATION: New York City



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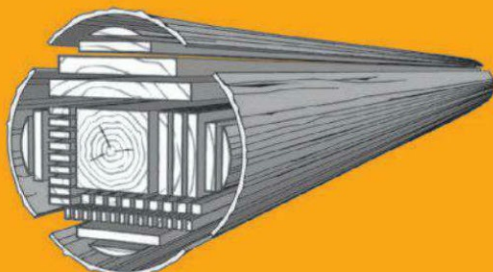
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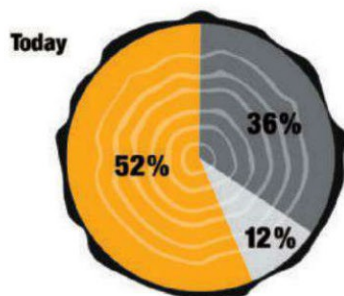
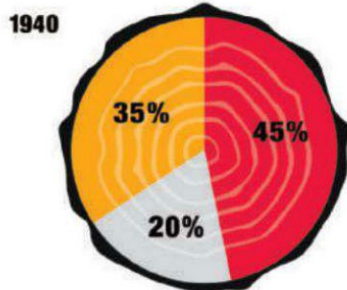
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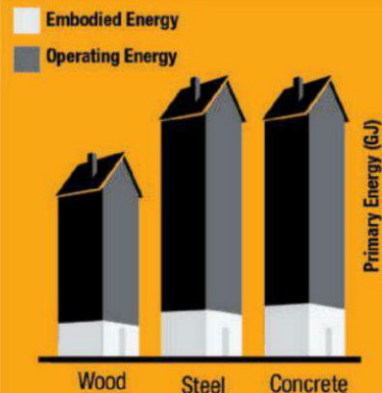


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Design for Troubled Waters

Cities need to grapple with complex ideas to prepare for the next superstorm.

BY JERRY ADLER

TWO LARGE buildings stand about a quarter mile apart in Red Hook, on the Brooklyn waterfront. One is a 19th-century brick warehouse handsomely renovated to house apartments and Fairway Market, a much-beloved gourmet grocery; the other is the local outpost of IKEA in a sprawling yellow-and-blue shed whose ground floor is mostly parking. The storm surge from Superstorm Sandy wrecked Fairway, which will take months to rebuild. IKEA, by contrast, with its merchandise mostly off the ground floor, was scarcely damaged and reopened a few days later; FEMA even housed a temporary office there.

There's a lesson to be learned there, but Stephen Cassell, a principal in New York's Architecture Research Office, thinks we're in danger of learning the wrong one. "The one surefire way to deal with flooding is to raise buildings off the ground," says Cassell, who spoke at a symposium November 16 on post-Sandy urban design organized by the American Institute of Architects' New York Chapter (AIANY). "But that doesn't make for good urbanism." Every disaster leaves its mark on the built environment, not necessarily for the better, as the rows of bollards and concrete planters lining the sidewalks of New York and Washington testify. The challenge will be to design buildings, public space, and infrastructure that can resist flooding without compromising other values, such as aesthetics, urbanism, and accessibility. Or inadvertently making things worse in other ways. Building owners in Lower Manhattan are drawing up plans to relocate backup generators from flooded basements to roofs—



Transportation Authority had begun a project to replace flush ventilation grates with undulating stainless-steel louvers-cum-benches, in an award-winning design by the New York firm Rogers Marvel Architects. The city's design guidelines for the development of Willets Point, 62 low-lying acres just east of

A New York City worker clears a sewer drain in Lower Manhattan after Superstorm Sandy.

The challenge will be to design infrastructure, buildings, and public spaces that can resist flooding without compromising other values.

from which some were moved down as a security measure after 9/11.

Even before Sandy, the prospect of bigger storms and the certainty of rising sea levels were influencing architects and planners, even in a city like New York, whose civic motto might well be "We make our own reality." In the wake of a summer deluge that shut parts of the subway system in 2007, the Metropolitan

the Mets' baseball stadium, call for raising the entire site to 14 feet above mean sea level, incorporating a terraced public space at the water's edge on the model of Hamburg's HafenCity on the banks of the Elbe. If planners had been thinking that way in the 1970s, when Battery Park City was being designed on Hudson River landfill, it would have saved a lot of trouble last fall.

Building by building, the architectural and engineering solutions to flood resistance aren't necessarily esoteric or even expensive. But they have been applied inconsistently at best, says structural engineer Guy Nordenson (see page 48). Building codes have been slow to catch up to the increased risk, lagging several decades behind, say, seismic protection. "The general attitude for a long time was, you build a levee and forget about it. They found out in New Orleans that wasn't the case," says Nordenson. Now the areas of New Orleans that flooded in 2005 during Hurricane Katrina are being recolonized by houses raised on pilings above the flood line, many of them built under the auspices of the Make It Right foundation. The flood line varies from place to place, obviously, and calls for different approaches. There's a perfectly good Southern vernacular for bungalows or shotgun houses raised a few feet above the ground, but to build a house in

midair demands a certain structural imagination, and some of the best examples have a touch of futuristic whimsy. The less successful examples are where the architect has plopped a turreted, gabled Spanish provincial atop a slab and then lifted it straight up off the ground. And, of course, almost none of them are accessible to the disabled, nor do they lend themselves to what Brandon Welling of Morphosis Architects describes as the porch-sitting, street-oriented working-class culture of the Lower Ninth Ward.

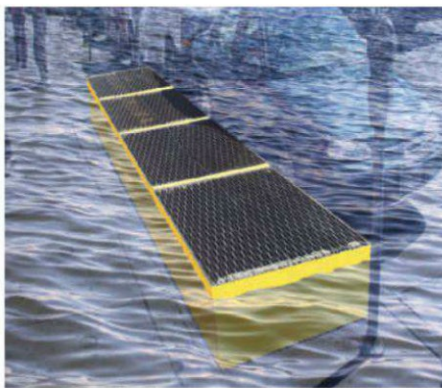
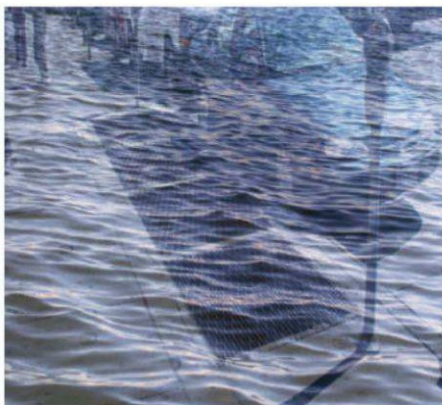
In its submission to Make It Right, Morphosis designed a house that sits at ground level on a base of concrete-encased foam but can rise as much as 12 feet in high water, sliding on two anchored posts that keep it from floating away. "It's not meant to be habitable while it's floating," Welling clarifies, "but if it does float, you can come back to it and live in it once it's settled." It was built, and is occupied, but so far no one else has opted for that particular solution.

But flood resistance can't be achieved one building at a time, says Donald Watson, former chair of the Environmental Design program at the Yale School of Architecture; it's a zoning and planning problem as well as an architectural one. Zoning in residential areas often imposes height restrictions; raising a building above grade might mean sacrificing a floor,

Flood resistance is a zoning and planning problem as well as an architectural one.

says architect Mark Ginsberg of Curtis + Ginsberg, a prominent advocate for better urban housing. If Manhattan office buildings are built out to their full allowable floor area, locating mechanical rooms above the basement (where they don't count against the floor-area ratio) will reduce rentable space. These issues can be addressed by local zoning, but putting a building entrance above street level requires a ramp for wheelchair access, which not many development sites in crowded downtown neighborhoods can accommodate—and changing that requires, as they say, an act of Congress.

In the long run, planners argue, we need a new way to think about flooding. "We've approached this as a binary question until now—either you're too low and you get flooded, or you're high enough and you don't," says Cassell. "We're going to have to build in resiliency. Probably 20 percent of Manhattan is landfill, and that's always going to be vulner-



A downpour in August 2007 caused flooding in many New York City neighborhoods and subway tunnels—major transit lines were shut down for most of a day. Rogers Marvel Architects' solution, commissioned by the Metropolitan Transportation Authority, was to raise sidewalk ventilation grates off the ground six to 18 inches. From top: The architects developed a raised-grate concept to arrive at their final design—hammered-metal grates with a wavy profile, some of them with benches. The first were installed in 2008.

able." That might mean, for instance, designing streets for water management, rather than letting rain and storm surges drain into the same sewers that handle waste. At the AIANY symposium, Cassell presented a plan for streets paved with pervious materials above a deep base of synthetic, water-absorbent soil, with embedded discharge channels isolated from sanitary sewers. It might also mean accepting that certain places and buildings will flood, but minimizing the resultant damage by a careful selection of materials (stone, concrete block, water-resistant drywall, and foam insulation instead of fiberglass) and uses (an occasional flood might be an acceptable risk for a newsstand or a sandwich kiosk, but not a jeweler or a BMW showroom). The goal, says Rob Rogers of Rogers Marvel, is "to make it more like a bad snowstorm than an atomic bomb—you shut down for a day, you clean it up, and life goes on."

Jonathan Rose, the developer, avoids building in areas subject to flooding but recognizes that it's going to happen anyway, and identifies some strategies to minimize the dangers. We have to design for the possibility that buildings could be without power for extended periods, he says. Thermal insulation should be treated not just as an environmental benefit but as a life-safety issue; residential buildings should be designed to maintain a minimum temperature of 45 degrees for extended periods without heat. Similarly, apartments should allow cross-ventilation, in case power goes out in the summer, and stairwells should have access to daylight.

Rose, as it happens, is a member of the New York State 2100 Commission, which is concerned with infrastructure resilience. It's sobering, if not downright scary, to hear him contemplate a future in which large numbers of citizens will be relying on sunlight to keep from freezing or falling to their deaths—a return to an era not just before electricity but even before fire. It's worth remembering, as we confront an uncertain and increasingly dangerous future, that even the most advanced civilization on earth cannot escape the fate of the planet it inhabits. ■

Jerry Adler is a former senior editor of Newsweek and author of High Rise (Harper Perennial, 1993).

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CIRCLE 57

Bracing for Change

The lessons of Sandy provide clues for how to adapt existing buildings.

BY RONDA KAYSEN



FROM TINY New Jersey Shore bungalows to Manhattan high-rises, properties were caught unprepared for the might of Superstorm Sandy. Now architects are grappling with the stark reality that many structures were not designed to withstand a changing climate. As the rebuilding process begins, so do complicated discussions about how to adapt existing buildings. The growing consensus is that they, too, must change with the climate.

"There is an overwhelming sense that we have to do something different. We were caught flat-footed, and we can't have that happen again," says Russell Unger, executive director of the Urban Green Council (UGC). Two weeks after the storm, New York City tapped UGC to lead a Building Resiliency Task Force. The first job is to compile a list of about 100 members from the building community, including property owners and managers, cost experts, engineers, and designers. Then findings and recommendations for adapting buildings will be released this summer.

In the meantime, the examples of success may serve as a template for how to rethink design in an era of unprecedented weather. Some properties directly in Sandy's path fared well, like the Goldman Sachs building in Battery Park City, which braced for the storm with sandbags. "What we need to do now is forensic: Go back and look at what

Sandbags helped to spare the Goldman Sachs building in Manhattan's Battery Park City from hurricane damage.

worked and what didn't," says Rafael Pelli, a Manhattan architect who designed the Solaire and the Visionare, two Battery Park City developments that remained dry largely because the neighborhood had been designed with higher street levels in anticipation of potential storm surges. The streets flooded,

"We were caught flat-footed, and we can't have that happen again." —Russell Unger

but buildings did not, for the most part.

There are clues in the failures as well. One New York Plaza, at the southernmost tip of Manhattan, has three subterranean floors that flooded almost completely. Although office tenants have returned, ground-floor retail requires a gut renovation. Brookfield Properties, which owns the building, points to city codes requiring fuel to be stored below grade as part of the problem: Without fuel for generators, pumping water out is difficult. "We need to think more about how we deal with flooding in such a highly dense and populated area with so much real estate," says Brookfield spokesperson Matthew Cherry.

But buildings don't exist in a vacuum, and

the solutions individual properties choose to implement will also be determined by post-Sandy codes that municipalities enact, and the infrastructure investments that New York and New Jersey make—such as in seawalls, storm-surge barriers, engineered sand dunes, and improvements to the electrical grid. Florida, for example, enacted strict new building codes, addressing items such as windows and generators, after Hurricane Andrew devastated the region in 1992. "You can't just put blinders on and think about what has to be done at the level of building without thinking about what can be done on a larger scale," says Pelli.

Short-term solutions are also on the table, such as setting aside an emergency-supply room to store critical spare parts for equipment that might get damaged. Property owners could move electrical panels higher and modify them so emergency equipment could be added during a storm. Ductwork could be moved higher, and louvers could be repositioned above windowsills so they don't act like hoses, funneling water into mechanical rooms, as happened during Sandy.

For many, Sandy's biggest punch was the weeks-long power outage. Without power, sump pumps failed and high-rises were unable to deliver basic services like heat and domestic water. Engineering firms have been inundated with requests for generators. But a generator is no guaranteed lifeline if the fuel source is compromised. The answer may be installing a

cogeneration system to reduce dependency on the grid, or rethinking how the grid is organized so a small collection of neighboring properties could share power in a microgrid.

Ideas that once seemed overwhelming and cost-prohibitive may actually take hold now that many properties have no choice but to overhaul their infrastructure as they begin to rebuild. "You get a clean piece of paper? Not often," says Edward Brzezowski, a mechanical engineer with the Falcon Group. "Now we have the opportunity to stand back and say, 'Maybe I can do something better.'" ■

Ronda Kaysen is a freelance journalist who writes frequently about real estate.

Answers for an Age of Extremes

Experts call for a hazards-reduction program for floods.

BY GUY NORDENSON

FOR THOSE of us involved in the 2010 exhibition *Rising Currents: Projects for New York's Waterfront*, at New York's Museum of Modern Art (MoMA), the question we've been asked most frequently since Superstorm Sandy is "Could things have been different?" The honest answer is mostly no. The barrier islands and reefs proposed in the *Rising Currents* show were there to break the waves in storms to form a new public space on the water's edge, as well as to defend the city. Sandy, in spite of being a tidal surge, was a late-season storm, and the cold temperatures kept the strongest winds at a high altitude, so fewer waves formed. Inside New York's upper harbor, the waves in Sandy appear to have been less violent. To protect against the tidal surge itself would require more specific and engineered protection in addition to the kinds of natural barriers proposed at MoMA.

Looking back to Sandy, we see how easily we are caught off guard. Thanks to Hurricane Irene in 2011, transit officials knew to shut down the system in advance and move the trains to safety, but they did not seal the road and rail tunnels against flooding. Irene caused the first evacuation in memory, but the lack of severe flooding then led some residents to ignore evacuation orders during Sandy, with terrible consequences. The unexpected flooding of an electrical substation downtown caused an extensive and lasting blackout. Many buildings were made uninhabitable when basement flooding knocked out their utilities. It seems pretty clear that building-code provisions for flood-resistant design and construction had been inconsistently applied at best.

So what can be done? The answer can be found in the nation's experience mitigating

while shaping a theoretical basis for earthquake-resistant design. The National Earthquake Hazards Reduction Program (NEHRP), initiated by Congress in 1977, formalized the government's role and steadily funded basic research. Spurred by the 1989 and 1994 California earthquakes, this led to the development of rigorous, probability-based seismic-hazards maps for the entire country and thoroughly vetted code provisions for buildings and bridges.

There is no national wind-hazards-reduction program, but the field has advanced steadily since the 1960s thanks to the contribution of key wind-tunnel facilities, notably in Ontario

a storm surge. We need physical testing for this just as much as we need to design for the turbulent flow of wind around buildings. YouTube videos of the 2011 tsunami flooding towns in Japan show its importance.

Even more critical is that we don't have reliable probability-based flood-hazards maps for the built environment executed at the same standards as our seismic- and wind-hazards maps. We need to embark on a sustained national hazards-reduction program for floods that includes these new kinds of maps (incorporating best estimates of the effects of climate change). We also need improved research on the performance of



Lower Manhattan with proposed barrier islands, from the influential study *On the Water: Palisade Bay* (2009).

as well as, for tornadoes, at the National Oceanic and Atmospheric Administration's National Severe Storms Laboratory in Oklahoma. Despite great advances in computational fluid dynamics, physical wind-tunnel testing of building models and field measurements of extreme storms are still necessary.

The geographer Gilbert White (1911–2006), generally considered the father of floodplain management, wrote in 2001 that "a full range of floodplain management tools should be used to address flooding problems, and assessing the effectiveness of these tools should be

structures in floods and extreme winds, with both numerical simulations and physical testing in large wave tanks. Bills now pending in the House and Senate would combine national seismic- and wind-hazards reduction into one Natural Hazards Risk Reduction Program. These should be expanded to include flood hazards as well, both coastal and riverine, and add the Federal Emergency Management Agency's flood-insurance program to its purview. The average funding for the NEHRP since 2005 has been \$125 million per year. A great deal of good has been accomplished with that money. Considering that the losses associated with recent storms have been at far greater magnitude, it is pretty clear what needs to be done. ■

Guy Nordenson, a New York structural engineer, is coauthor of *On the Water: Palisade Bay* and advised on MoMA's *Rising Currents* exhibition.

We need better research on the performance of structures in floods and violent winds.

the hazards of earthquakes and extreme winds. Individuals and professional organizations, most notably the Structural Engineers Association of California and the Earthquake Engineering Research Institute, decades ago began pressing local and federal governments

done on individual buildings and reaches for floods of up to 500-year frequency." He succinctly points to what is lacking now in flood-resistant design. For one thing, we don't understand what happens to individual buildings when water flows rapidly around them in



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Working All the Angles

Daniel Libeskind adds to his Jewish Museum Berlin.

BY FRED A. BERNSTEIN

SOMETHING ABOUT Berlin brings out the best in Daniel Libeskind. It is here that he had his greatest triumph with the opening, in 2001, of the Jewish Museum Berlin, a building with cuts and slashes that make brutality palpable. On the audio tour, Libeskind says that some people will be nauseated by the museum's angles. But that's OK. If his way of talking about the symbolism of his buildings can seem overwrought

to a planned skyscraper village in Seoul—an almost comical contradiction of his insistence that designs grow out of the meaning of a time and place. He seems determined to create a global brand of trademark architectural moves—a kind of off-kilter Lego set that could be called Libo—whether they fit the program, ignore the program, or in some cases seem almost to mock it.

But he will always have Berlin, and it



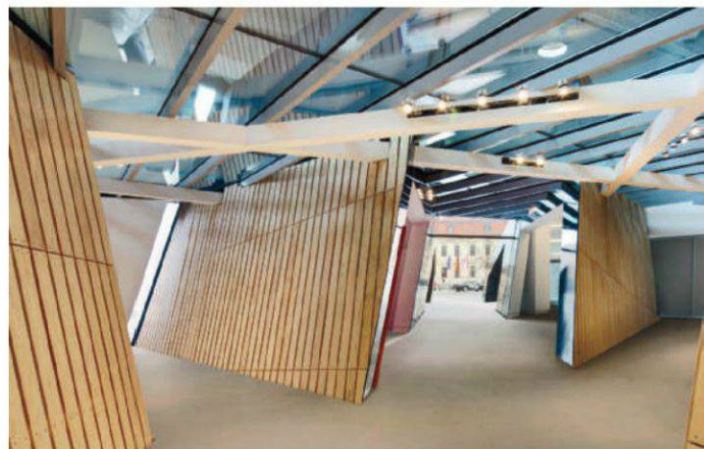
(he is happy to offer almost any meaning until he finds one that sticks), in Berlin the architecture itself speaks volumes.

But the same architectural style—and Libeskind definitely has a style—hasn't always transferred well to other times and places. Take the Crystals at CityCenter in Las Vegas, where his angles are used as mere window dressing—high-end architecture for high-end shoppers. (Rockwell Group was brought in to design the interiors, lest the severity of the building leave visitors queasy.) But why does a shopping mall in Vegas have the same cuts and slashes Libeskind said were meant to evoke the traumatic history of German Jewry? In the meantime, the architect still claims his master plan for the World Trade Center (WTC) in New York is the one that has been realized—but you need only look at the WTC website to see how much was altered.

Most recently, Libeskind has transferred his World Trade Center concept

is here that he has once again played to his strengths. The Jewish Museum Berlin long ago outgrew its 1735 home, the Kollegienhaus, as well as the Libeskind structure, with some 70 employees shunted off to rented spaces. Then, too, the museum saw an opportunity to make its archive accessible to the public by moving it across the street to the old Central Flower Market Hall, a factory-type building by architect Bruno Grimmek, completed in 1965. The building's most impressive feature is the series of north-facing clerestories set into gracefully curved concrete vaults.

After a long negotiation, the city turned over the 65,000-square-foot building to the museum, and even created a handsome new plaza outside. What remained was to convert 25,000 square feet of the market into what is officially called the Academy of the Jewish Museum Berlin in the Eric F. Ross Building (with the rest of the space saved for future museum exhibitions and events). Libeskind rose to the occa-



sion mostly by not raising partitions to the ceiling. He inserted two rows of nicely proportioned offices and meeting rooms along opposite edges of the building; the new construction is barely half the height of the original interior, which stays largely untouched. (And he left the curves—never a Libeskind favorite—alone.) Between the rows of offices, the museum plans to install the so-called Garden of the Diaspora, consisting of mosses and ferns on raised tables, designed by Berlin's Atelier le Balto.

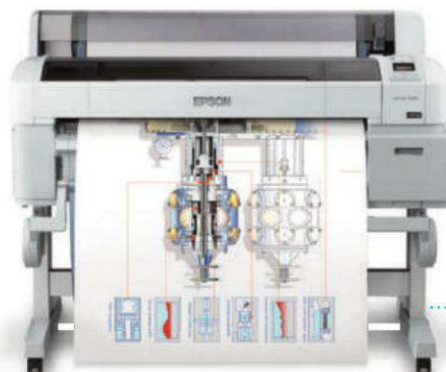
But Libeskind's big move was to create three cubic volumes in front of the warehouse-like space. One contains the entrance; another, the library/archive; and the third, a multipurpose room. The three cubes, jacked up at angles that can only be described as Libeskind-esque, are small enough, in relation to the 1965 building, to feel like just the right amount of Libo. Libeskind, in this case, is being contextual—even if he is responding to the context he created just over a decade ago on the other side of Lindenstrasse.

Why is the new building so much less elaborate than most of his projects? A tight budget, for one; a tight schedule, for another. But a slightly cynical conjecture would be that Libeskind didn't want to compete with the one thing that is sacrosanct to him—another Libeskind work—and so he pulled his punches. But whatever the reason, he has come up with a building that is dignified, restrained, and appealing without being attention-sucking. It is a case of Libeskind recognizing the limits, and the considerable beauty, of his approach. ■

The Academy of the Jewish Museum Berlin, housing an archive, library, and education and meeting spaces, occupies the former Central Flower Market Hall. The converted facility is located across Lindenstrasse from Studio Daniel Libeskind's landmark 2001 Jewish Museum Berlin.

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CIRCLE 30



perspective **house of the month**

ANMAHIAN WINTON ARCHITECTS' LOW-PROFILE TELLURIDE HOUSE STANDS UP TO HARSH WEATHER WITH A PALETTE OF HEARTY MATERIALS, FROM COPPER TO COLORADO LIMESTONE. BY LAURA RASKIN

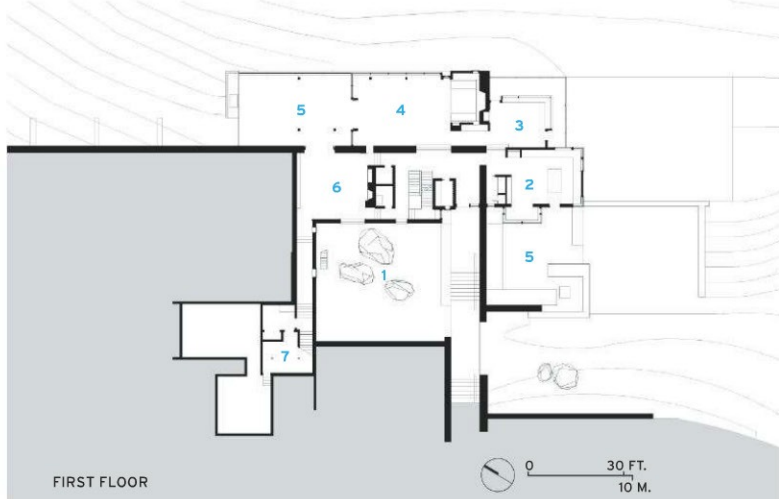
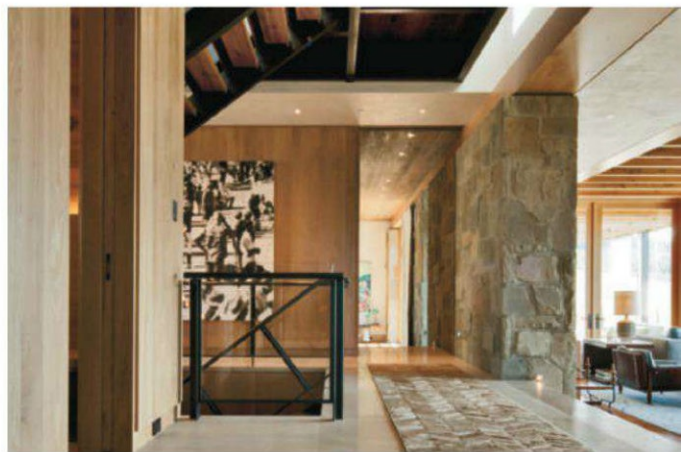
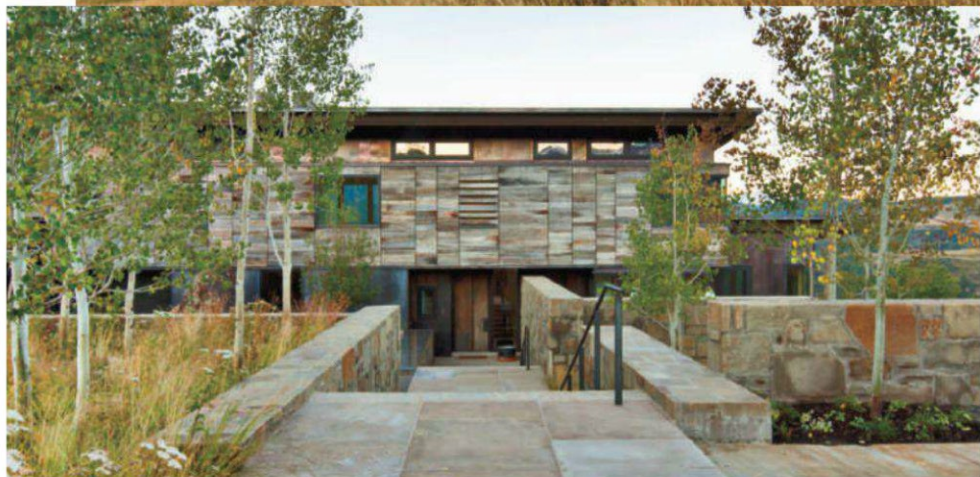
SITTING ALMOST 10,000 feet above sea level on a steep slope in Telluride, Colorado, a vacation home withstands extreme weather: deep snows and blazing sunshine. Cambridge, Massachusetts-based Anmahian Winton Architects wanted to take advantage of the dramatic site while minimizing the adverse effects of the climate. "A lot of our effort was intended to dig the house in and keep it low profile," says principal in charge Nick Winton, who collaborated with architect Karen Swett and landscape architect Michael Boucher.

The 8,000-square-foot steel-and-wood-frame structure will eventually become the clients' full-time residence, while serving as a hub for relatives. The architects developed a roughly L-shaped plan with connected rectangular volumes that read as separate pavilions and offer opportunities for privacy.

Colorado buff-limestone walls frame a depressed entry courtyard and provide a perch for the second story. The extended horizontal massing recalls houses by Frank Lloyd Wright, and, as Winton notes, the stone walls echo the scale and mortar detail of those found in old Telluride. On the entry floor, a kitchen and dining room have panoramic views, while the living room looks down the slope. A master suite is set apart from the rest of the house, with a connection on the entry level. Each main room has a relationship to the outdoors, says Winton, and what he calls a "micro-courtyard."

The other rich, natural materials follow the logic of the limestone walls: They're durable, low maintenance, and

textured. Copper and steel plate clad the facade. Oak reclaimed from a barn serves as a fully ventilated rainscreen and a real screen in front of some windows. "The owners were inclined to make high-quality choices about materials and sustainability. And they did," says Winton. ■



- 1 ENTRY COURT
- 2 KITCHEN
- 3 DINING
- 4 LIVING
- 5 TERRACE
- 6 DEN
- 7 MASTER SUITE

The house is surrounded by a 35-acre meadow (top). Visitors step down into an entry courtyard (center). Colorado buff-limestone walls extend from the interior to the exterior; floors are of the same material, but polished (above).

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Carrie Busey Elementary Floor Plan

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Stuart Brodsky, AIA, LEED AP
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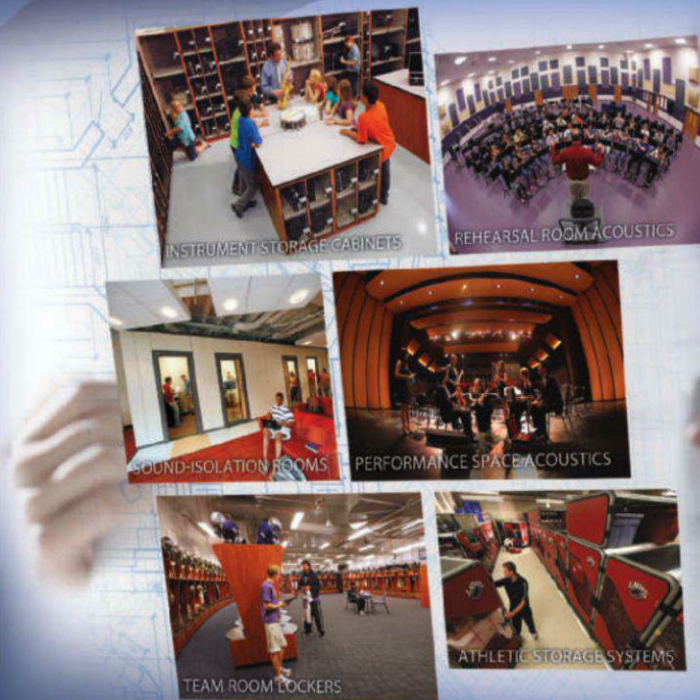
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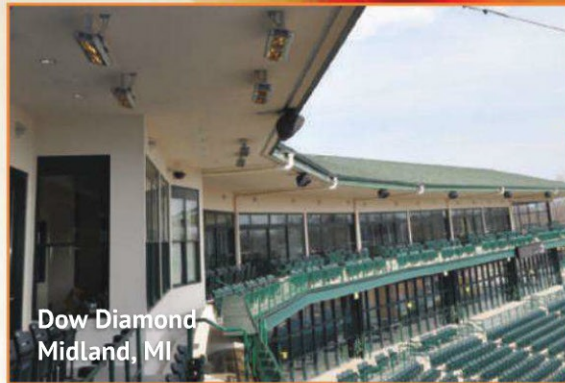
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Ezra Stoller, Photographer, by Nina Rappaport and Erica Stoller. Introduction by Andy Grundberg; contributions by Akiko Busch and John Morris Dixon. Yale University Press, 2012, 288 pages, \$65.

Balthazar Korab, Architect of Photography, by John Comazzi. Princeton Architectural Press, 2012, 192 pages, \$40.

Reviewed by William Morgan

PHOTOGRAPHY NOT only helped to define Modern architecture, it also created its celebrities. It is difficult to imagine mid-20th-century American design without recollecting Ezra Stoller's iconic image of

SOM's Lever House or Balthazar Korab's shots of Eero Saarinen's TWA terminal. These two photographers documented all the greats—Wright, Mies, Aalto, Kahn, Johnson, and more. Once regarded as commercial adjuncts to the profession, they are now subjects of monographs that argue for their acceptance as artists in their own right.

Ezra Stoller, Photographer is a handsome volume on the one-time industrial-design student who studied architecture with Edward Durrell

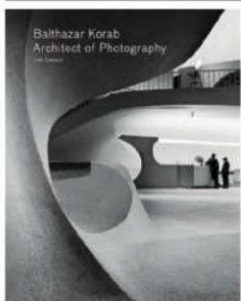
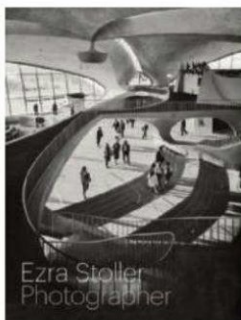
Stone, photographed homes for *Ladies' Home Journal*, and carved out a niche for himself as "the photographer of choice for architects of curtain-walled corporate landmarks," as critic John Morris Dixon notes in one essay. "Modernism's bold unadorned forms lent themselves to the strong compositions Stoller strove for in his photos." For most of us of a certain age, Stoller's photos of the Guggenheim, Manufacturers Trust, or the Glass House are indivisible from the buildings themselves.

Balthazar Korab, Architect of Photography covers much the same ground. Sadly, the

small format of this volume doesn't do Korab's work justice, but his is the more interesting story. Born in Hungary, he survived the Nazis, fled the Soviets, attended the École des Beaux-Arts in Paris, worked for Le Corbusier and Saarinen, and finished fourth in the Sydney Opera House competition. While Stoller also photographed industry, Korab branched out more, documenting the 1966 floods in Italy, shooting the vernacular buildings of Michigan, and creating a portfolio of cultural artifacts, such as a White Castle restaurant and a one-room schoolhouse that President Bill Clinton gave to his Hungarian counterpart.

Korab seems to have had more fun too: He was willing to take risks, and was less concerned with proper perspective (his first camera was a journalist's Leica, not an 8x10 view camera). A comparison of the two photographers' takes on Richard Meier's Douglas house overlooking Lake Michigan is revealing. Stoller's picture is a Mondrian-like composition, about lines and transparency; Korab chooses a vertiginous shot straight down to the water that is pure Alfred Hitchcock. ■

To see more photographs from these books and a third one on photographer Maynard L. Parker, go to architecturalrecord.com and click on Books.



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CIRCLE 92



Made of the Right Stuff?

New disclosure tools highlight data on the sustainability of building products.

BY PAULA MELTON

AS MARKET demand for healthier building products is reaching critical mass, a whole new industry sector is responding with more powerful tools for assessing and improving materials. Some of the new programs help manufacturers provide high-quality information while leaving less room for them to make questionable marketing claims. Others offer a framework for developing better products but don't necessarily require public disclosure of ingredients. Both types will likely be recognized in LEED v4, an update to the popular green-building rating system slated to be voted on by members of the U.S. Green Building Council (USGBC) in June.

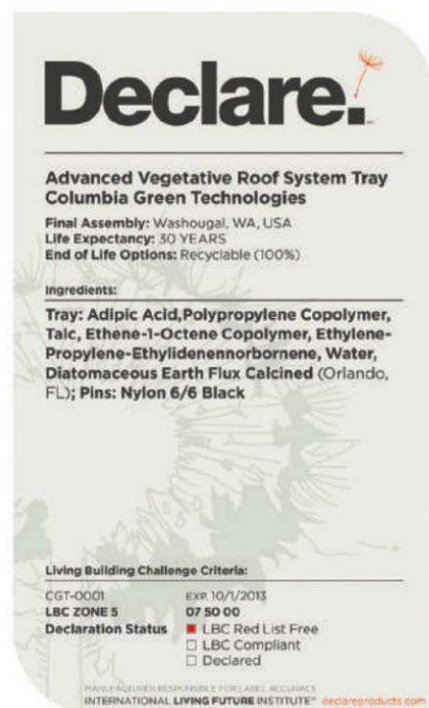
Nearly all these efforts have emerged as a collaboration among green-building advocacy groups, construction and design professionals, and manufacturers. "We were talking at manufacturers previously," quips Brendan Owens, the USGBC's vice president of LEED technical development. "When we started talking with manufacturers, many problems fell away."

The Health Product Declaration (HPD), officially released in mid-November, provides a standard format for ingredient disclosure. The development effort was initiated by the Healthy Building Network and the publisher BuildingGreen (the editorial partner of *RECORD's* sister publication *GreenSource*). Architecture firms, property owners, and product manufacturers also participated. The aim of the HPD is to get beyond the cherry-picking style of labeling ("BPA-free" or "50

We need more awareness of what is in our products, says architect Peter Syrett.

percent recycled content") in favor of a complete health-hazard list.

The similar Declare product database, launched in October, is a program allowing manufacturers to voluntarily publish ingredients, sources, and manufacturing locations for their products. It can be used by anyone, but its current focus is on "red-list-ready" products for projects pursuing Living Building Challenge certification. A red-list-ready product is one that contains no ingredients from the stringent rating system's hazard list, such as PVC and added formaldehyde. Ingredients and life-cycle information are also displayed on an at-a-glance product "nutrition label."



The Declare program includes an on-product "nutrition label" that lists ingredients and life-cycle information.

One concern is the potential for information overload. Is it really an architect's or specifier's job to scrutinize every ingredient? "I don't think everyone needs to become an industrial hygienist or a Ph.D. candidate in chemistry," says Perkins+Will associate

with the right expertise can filter and share information in an accessible way. Owens predicts that such data will eventually be incorporated into building-information-modeling software.

Now that the concept of disclosure is gaining market traction, more manufacturers are looking for ways to clean up their products. One established framework for doing so is Cradle to Cradle (C2C), which just released its 3.0 version. C2C is a "multi-attribute" certification that helps manufacturers improve on a range of environmental and health impacts. It is distinguished by a focus on gradual removal of all toxic ingredients.

What C2C does not require is public disclosure of ingredients. That may seem odd to people following the development of LEED v4, which in its current draft recognizes C2C for encouraging transparency. LEED's proposed disclosure credits are meant to push manufacturers to assess their products, even if they're not ready to make that information public. "We want to reward [manufacturers] for that behavior," says Owens, adding that subsequent versions of LEED will not likely recognize C2C as a transparency tool unless it is modified. William McDonough, cofounder of C2C, wants the program to move toward more disclosure. "Transparency is important," he said at a November press conference. "We've always had that as an ambition."

A newer framework for continual product improvement—and one that's more likely to be accessible to smaller companies—is laid out in *The Guide to Safer Chemicals*, recently published by Clean Production Action. Like C2C, the guide recognizes multiple levels of improvement leading to a nontoxic ideal. Unlike C2C, it evaluates only toxicity (not environmental impacts like carbon or energy), but it includes public disclosure of ingredients and manufacturer support for further market innovation.

With so many programs in play, it can be easy to spend time discussing each system's strengths and weaknesses, but Syrett says that is a distraction. "I look at the work of the HPD and other endeavors as part of a larger effort to build better and smarter," he says. "If we really carry this forward, we will have more jobs, a better planet, and healthier humans." ■

Paula Melton is managing editor of *Environmental Building News*, published by *BuildingGreen*.

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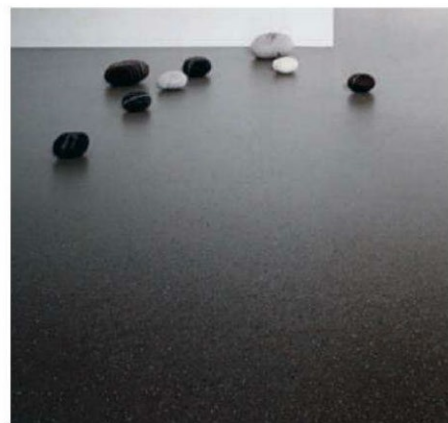
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**Petrified Tree Ceramic Tile**

Emil Ceramica italytile.com

Taking the faux-wood trend in ceramic flooring up a notch, Emil Ceramica launched the Petrified Tree collection at the Cersaie trade show in Bologna last September. The manufacturer used high-resolution pictures of 50 fossilized wood blocks to replicate the marble-like crystallizations and veins of petrified wood in porcelain stoneware blocks. The tiles come in two finishes, three colors, and rectangular formats that range from 6" x 35" to 18" x 35". Mosaics and other decorative and special pieces complete the collection.

CIRCLE 200

State of Mind Carpet

Mohawk Group mohawkgroup.com

The State of Mind modular carpet collection features a customizable progression of up to 25 colorways and a unique layering of four patterns. Designers can use color only, pattern only, or a layering of color and pattern together. An online tool was developed to help illustrate the color progression and direction of the collection's patterns prior to installation. The five-layer backing system contains 35% preconsumer recycled content. CIRCLE 201

Reclaimed European Beech

Viridian Reclaimed Wood viridianwood.com

European Beech is a new line of flooring reclaimed from large-scale beech crates used to ship wind turbines and other steel cargoes from Northern Europe. Reclaimed from the Port of Vancouver, the European Beech wood has a hardness rating of 1,300 on the Janka scale, making it suitable for commercial environments. The FSC-certified flooring is milled in a thickness of ¾", in widths of 2½", 3", 4", 5", and 6". CIRCLE 202

ASI Agglomerate Stone Collections

Architectural Systems, Inc. archsystems.com

ASI Agglomerate Stone is now available in updated colorways in two collections: engineered marble-agglomerate tiles and quartz slabs. Ideal for bar tops and countertops, the quartz slabs offer a mix of silky shimmer and rough texture. The tiles come in microchip and large-chip options (large chip is shown), allowing for scalability. All are low-emitting and made from recycled content. CIRCLE 203

Noraplan Unita

Nora Systems nora.com/us

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Heritage Timber Edition

DuChateau Floors duchateaufloors.com

This new collection for interior commercial and residential floor, ceiling, and wall-panel applications replicates the patina of reclaimed building materials with artfully distressed surface scrapes, nail holes, notches, and other textures. Available in five styles, the 7 $\frac{7}{16}$ " FSC-certified European white-oak planks use a low-VOC, preservative-free hard-wax-oil finish. **CIRCLE 205**

Stiletto Bamboo Flooring

Smith & Fong plyboostiletto.com

Stiletto is a new range of FSC-certified PlybooStrand bamboo flooring. The 5 $\frac{1}{8}$ " x 72 $\frac{5}{8}$ " x $\frac{9}{16}$ " planks are manufactured through a urea-formaldehyde-free process in which bamboo strips are compressed into a super-dense block and the composite material is then manufactured into planks. A click-lock installation mechanism allows it to float over 95% recycled rubber padding or be glued. **CIRCLE 206**

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Linorette Linoleum Flooring

Armstrong armstrong.com

Named America's most beautiful hospital for 2012 by Soliant Health, a national health-care-staffing firm, the new Martha Jefferson Hospital in Charlottesville, Virginia, features Armstrong's Linorette line of commercial linoleum flooring. After testing mockups and reviewing 3-D models, the client chose Linorette because it met the visual, sustainability, and maintenance standards required for the project. **CIRCLE 208**

Timeline Color Series

Timeline timelinewood.com

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The background is a solid orange color with a series of concentric circles in a lighter shade of orange, creating a ripple effect. In the upper left, a small, modern ceiling fan with three white blades and a silver-colored hub is visible. In the lower right, a larger, more complex ceiling fan is shown. It has four light-colored wooden blades and a central hub composed of several stacked, circular wooden discs. A black cord hangs from the top of this fan. The text "cool by" is positioned to the left of the larger fan, and the word "design" is written in large white letters at the bottom right.

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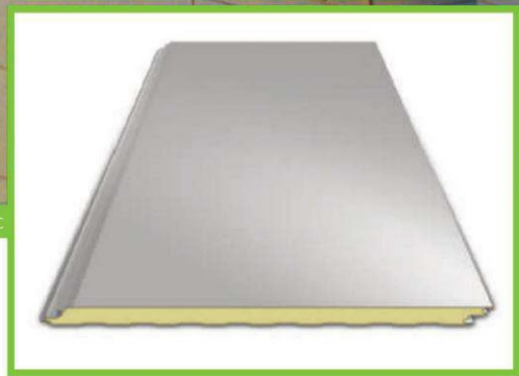
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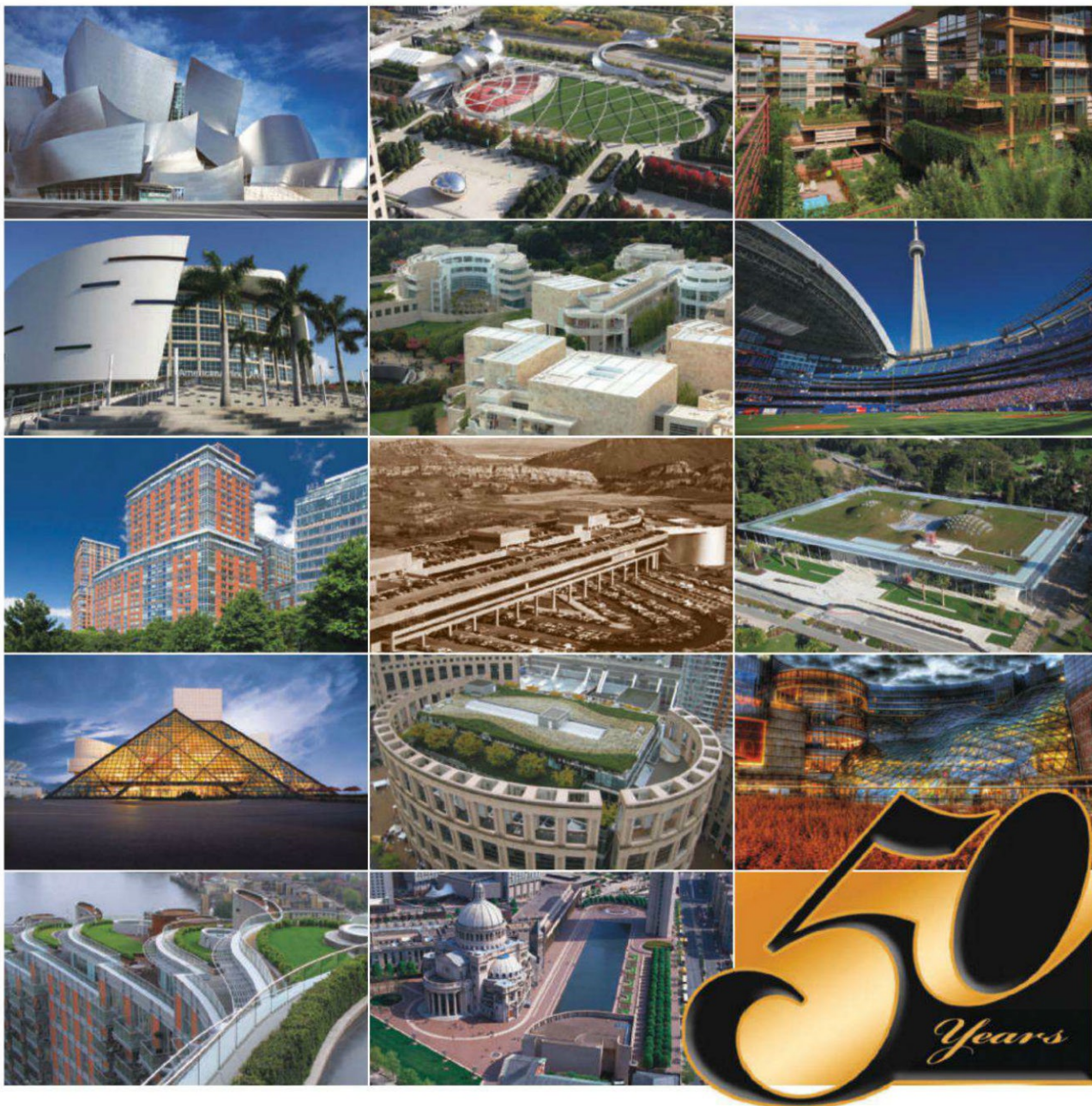


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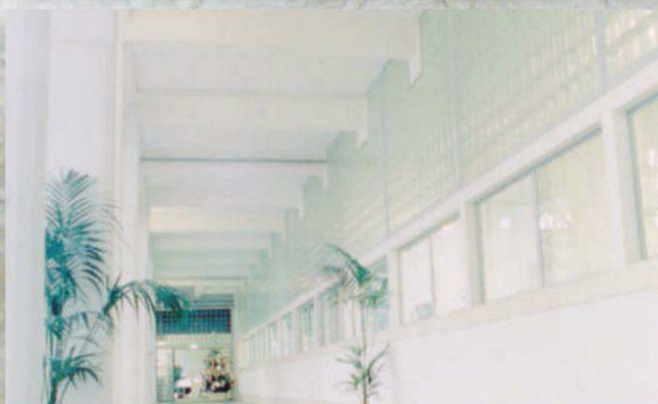
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CIRCLE 37

The Exhibitionists

CULTURAL BUILDINGS must negotiate conflicting agendas. On one hand, they need to be supportive platforms, framing curatorial visions without suffocating them. But they also need to be works in themselves, objects that put forward an institutional identity or even become part of the collection that they house.

The projects in this section attempt to strike a balance between those two approaches. Zaha Hadid's Eli and Edythe Broad Art Museum (shown here) asserts its sculptural form into every exhibition space—but also allows for otherwise straightforward galleries. With its unusual daylighting, Herzog & de Meuron's Parrish Art Museum adds just enough brilliance to the work inside to make it feel specific to its place. The cragginess and fissures of Morphosis's Perot Museum of Nature and Science connects orthogonal galleries with a frenetic atrium. And the three commercial galleries that conclude the section provide versatile spaces for exhibitions and sales while signaling a new cultural life for entire neighborhoods.

Perot Museum of Nature and Science | Dallas | Morphosis Architects

"FORCEFUL," "ACROBATIC," "muscular," "raw," even "gritty" are usually the operative adjectives to describe the architecture of Thom Mayne (2013 AIA Gold Medalist) and his firm, Morphosis. But not "refined." Yet the Perot Museum of Nature and Science, which opened in Dallas last month, seems surprisingly restrained for a building by the Los Angeles firm. With its pale, crinkly precast-concrete panels enclosing a cubic volume, it appears rather sedate from afar. At the same time, there is a raw energy in the way the calm cube erupts from a craggy free-form plinth covered with shards of rock and local plants.

While the cube and plinth provide the dominant volumetric elements, the skin brings the exterior into high relief. Riddled by wrinkles, creases, and puckers, the precast-concrete cladding would look like an elephant's hide if it were not so light in color. Instead, the slightly mottled off-white surface has a ruched texture like a luxuriantly pliable fabric. The heavy cloak of 656 precast panels, typically 8 by 30 feet (and some weighing 16,000 pounds and up to 9½ inches thick), gives the striated skin arresting shadow lines, a coup de théâtre made possible by the architects, the engineers, and a concrete subcontractor using building-information modeling (BIM).

The Perot cube did not come all that naturally to Mayne. His first scheme, an angular, hunkering form, extended over much of the 4.7-acre site, and its galleries adopted the



PHOTOGRAPHY (FROM LEFT): © IWAN BAAN; ROLAND HALBE

displayed shapes of the container itself. But the client, Mayne found, "felt more of a comfort level with neutral stacked exhibition spaces and not too much light." And terms such as "orthogonal" and "opaque" seemed key to understanding the museum's vision.

Mayne's response was a 170-foot-high building containing four floors inside an almost blank cube devoted primarily to windowless galleries. Three design firms (Amaze Design, Paul Bernhard Exhibit Design, and Science Museum of Minnesota) took over installations for the 11 permanent exhibition halls,

ON THE EDGE
Plunked next to an elevated highway that separates it from downtown Dallas (above), the museum's cube sits atop a free-form plinth eroded by a glacial flow of curtain wall (right).

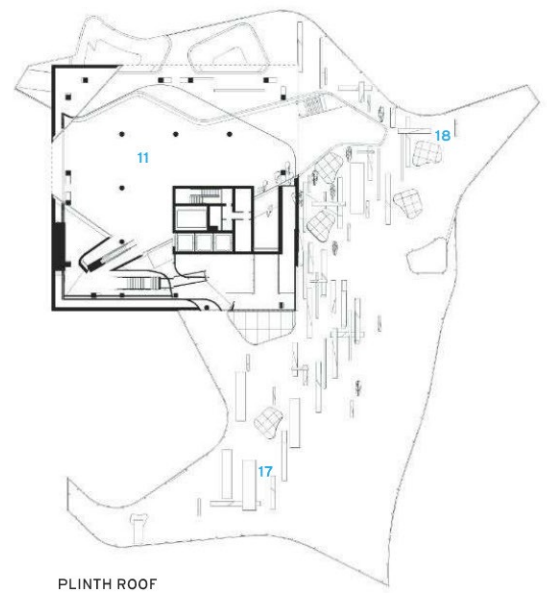
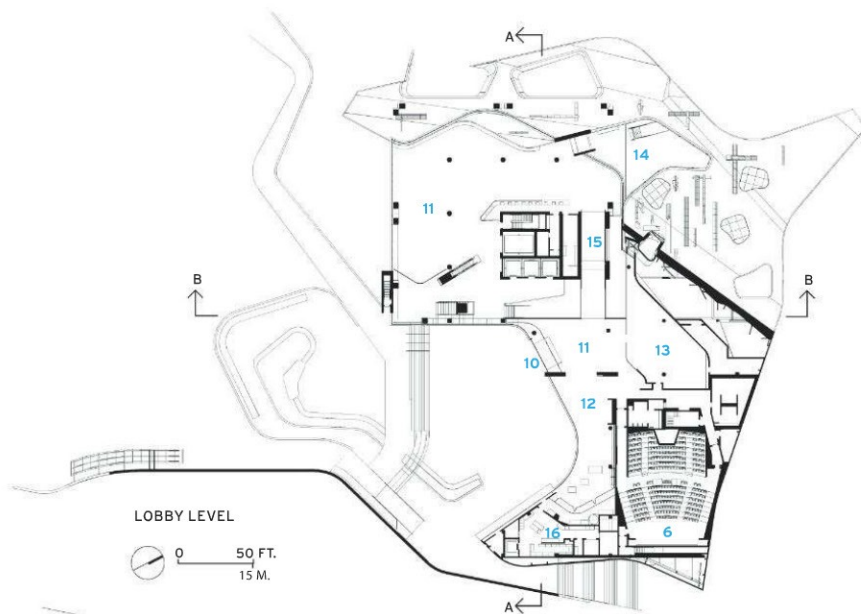


Sheared and Shirred: Surfaces and Solids

Thom Mayne and his firm, Morphosis, turn a corner for the Perot Museum of Nature and Science in Dallas.

BY SUZANNE STEPHENS

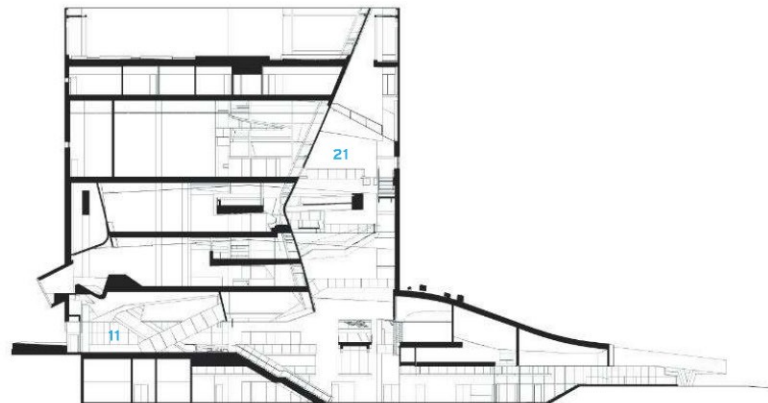




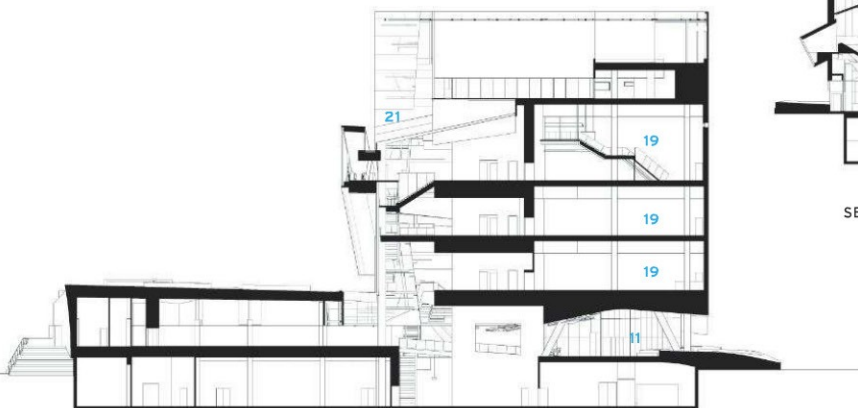
- 1 LOWER-LEVEL LOBBY
- 2 CLASSROOM
- 3 CHILDREN'S MUSEUM
- 4 CHILDREN'S COURTYARD
- 5 LIGHT WELL
- 6 AUDITORIUM
- 7 TEMPORARY GALLERY
- 8 SPORTS GALLERY
- 9 MECHANICAL
- 10 MAIN ENTRY
- 11 MAIN LOBBY
- 12 CAFÉ
- 13 MUSEUM STORE



- 14 TERRACE
- 15 RAMP
- 16 KITCHEN
- 17 SOLAR COLLECTOR
- 18 SKYLIGHT
- 19 GALLERY
- 20 STAIR TO MEZZANINE
- 21 ATRIUM



0 50 FT.
15 M.





SWIRLING DERVISH

From the parking level to the west, visitors can ascend an arcing ramp to the top of the plinth and enter the museum lobby. Precast-concrete panels, creased and puckered, form a highly textured cloak that seems held together by a glass cartridge containing one leg of the escalator.

focusing on fossils, birds, geology, space exploration, and other topics.

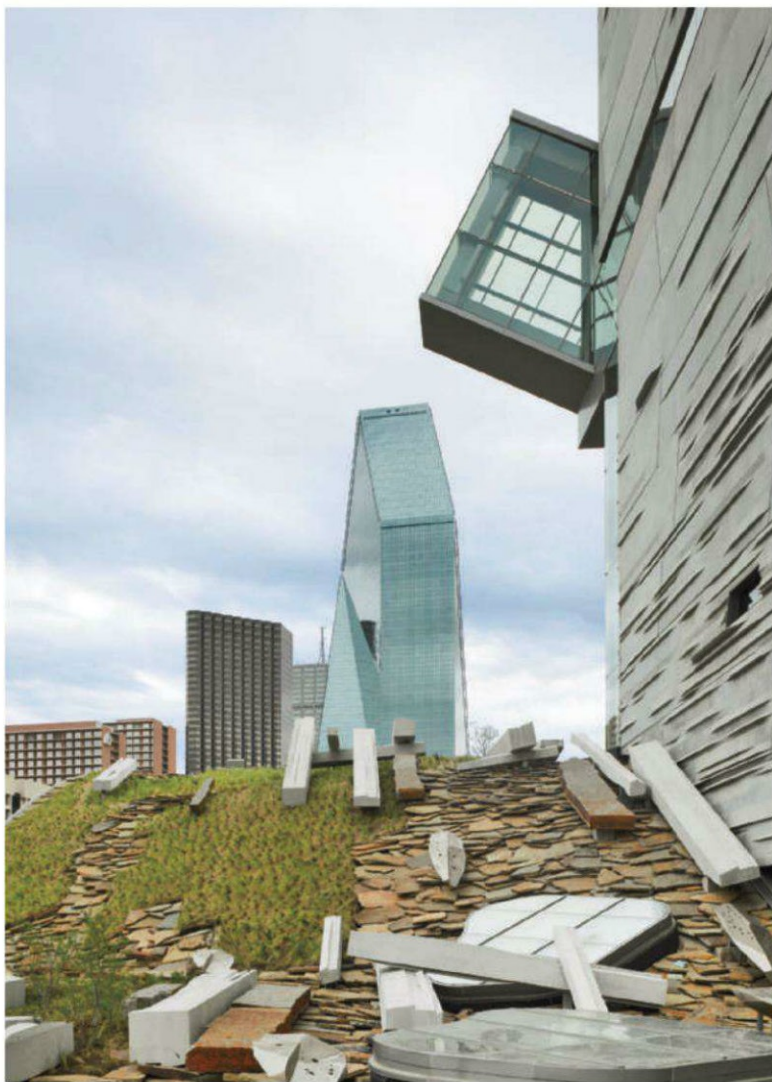
Children's classrooms and exhibition areas occupy the plinth's lower level, which visitors can enter from the east, where the architect's geological formation seems pushed up by a glacial flow of curtain wall. The glassed-in main lobby, a void separating the cube and plinth, is reached by visitors ascending a curved ramp from the parking area to the west.

In order to bring daylight into the museum, Mayne cracked open the southeast corner of the cube to create a glass-and-steel atrium containing escalators and staircases. He made the museum's major circulation device—the escalator—a salient feature of the exterior by enclosing a 54-foot-long section of it in a glass cartridge smacked onto the south facade. The exposed escalator is the final move in a sequence that begins at the lobby level; where it pushes

out, the cartridge is cantilevered from a beam that in turn is cantilevered from another beam. These acrobatics control deflections and vibrations, notes structural engineer Kurt Clandening of John A. Martin & Associates, which worked with Datum Engineers on the project.

Daylight floods the cube's atrium and dramatizes the sculptural pyrotechnics: Here a precast-concrete curvilinear vertical assemblage, suspended from the roof, alternately narrows and widens into a tornado-like whorl to embrace staircases and escalators. Nearby a poured-in-place-concrete shaft contains glass elevators for those who succumb to vertigo in glancing over perforated powder-coated aluminum balustrades or by peering down 99 feet through the metal grate floor of the fourth-floor bridge.

The escalators only go up. Visitors are encouraged to start at the top, where an 85-foot-long dinosaur's skeleton



Craggy Landscape On the plinth roof, Morphosis, working with Talley Associates, created a garden of local stone and vegetation (left and above), where precast elements like those found in the cube seem to have fallen off the building. Inside the lobby (below) the stone shards continue, as if detritus had flowed in from the outside. In the atrium (opposite) a precast-concrete curved vertical element seems to twist like a tornado through the stair and escalator hall, which admits daylight through large expanses of glass.

credits

ARCHITECT: Morphosis Architects – Thom Mayne, design director; Kim Groves, project principal; Brandon Welling, project manager; Arne Emerson, project architect; Aleksander Tamm-Seitz, project designer

ASSOCIATE ARCHITECT: Good Fulton & Farrell

ENGINEERS: John A. Martin & Associates (consulting, structural); Datum Engineers (structural); Buro Happold (m/e/p); URS (civil)

CLIENT: Perot Museum of Nature and Science

LANDSCAPE ARCHITECT AND SITE SUSTAINABILITY: Talley Associates

SIZE: 180,000 square feet (gross)

COST: \$92 million (construction only)

COMPLETION DATE: December 2012

SOURCES

PRECAST CONCRETE: Holcim (cement); Gate Precast (fabricator)

METAL PANELS: Mitsubishi Plastics Composites America (Alpolic)

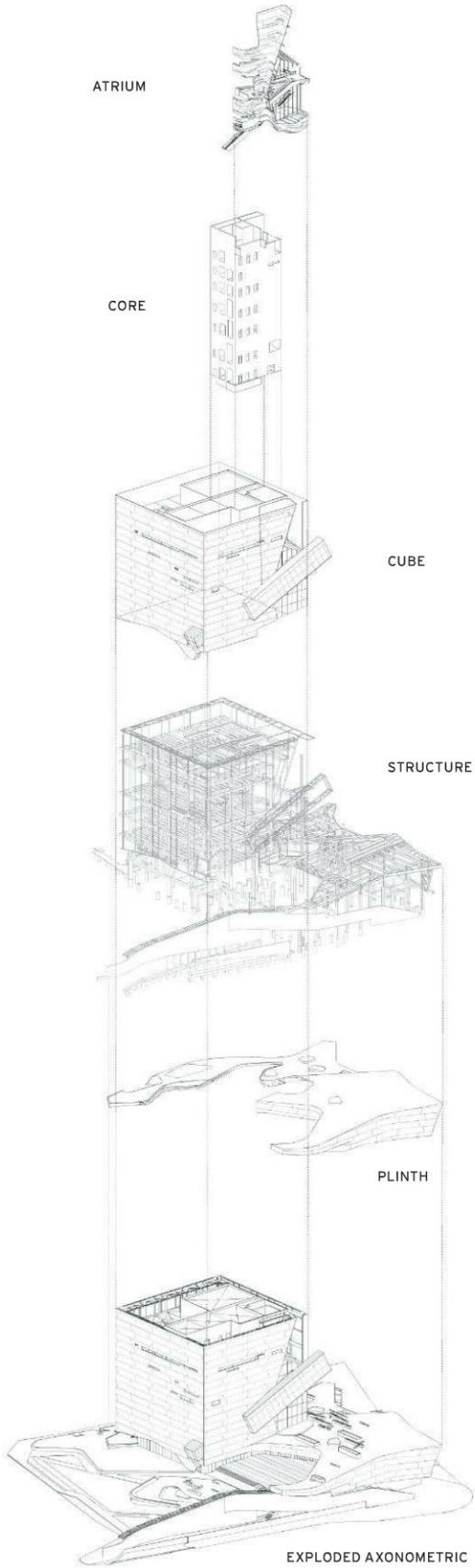
CURTAIN WALL AND WINDOW WALL: Oldcastle BuildingEnvelope, Novum Structures

INSULATED GLASS UNITS, LAMINATED GLASS, AND SKYLIGHTS: Oldcastle BuildingEnvelope, Avic Sanxin

GLASS ENTRIES: Oldcastle BuildingEnvelope

LANDSCAPED ROOF: American Hydrotech Garden Roof





PHOTOGRAPHY: © ROLAND HALBE (FAR LEFT, BOTTOM LEFT); IWAN BAAN (TOP LEFT, RIGHT)





The Perot combines traditional galleries with unconventional halls and Euclidean geometry with hyperbolic curves.

MOON GLOW

Like a sunrise at the center of the earth, the design for the 300-seat 3-D theater on the main level (above) sends jagged shafts of light through the acoustical stretched fabric framing a screen digitally printed with a pattern of stem cells. From the main lobby, visitors walk on a ramp (opposite) under polygonal fiberglass pods that seem magnetically attached to the mesh ceiling.

(a reconstructed *Alamosaurus* incorporating actual vertebra fossils) charges through a 36-foot-high space on the fourth floor; large concrete Vierendeel trusses on the floor above allow the dinosaur to have sufficient headroom.

Lower down, where the cube seems to hover above the lobby level on the plinth, large V-shaped concrete columns supplement a grid of round concrete ones, and transfer girders adjust loads at the perimeter. In this light-filled space, a limpidly curving glazed wall relies on a tension-cable-supported system to stabilize its organic flow. The lobby's mesh ceiling partially conceals the concrete deck above and carries slender rods of LEDs. In addition, polygonal fiberglass pods—similar to those resting on the exterior landscape of the plinth's roof—nestle against the ceiling, emitting light through small perforations.

Mayne wanted the building to function as its own scientific exhibition as well as a provocative work of architecture. Accordingly, the museum design includes various sustainable features: Rainwater rolls down the slanted roof into two cisterns (with minimal drainpipes), which recycle up to

50,000 gallons for irrigation and flushing. Three solar collectors on the plinth roof help heat water, and most of the concrete in the project uses fly ash, slag, and other supplementary cementitious materials to reduce the carbon footprint. Since the precast panels cover most of the cube, the heat load is cut down as well—all of which will keep operating costs down for the \$185 million museum.

Mayne won the commission over architects Ennead, Shigeru Ban, and Snøhetta, though he had not designed a museum before. It was a first new building for the client as well. The museum's contents came from three different collections exhibited at Fair Park in Dallas, built for the 1936 Texas Centennial Exposition. Nicole Small, the CEO of the Perot, says Mayne “understood the building could be a teaching tool. The way he thinks about sustainability and materials is creative and rigorous.”

With its Cartesian cube and its free-flowing, lavalike plinth, the Perot museum is one of Morphosis's most remarkable works to date. Like James Stirling's architecturally synoptic Neue Staatsgalerie in Stuttgart (1984)—“my model,” Mayne notes—the Perot combines traditional roomlike galleries with unconventional halls. It also mixes Euclidean geometry with hyperbolic curves, and juxtaposes fluid and restrained spaces. The striking design evokes the naturally sheared cube of black pyrite from Spain on view in the museum's Lyda Hill Gems and Mineral Hall. The connection between natural and man-made artifact speaks of a flinty integrity that makes architecture meaningful. ■



Parrish Art Museum | Water Mill, New York | Herzog & de Meuron

The Undecorated Shed

A stripped-down design by Herzog & de Meuron illuminates painting and place.

BY WILLIAM HANLEY



VERNACULAR SPECTACULAR

The daylight cottages and barns often converted into studios by Long Island artists inspired Herzog & de Meuron's twin-gabled form (opposite). The designers placed the building near the center of a former agricultural site converted into a meadow. The grasses are intended to grow with minimal intervention, softening the view of the Parrish's long concrete facade (above).

EARLY ON an autumn afternoon, an untitled 1990 abstraction by Esteban Vicente in the new Parrish Art Museum presented a smudged block of azure hovering over brushy patches of red-orange and umber. Two hours later, the angle of the sunlight coming into the gallery had shifted, and the new light made the warm colors catch fire and the blue sour and recede.

The change was unusual. While many museums allow daylight to enter their galleries, they typically filter it to a neutral glow. The Parrish lets the coastal light of New York's East End of Long Island color the experience of the work on view. Shifting and tonal, light enters the gallery as it might have entered Vicente's Bridgehampton barn-turned-studio in the mid-20th century. "You find many artists who work here because of the landscape and the light in this place," says Ascan Mergenthaler, Herzog & de Meuron's partner in charge of the project. "We took the classic Long Island artist's studio, with a house shape and skylights, as a model for the museum building."

As you drive east on the Montauk Highway, the Parrish

emerges between rural hamlets with an incongruously industrial scale. A long, low rectangular volume, it could be a big-box store or the giant cousin of one of the agricultural buildings that dot the area. At 614 feet long but less than 100 feet wide, its narrow end elevations peak in twinned gables like two fused-together barns. A long metal roof overshoots the structure to create sheltered porches on all sides. Throughout the 34,400-square-foot building, a limited selection of materials—concrete, wood, metal, glass—and luminous open spaces give the museum stunning simplicity, made all the more remarkable because it was born of necessity.

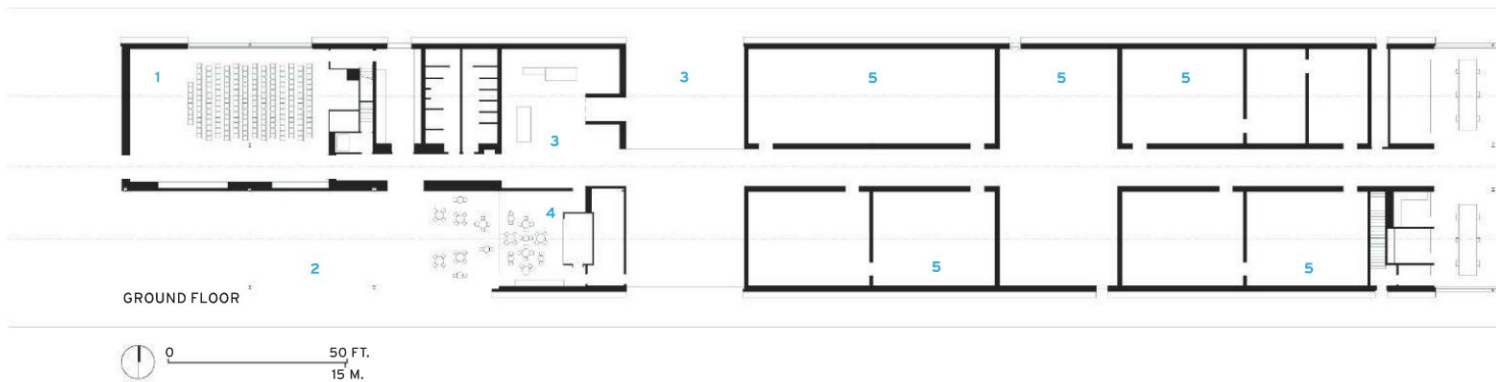
Long before the Hamptons signified celebrities and billionaires summering in secluded vacation compounds, artists and their less ostentatious patrons fled the clamor of New York for the East End. The Parrish counts work by those with a connection to the region as the core of its collection, which now numbers 2,600 objects in a variety of media and spans artists from William Merritt Chase, Fairfield Porter, and Willem de Kooning to Chuck Close and April Gornik. But the Italianate 1897 building by Grosvenor Atterbury in



Southampton that served as the museum's previous home lacked space for both its growing holdings and its program of temporary exhibitions. After an aborted attempt to expand, museum officials decided to build. In 2005 they acquired a site a few miles down the road, just outside the hamlet of Water Mill, and selected Herzog & de Meuron to design a new facility.

Mergenthaler and his team envisioned the new Parrish as a cluster of peaked structures, abstracted versions of the barns, sheds, and small residential buildings typically converted by artists into studios. (They also recalled the Monopoly house shapes of earlier Herzog & de Meuron work.) But the museum slashed the original budget of \$80 million by nearly two thirds when the recession hit. Despite the dramatic cut, Herzog & de Meuron stayed on board. Mergenthaler reconfigured the constellation of buildings into a single long volume but kept the pointed form. "It was clear that we would have to work with repetition, and it was a really simple idea to repeat one module in a long way," he says. The project opened in November at a cost of \$26.2





TWIN PEAKS While great for catching light, the Parrish's roofline creates a massive trough down the center of the structure (left). To manage rainwater and snow melt, the designers concealed primary and backup pipes in the X-braces that cross the building's central spine; the pipes deliver water to a belowground infiltration system without adding visual clutter to the building. Based on a 1,000-square-foot unit, some galleries (opposite) double to 2,000 square feet; others are subdivided into an intimate 500.

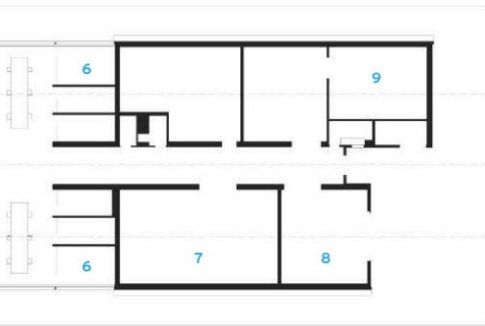
million; with 7,600 square feet of galleries, it nearly triples the museum's exhibition space.

To keep costs down, Mergenthaler used the pocked and craggy concrete that covers the museum's long exterior sides after seeing similarly rough walls in a local basement. The scruffy character of the mottled concrete keeps the vast expanses from looking monotonous. "The thing that you really engage with first has to have a presence, a solidity, and a character," says Mergenthaler. "It's not just cladding."

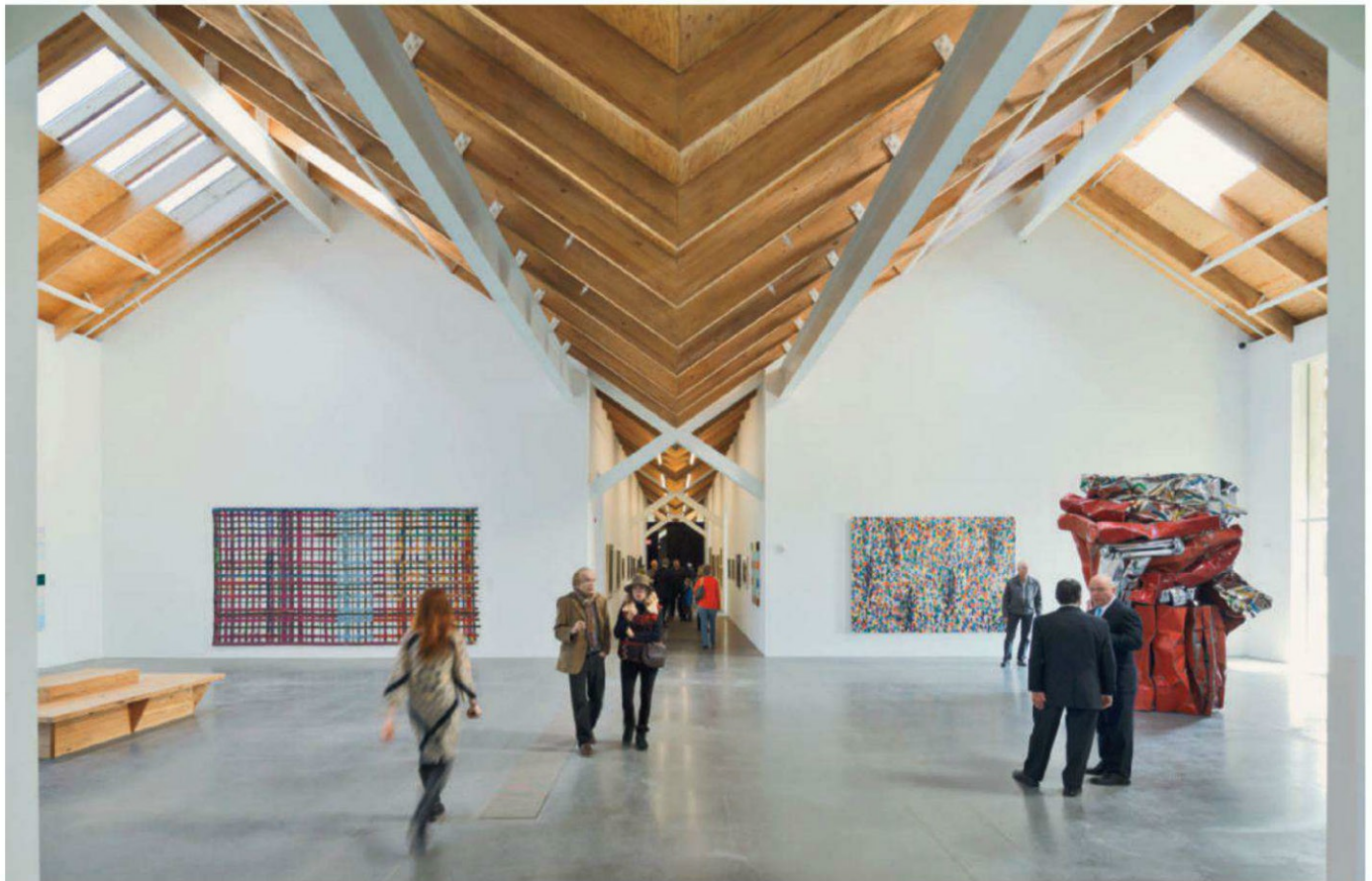
Visitors arrive at the museum along paths through a meadow of unmanicured local grasses that lead from a rear parking lot to the entry. Inside, the firm placed the galleries in a grid at the center of the building and bookended them with administrative space on one side and, on the other, a black-box theater and a café with a broad outdoor terrace. A cathedral-like axis runs through the center of the conjoined gables and connects all the interior spaces before dead-ending at the offices and theater. Konstantin Grcic

designed much of the furniture, including a café chair that will have its commercial debut at the Salone del Mobile in Milan this spring. He also created the spindly, Calderesque lamps that hang from a modestly finished plywood ceiling in the entry and office areas.

The galleries, on the other hand, rely on East End daylight supplemented by side-mounted compact fluorescents for illumination. The gabled roofs face true north and south, and while most museums prefer the uninflected character of northern light, each set of three north-facing skylights at the Parrish comes with one wild card to the south. The southern skylights spike the galleries with a more varied and colorful light that gets a volatile glow from coastal water vapor. "Straight up, the sky looks much like it does everywhere else," says Andrew Sedgwick of Arup's lighting division, who consulted on the project. "But down near the horizon, it changes color and brightness more than you would see in other places." The angle of the roof allows the



- 1 AUDITORIUM
- 2 TERRACE
- 3 ENTRANCE
- 4 CAFÉ
- 5 EXHIBITION SPACE
- 6 ADMINISTRATION
- 7 ARCHIVE
- 8 ART LOADING
- 9 STORAGE FOR WORKS ON PAPER



openings to capture a wide field of daylight without harming the artwork. In fact, the designers applied only UV coating and a nearly invisible hex-cell filter to the glass—look up, and you can see clouds passing—just to block the harshest summer light. According to Sedgwick, the amount of sun exposure that works receive balances out over the course of a year to stay within the threshold recommended by conservators. For shows that include photography or works on paper, scrims stretched on wooden frames manually mount into the skylights—a far cry from the complex and expensive motorized shading systems in many museums today.

The varied light presents a challenge for curators used to constant conditions, but it also captures the character of its place. By adapting its artist's-studio concept to a severely cut budget, rather than starting from scratch, Herzog & de Meuron created one-of-a-kind exhibition spaces. At the Parrish, work created on the East End appears in a way that approximates its origins, while other work takes on the character of the museum's context. And in every gallery, the light is spectacular. ■



credits

DESIGNER: Herzog & de Meuron - Ascan Mergenthaler, partner in charge; Jacques Herzog and Pierre de Meuron, partners

ARCHITECT OF RECORD: Douglas Moyer Architect

CONSULTANTS: Konstantin Grcic (furniture); Reed Hilderbrand (landscape); Arup Lighting

ENGINEERS: S.L. Maresca & Associates (structural); Buro Happold (mechanical); Nelson, Pope & Voorhis (civil)

CLIENT: Parrish Art Museum

GENERAL CONTRACTOR: Ben Krupinski Builders

SIZE: 34,400 square feet

COST: \$26.2 million

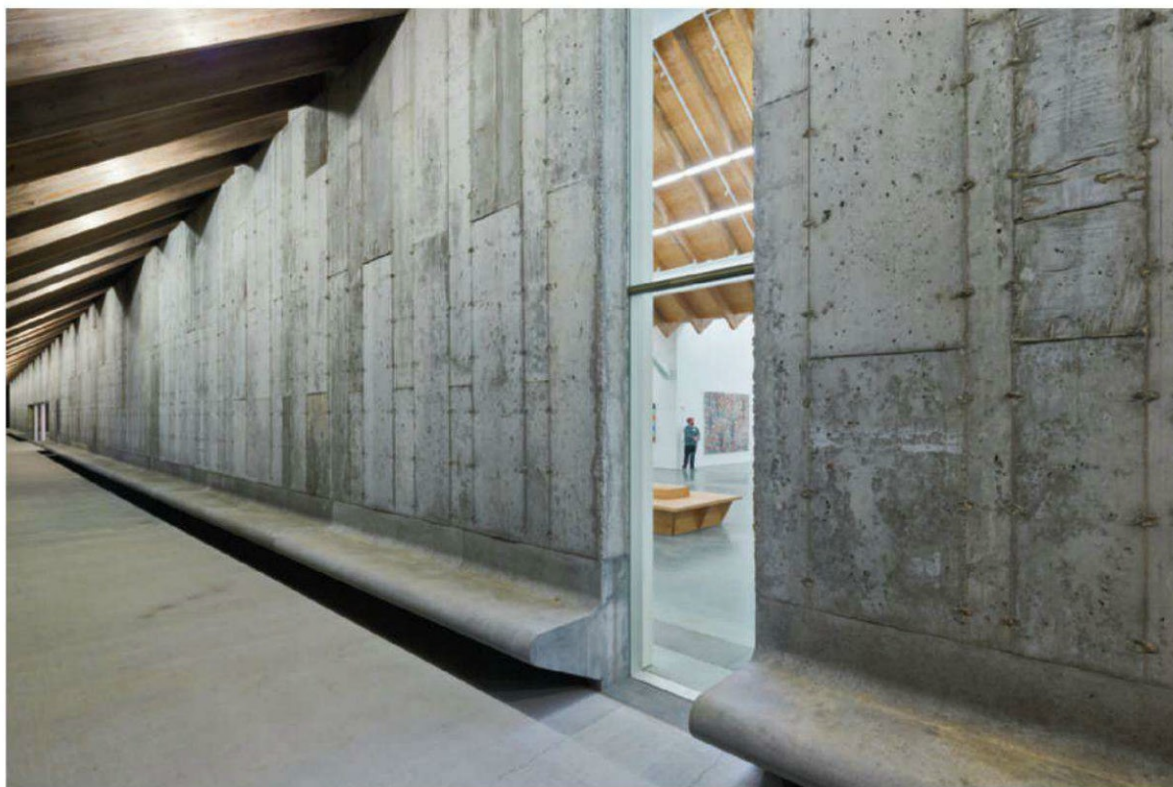
COMPLETION DATE: November 2012

SOURCES

GLASS AND GLAZING: Westhampton Architectural Glass

TILE: Lido Stone Works

WOOD FLOORING: Bayshore Wood Flooring



FLEXIBLE FRAMES
Back-of-house stairs adjacent to the administrative spaces (above) lead to below-grade art storage. Outside, the concrete facade (left) slopes out into a bench, allowing visitors to contemplate the landscape under the Parrish's deep eaves. A long circulation spine (opposite) stretches through the center of the project.



Eli and Edythe Broad Art Museum | East Lansing, Michigan | Zaha Hadid Architects



Big Museum on Campus

Michigan State University's dazzling new building swaggers into town but fits right in.

BY BETH BROOME

THE NEW Eli and Edythe Broad Art Museum on Michigan State University's East Lansing campus bursts from its traditional collegiate setting like a futuristic concertina pushing free from the deep pit of the devil's orchestra. "It is a strange object sitting on the edge of campus," admits Zaha Hadid, but one with a magnetic quality, she points out. "This radically abstract object," adds her partner Patrik Schumacher, "brings this element of making strange—of building something to be explored and discovered."

The need to house a growing art collection and expand programming, aided by a whopping \$26 million gift from businessman, philanthropist, and MSU alumnus Eli Broad and his wife, Edythe, in 2007, provided the genesis for the project. The original idea was to build an extension to MSU's Kresge Art Center, a midcentury building tucked far into campus, housing the Department of Art, Art History, and Design as well as the esteemed Kresge collection of 7,500 works dating from the Greek and Roman periods through the present day. But Eli Broad wanted to do something more transformative. University president Lou Anna K. Simon

agreed and identified the prominent site of the 1947 Paolucci Building as the home for a new museum. Hugging the campus's northern edge on the busy, commercial Grand River Avenue, the location would assure visibility and encourage community engagement. MSU organized a competition, selecting Zaha Hadid Architects in 2008 (from a shortlist that included Coop Himmelb(l)au, Morphosis, Kohn Pedersen Fox, and Randall Stout Architects). After Broad chipped in another \$2 million and the Paolucci Building had been razed, the museum broke ground in early 2010.

Bold and brassy, the building, say the architects, was designed with some restraint—a result of its strict \$45 million budget and modest size of 46,000 square feet. In fact, it is devoid of curvilinearity: All surfaces are flat and all lines, as much as they dart hither and thither, are straight. "We imposed this formal universe of the trapezoidal volumes and spaces all the way through," says Schumacher. The building's tilting and thrusting and crazed striations make it appear distorted, and its volume is difficult to understand without a complete tour around its exterior. This lack of perpendicular



WRINKLE IN TIME

The rainscreen consists of stainless-steel cladding on an aluminum girt system anchored to a plywood substrate. Because the sections overlap, they had to be installed in a strict order. The building opens to a tranquil courtyard (above) and abuts the busy Grand River Avenue (right).



or parallel lines necessitated modifying the building process. "We put few dimensions on the construction documents," says Paul Stachowiak, president of Integrated Design Solutions (IDS), the executive architect on the job. "Everything was a point in space. We had to work in [Cartesian coordinates] eastings and northings, versus feet and inches, so things were surveyed and adjusted along the way."

The pleated and louvered metal skin was present in the architects' first sketches. Motivated by a desire to admit filtered light, the designers mimicked a factory sawtooth roof in miniature and then expanded the idea to characterize the zigzagging of the whole surface. The striations shooting off in all directions are like pinstripes gone wild, which, in concert with the metal's reflectivity, pleasantly activate the surface. Using a 3-D model, the team—including ZHA in London,

IDS outside Detroit, engineers Structural Design Inc. in Ann Arbor, and consultants Zahner in Kansas City, Missouri (for stainless steel), and Josef Gartner in Germany (for glazing and structural steel)—held weekly calls for almost a year to refine the envelope. You get the sense that ZHA conducted this maniacal symphony because it could, cheered on by Broad and MSU, who will use the resulting big gesture as a calling card. Nevertheless, respecting the scale of the neighboring leafy Collegiate Gothic red-brick quads and the commercial strip across the way, the building fits in.

Having both a campus and city entrance provided an important symbolism for the school. You can enter from the west into a central hall or from the east through a courtyard into the lobby, which leads into a welcoming, double-height café and education wing behind large, tilted structural window walls. Off the lobby, a floating staircase is cantilevered and cranked through the volume. It is flanked by two load-bearing walls of silky-smooth concrete canted at 15 and 20 degrees, respectively. This skewing sets the visitor off kilter. But you regain your equilibrium as you enter the galleries—though neither orthogonal nor completely straight-walled,

ALL ASKEW

The east entrance (below) looks out to a courtyard. No two of the triple-glazed, argon-filled windows are the same dimensions, which created installation challenges. The café and stair (right and far right) lead off from the lobby. Polished concrete and maple floors distinguish public spaces from galleries. Vertical fins on the south elevation screen the café window (bottom right) and belie the transparency that's apparent from within.

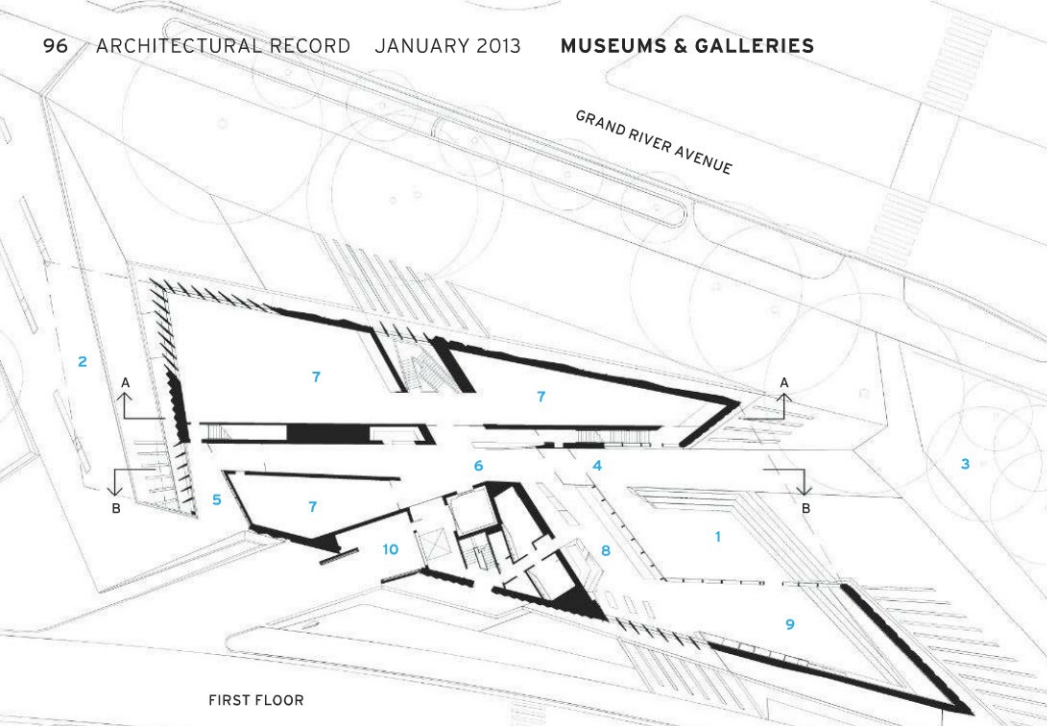
The building's tilting and thrusting and crazed striations make it appear distorted.



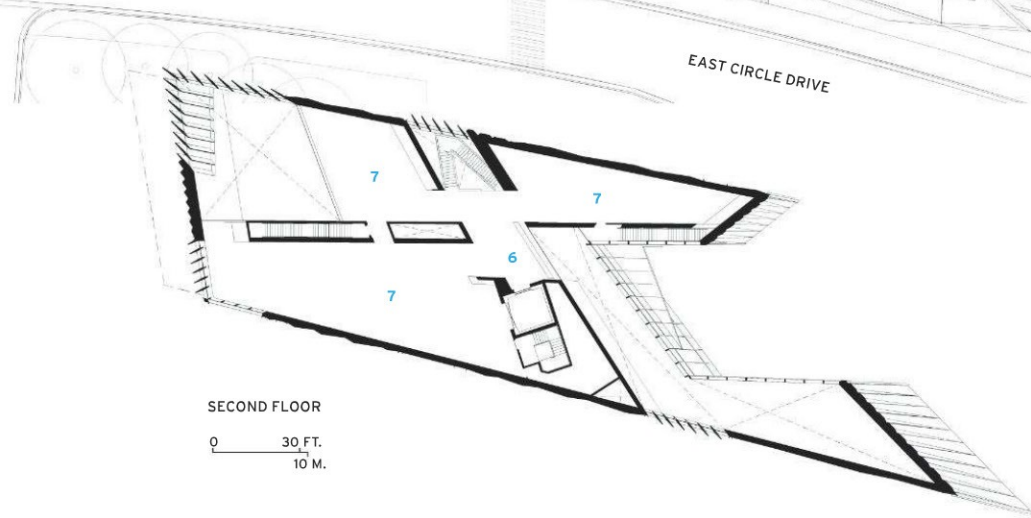


SPECTACLE OF SPORTS: weathering steel panels wrap around Parkways Center to form a canopy that theatrically cantilevers 80 feet over the plaza. The doughnut-shaped canopy includes 3,000 square feet of site signage. *Harcinet fugia voluptatis reitend omni vero quibus in dolo pro vidus exilis repel magnatemque ne porulum que*



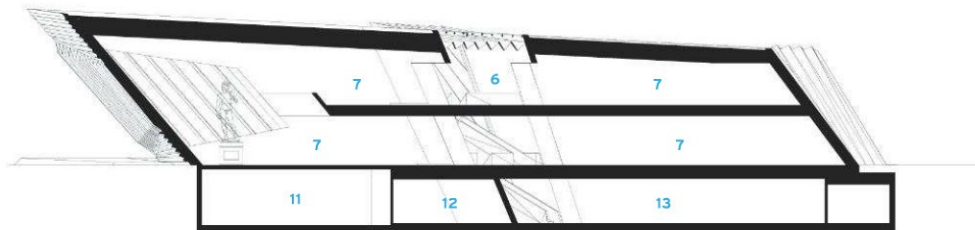


FIRST FLOOR

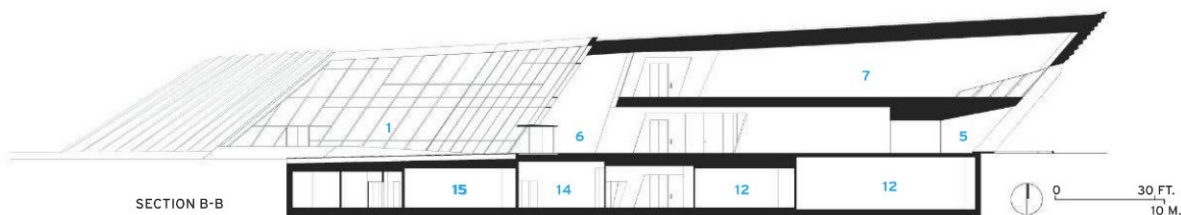


SECOND FLOOR

0 30 FT.
10 M.



SECTION A-A



SECTION B-B

- 1 COURTYARD
- 2 WEST PLAZA
- 3 SCULPTURE GARDEN
- 4 EAST ENTRANCE
- 5 WEST ENTRANCE
- 6 LOBBY
- 7 GALLERY
- 8 CAFÉ/SHOP
- 9 EDUCATION WING
- 10 LOADING DOCK
- 11 MECHANICAL
- 12 ART HANDLING
- 13 STUDY COLLECTION
- 14 NEW-MEDIA GALLERY
- 15 ADMINISTRATION

credits

ARCHITECT: Zaha Hadid Architects – Zaha Hadid, Patrik Schumacher, partners; Craig Kiner, project director; Alberto Barba, project architect; Nils Fisher, project director (competition)

EXECUTIVE ARCHITECT: Integrated Design Solutions

ENGINEERS: AKT II (structural); Max Fordham and Partners (m/e); FTC&H (civil); Structural Design Inc. (structural engineer of record)

CONSULTANTS: Front Inc. (facade); Zahner (stainless steel); Josef Gartner (glazing/structural steel); Granger (architectural concrete); Lord Cultural Resources (cultural)

CONSTRUCTION MANAGER: Barton Malow

SIZE: 46,000 square feet

COST: \$45 million

COMPLETION DATE: November 2012

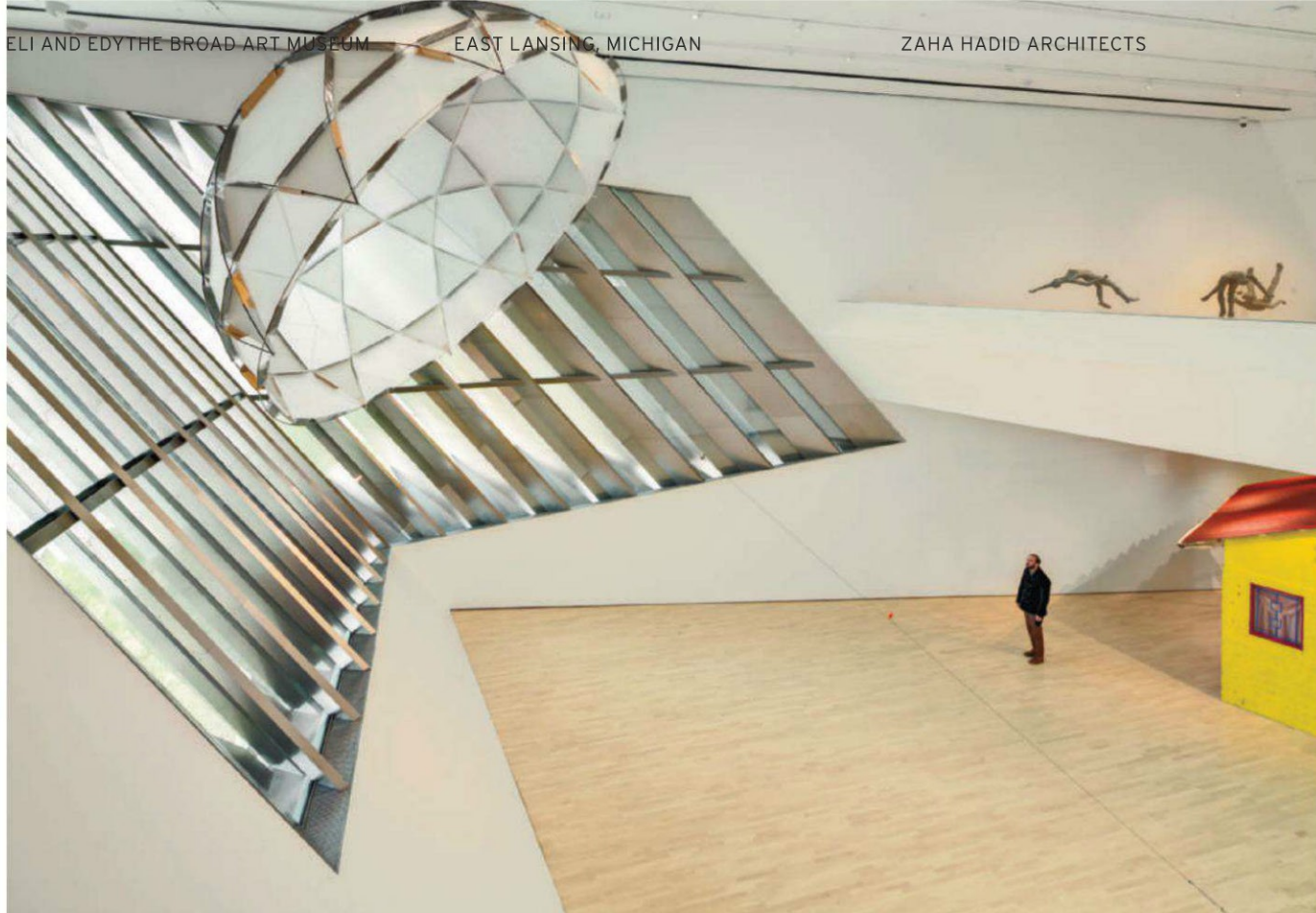
SOURCES

LOW-E GLASS COATING: Guardian

AIR/MOISTURE/VAPOR BARRIER: W.R. Grace

ENVELOPE INSULATION: BASF

SOLID SURFACES: DuPont, Corian



they are, in relation to the public areas, tame. The double-height Minskoff Gallery, with its jutting glazed maw, is the most dynamic of these, offering interesting installation possibilities—the museum displays pieces from the Kresge collection, which it inherited, alongside commissioned and loaned work (in particular from the Broad collections). But some of the smaller, narrow exhibition spaces feel confined and taper to abrupt terminations next to emergency exits that seem unconsidered, as if the designers petered out and just put up a wall, tilting it for visual interest.

By dispensing with the white-cube gallery, the architects say they hoped to challenge curators and visitors. “We want to participate in the dynamism of the building, rather than try to figure out how we are going to fight this thing,” says museum director Michael Rush. Pointing to parallel ambitions in contemporary art, he underscores the opportunities here: “In a structure like this, where the body is engaged physically with its surroundings, you have this amazing synergy between building, art, body, and perception.” At another level, the museum challenges the university. “It’s a springboard for saying, ‘Let’s break out of convention,’” says MSU associate provost Linda Stanford, “both in terms of building and also what we do academically.”

Schumacher explains the museum’s relationship to its backdrop as a “figure-ground” one. And Hadid notes that the campus provides a “frame.” Even so, while achieving extreme visibility, the architects have met the seemingly oppositional challenge of integrating this odd though amiable creature into its conventional college-town setting. ■



CREATIVE ENERGY Dedicating at least 60 percent of the building to the display of art was a condition of Broad’s gift and resulted in flexible spaces and limited auxiliary areas. Works by Marjetica Potrc, Iñigo Manglano-Ovalle, and Chen Qiulin are visible in the soaring Minskoff Gallery (top). The metal-clad stair (above) cantilevers vertiginously between floors.

Here Comes the Neighborhood

Three veteran art dealers in two cultural capitals open new galleries in surprising locations. The spaces have begun to transform gritty areas in Hollywood and New York's Hell's Kitchen. **BY WILLIAM HANLEY**

Sean Kelly Gallery, New York City



THE PIONEER When Sean Kelly abandoned New York's SoHo for the warehouses of Chelsea in 2001, he set up shop a few blocks north of his peers. His latest space, which opened in October, again pushes into territory just beyond the New York art map. Located in Hell's Kitchen, Kelly's two-level gallery occupies 22,000 square feet of a 1914 building (near right). Family friend Toshiko Mori designed the renovation, organizing gallery and administrative spaces (far right and above) around a central library (above right). A few blocks from the Hudson Yards mega-development, near which Mori is designing two subway entrances and a café, the project will get some high-profile neighbors by 2017. But the architect expects other art dealers to follow Kelly's lead even sooner. "The neighborhood doesn't really have an identity," she says, "and the art world tends to gravitate toward those kinds of holes in the urban fabric."





Regen Projects, Los Angeles



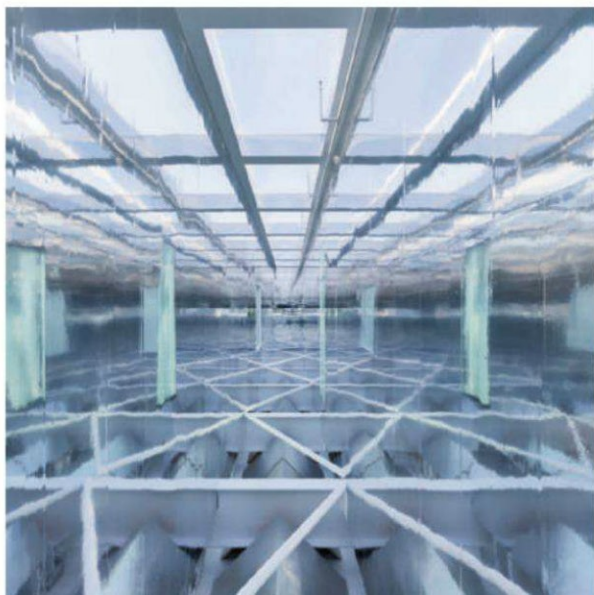
LIGHT SHOW On a scruffy block in Hollywood, Shaun Regen's new gallery looks like a white ship cruising down Santa Monica Boulevard. A repurposed post-production studio, the Michael Maltzan-designed 20,000-square-foot space, which opened in September, continues the single-story profile of its neighbors but adds an unusual roofscape (above). Maltzan kept the original bow-string ceiling trusses in the half of the building used for administration and storage. But on the side that houses a large, public gallery, he replaced almost all of the structure



Regen Projects

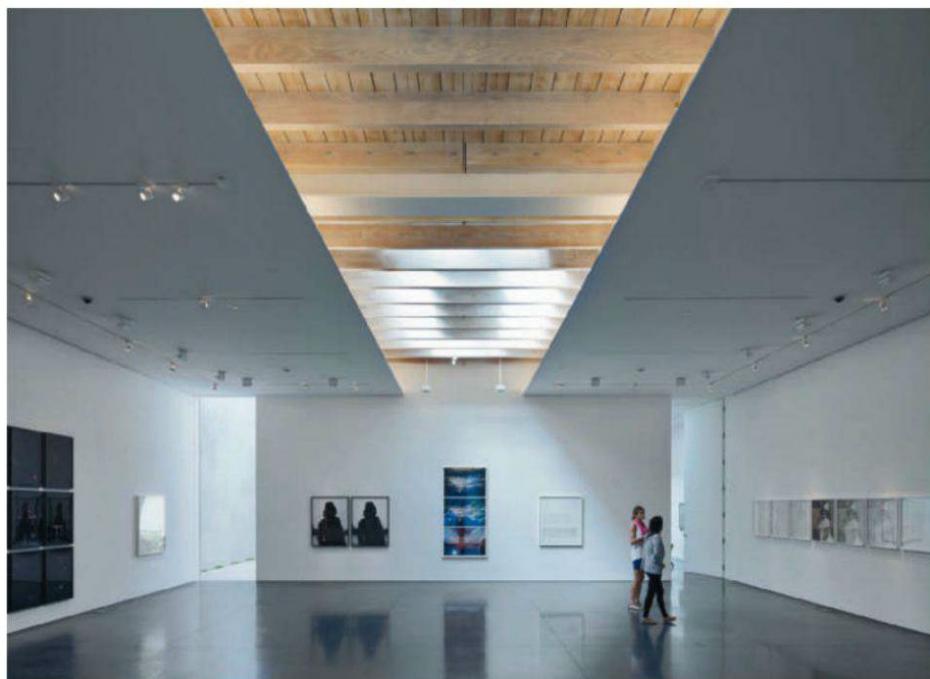


to create high ceilings and to support a rooftop exhibition and event space. To bring daylight into the interiors without taking away from the roof space, Maltzan devised a chimneylike light well lined with reflective film (below left). Sunlight enters from above and bounces down a shaft into a horizontal cavity in the main gallery's ceiling. Filtered by a scrim, it illuminates the exhibition spaces below through overhead openings (above). Visitors get their only glimpse of the apparatus through the discreet frame of a rectangular window on the roof deck (below). "As much as I love the mystery of the light," says Maltzan, "there's something spatially really beautiful about the inside of that highly reflective light corridor as well." Around the corner from the new Perry Rubenstein space, Regen's distinctive roof is poised to become a beacon in a new Los Angeles gallery district.



HOLLYWOOD BABYLON New York dealer Perry Rubenstein's first Los Angeles gallery makes a statement against the typical white box. Its exterior is finished with a tough- and chic-black industrial coating and a deep-gray paint (below). "Hollywood has an edge to it," says the project's architect, Kulapat Yantrasast. "And Perry didn't want people to feel like he was trying to bring Chelsea to L.A." The gallery's 9,000 square feet of space progresses with a very Los Angeles ease. Visitors enter between two reception desks—there is no imposing lobby. A courtyard (right) provides outdoor circulation among the galleries (bottom left and center right). Shaped like the "O"s in the Hollywood sign, three skylights (one shown bottom right) playfully signify the location. They will create a visual double of the original sign, which presides over the neighborhood in a classic vista, when a roof terrace opens this spring.

Perry Rubenstein Gallery, Los Angeles





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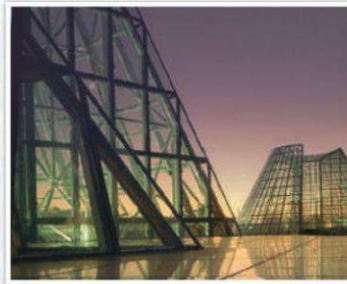
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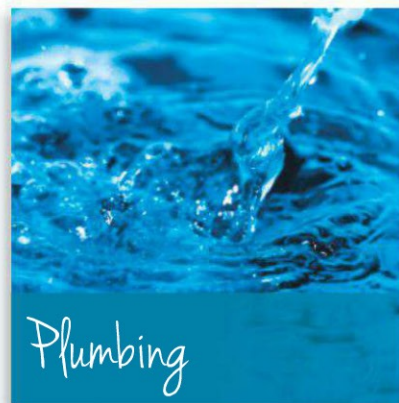
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CIRCLE 23

Photo of Halsell Conservatory • San Antonio, Texas • Architect: Emilio Ambasz



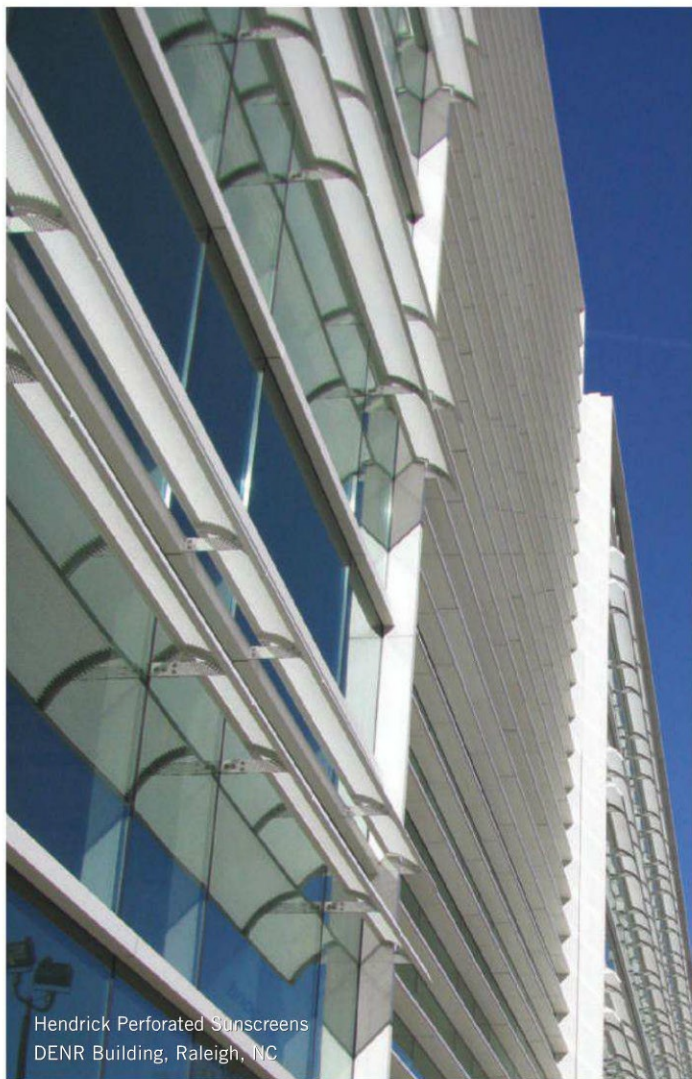
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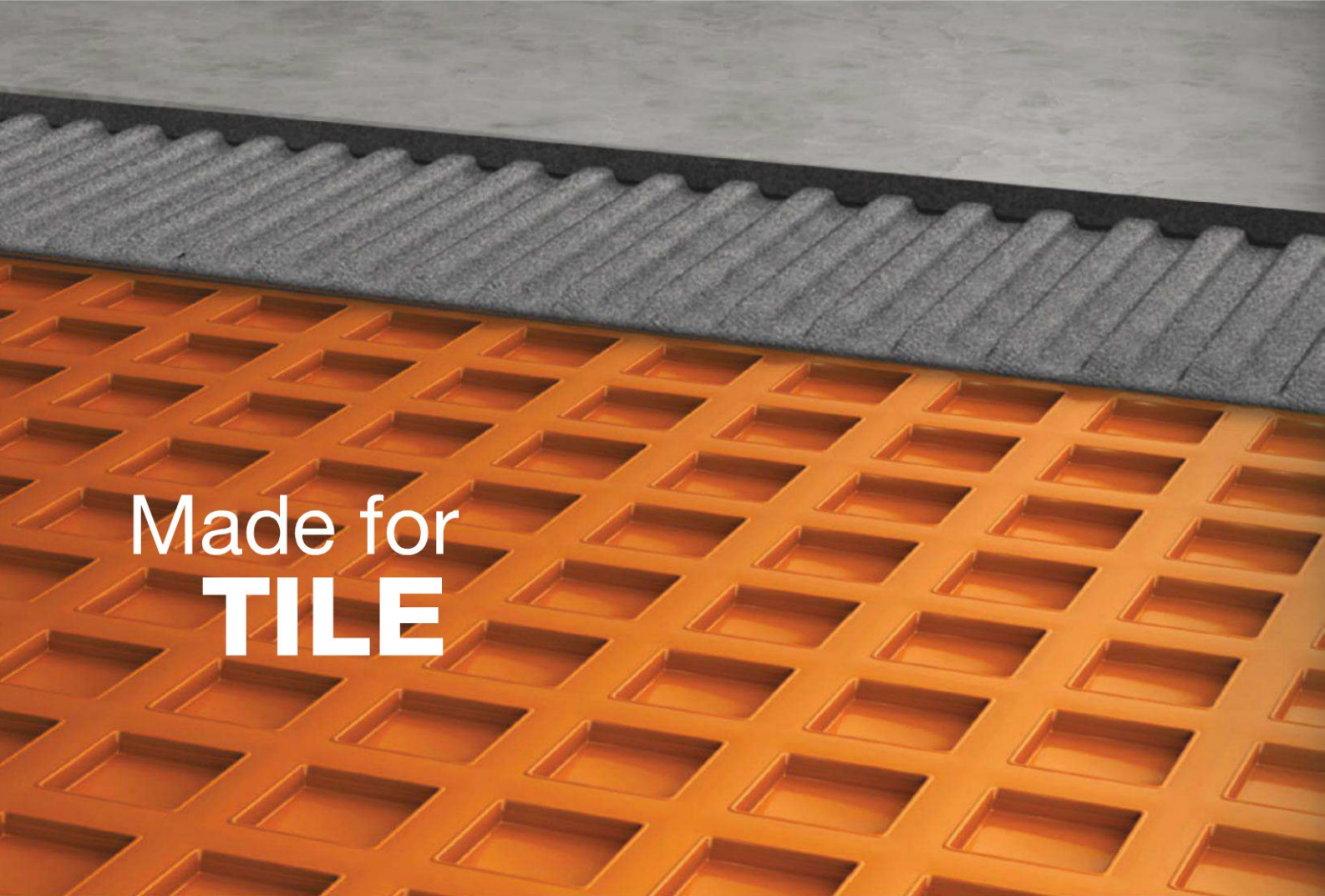
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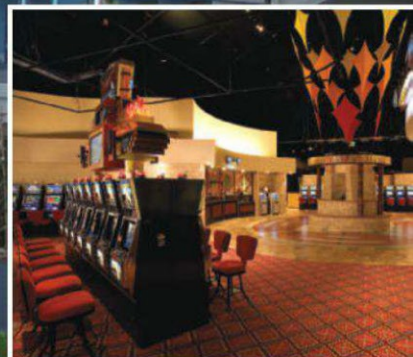
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THE PRESSURE is on around the globe to produce high-caliber students at every grade level and to support the needs of all children. Increasing numbers of educators and school boards are inviting innovative architects to help them rethink the learning environment (and in light of the recent tragic events in Newtown, Connecticut, much of this rethinking will no doubt revolve around security issues). The schools showcased here, filled with daylight and flexible spaces, represent the best of such collaborative efforts. By breaking down traditional assumptions and configurations in school architecture, design teams are not only responding to current societal demands and teaching methods, they are also laying the groundwork for potential changes in the future. Comfortable and stimulating, these facilities have been planned to accommodate the work and play necessary for our kids to thrive and grow.

112 PROJECTS

140 SCHOOLS FOR CHILDREN WITH ASD

148 K-12 SCHOOL PRODUCTS

Schools of the 21st Century

PHOTOGRAPHY: © KEVIN TITTLE

Kathlyn Joy Gilliam Collegiate Academy | Dallas | SHW Group

In a Class of Its Own

The design of a south Dallas high school provides students with a college-like atmosphere.

BY LAURA MIRVISS

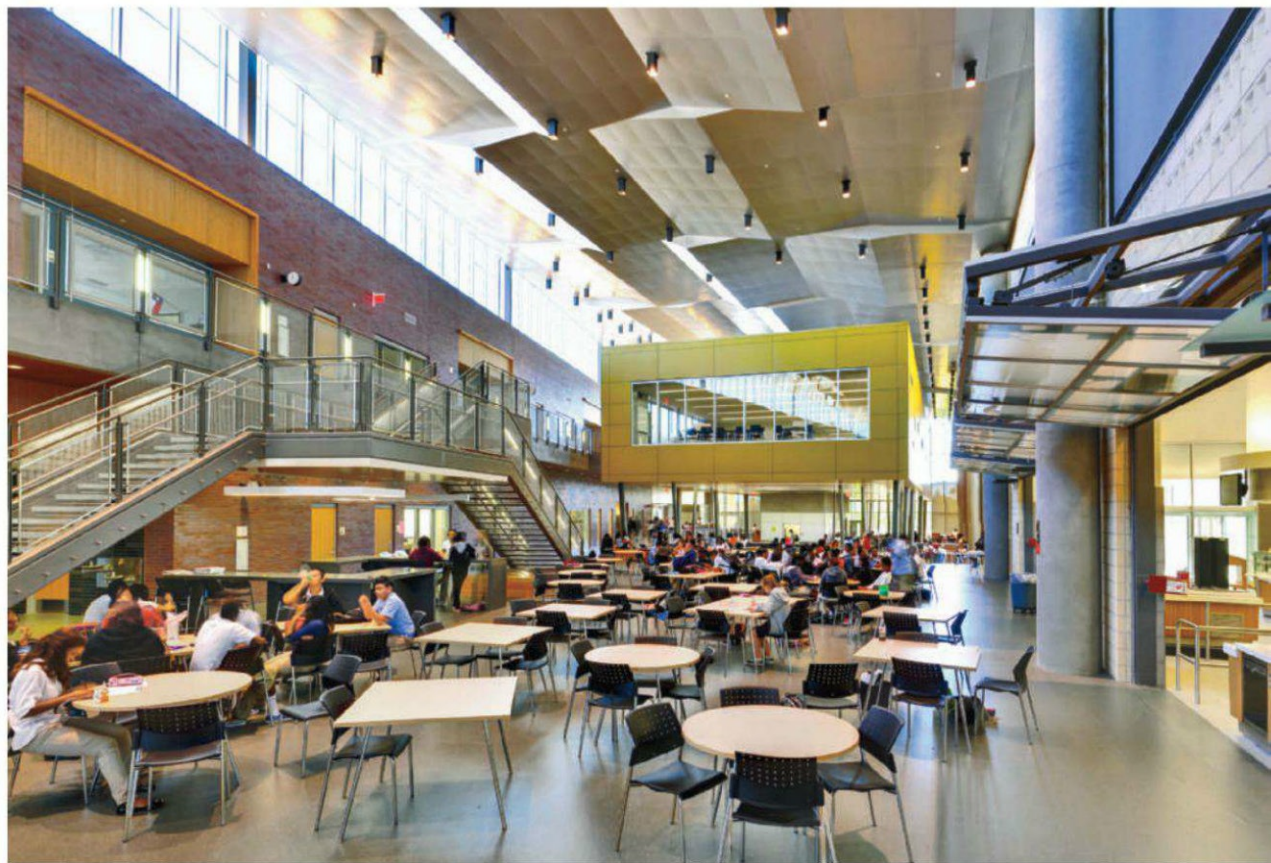


LIKE A PROUD parent, Denise Davis, an associate at the Communities Foundation of Texas, shows off photographs of the Kathlyn Joy Gilliam Collegiate Academy whenever she is asked about exciting developments in early-college-high-school programs. Davis, whose statewide foundation helps college-readiness programs get off the ground, has much to brag about: The Gilliam Academy, serving motivated but low-income students, had a graduation rate of 100 percent last year. All students graduate with college credits, and some walk away with associate's degrees.

A 20-minute drive south of downtown Dallas, Gilliam is the Dallas Independent School District's third early-college high school. While its predecessors rent space on existing college campuses, the \$21.3 million Gilliam is the first stand-alone college-prep high school built from the ground up in Texas. And it is one of the district's most striking success stories.

Opened in August 2011, the 104,000-square-foot facility sits on a 10-acre plot on the top of an uncharacteristically hilly stretch of grassland, just off a six-lane road that connects to the main interstate. The steel-framed building is tucked into the northeast corner of the sprawling, though still developing, 260-acre University of North Texas at Dallas campus. Oriented with its long axis in an east-west direction to minimize heat gain and glare, the low-slung structure, with a gradually canted roof, is clad

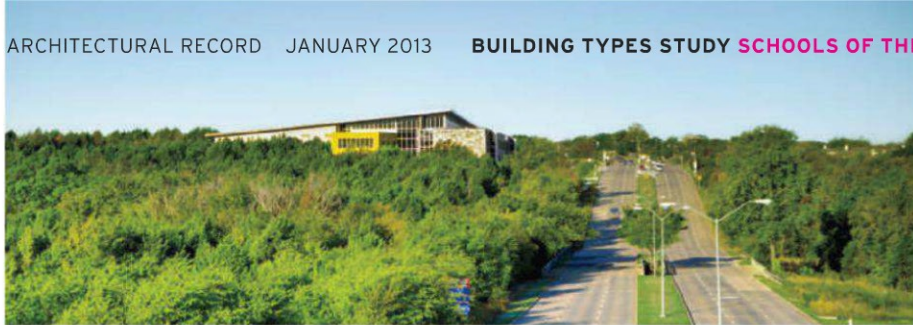
SURROUND SOUND
Acoustics are critical in the atrium, where finely perforated metal ceiling panels, rubber flooring, and slotted masonry units on the south wall maximize sound absorption.



in fiber-cement board and brick. The building is designed to complement the neighboring university's brick and window-lined facades, while also having its own declarative aesthetic.

When the architects from SHW Group's Dallas office met with district officials to first discuss the design of a school devoted to college readiness, they quickly realized they had entered uncharted territory: They could not simply scale down a standard 3,000-student public high school for Gilliam's much smaller population of 400 students. "It was a different kind of building they were asking for," says Vandana Nayak, the SHW project manager. "There was no prototype in the state of Texas."

The architects encouraged the school district to take a step back and spend a month going through a formal visioning process with administrators, teachers, students, parents, legislators, and police to outline their goals for the space. The committee's report, which emerged after 15 hours of meetings, emphasized collaborative, informal, and unstructured learning—"new words" in school design, says Terry Hoyle, a principal at the firm. "Students are learning in different ways than they did 50 years ago,



and the space needed to reflect that.”

Using the report as a guidepost, the architects came back with two schemes for the district to choose from: a campus plan with separate buildings connected by a lawn, or a single building with a large common area. The district opted for the latter because of security concerns. Much like a college student union, the two-story building has an open, central double-height atrium with north-facing clerestory windows. It contains a college and career center, cafeteria, library, and other collaborative spaces, including four demountable glass conference rooms for small-group work. Classrooms, with generous windows affording sweeping views of the city skyline, run along the northern wall on both floors and are designed to be as versatile as possible so teachers can trade them throughout the day. A 7,500-square-foot gym, a buffet-style serving area, and a 250-seat lecture hall with a retractable back wall for outdoor performances anchor the south side.

The school is designed to give upperclassmen more independence, and their classrooms on the first floor offer immediate access to communal spaces—and potential distractions—like the cafeteria. (Upperclassmen are also free to leave campus to attend classes at a community college four miles away, though this year 11 professors decided to come to them and teach on-site.) The younger students have classes upstairs. “The older students can come and go and self-regulate,” says Gayle Ferguson Smith, Gilliam’s principal. “And the younger students can watch what’s happening below and model their behavior.”

Also on the second floor, a yellow fiber-cement-board-clad box called the “perch” looms over the atrium and protrudes out the side of the building, sheltering an observation deck underneath. Elevated by artfully angled steel columns, the space contains meeting rooms and staff offices—a blaring physical reminder to students to seek academic support. With large windows, the staff has a bird’s-eye view of the first floor—one of many design tricks that lead students to complain (and teachers to brag) that there is nowhere to hide on campus. Says Nayak, “The goal was to create a collegiate feel, but still have supervision.” ■



FIRST FLOOR



SECOND FLOOR

- 1 CLASSROOM
- 2 STUDENT COLLABORATION SPACE
- 3 CAFETERIA
- 4 LECTURE HALL
- 5 TEACHER COLLABORATION SPACE
- 6 GYM
- 7 MEDIA CENTER
- 8 BUILDING SUPPORT
- 9 ADMINISTRATION

credits

ARCHITECT: SHW Group – Terry Hoyle, principal in charge; Vandana Nayak, Mike Elmore, project managers; Konrad Judd, principal designer; Roz Keck, programmer/planner; Jennifer Deng, Amy King, project architects

LANDSCAPE ARCHITECT: Linda Tycher & Associates

ENGINEERS: Pacheco Koch Engineering (civil); AG&E (structural); SHW, AACE (m/e/p)

CLIENT: Dallas Independent School District

SIZE: 104,000 square feet

COST: \$21.3 million

COMPLETION DATE: August 2011

SOURCES

METAL CEILING: Simplex Ceilings

GLASS: PPG

FIBER-CEMENT BOARDS: Auria

MASONRY: Acme, Blackson

**CENTER STAGE**

Movable glass conference rooms, lined with magnetic glass marker boards, are designed for group work (above). The lecture hall opens in back to an outdoor amphitheater, where long slabs of rock are scattered in the grass as bleachers (left). The school is located off a six-lane road and overlooks a forested nature preserve (opposite).

Benjamin E. Mays High School | Atlanta | Perkins+Will

Southern Revival

A major renovation and expansion gives an Atlanta high school a much-needed update.

BY ASAD SYRKETT

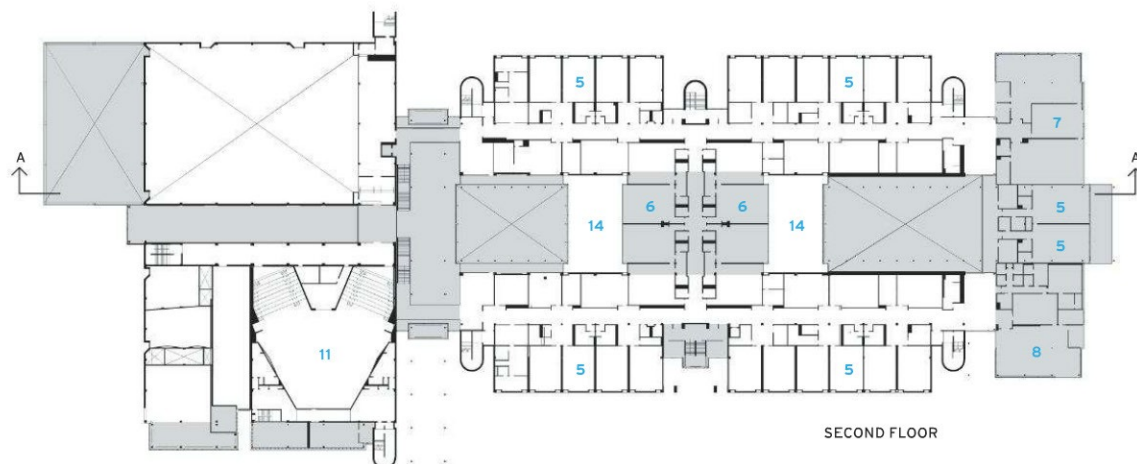
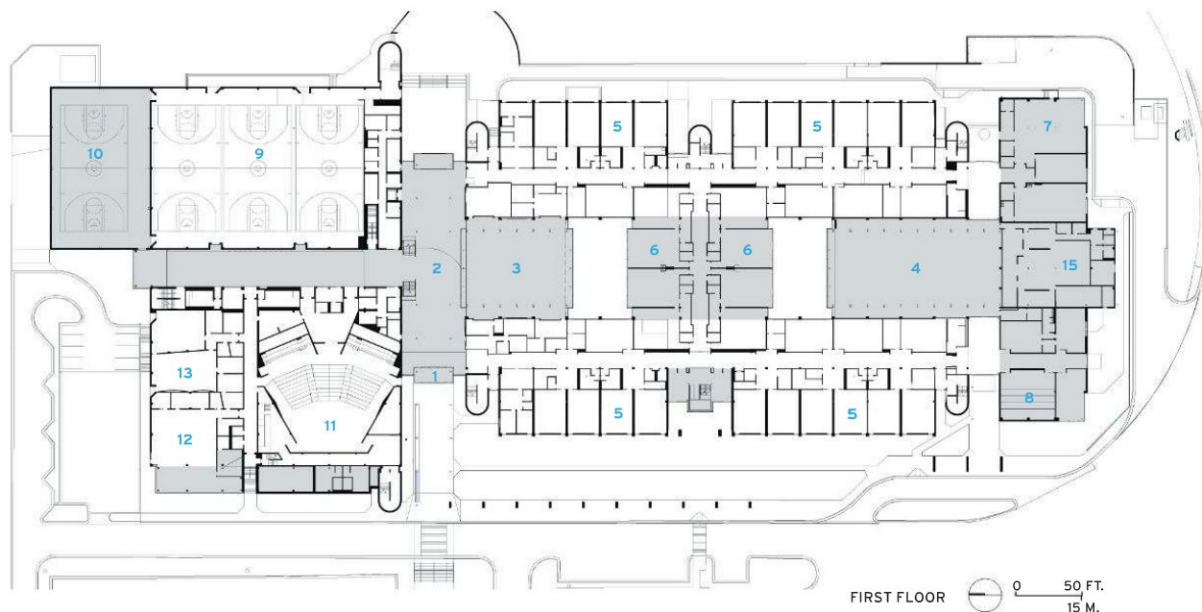


ENCIRCLED BY a stand of towering deciduous trees, Benjamin E. Mays High School keeps a low profile, despite having been home to such notable alumni as visual artist Radcliffe Bailey and musician Cee Lo Green, and currently being the largest school serving grades nine through 12 in the Atlanta Public Schools (APS). When it was built in 1981, the 310,000-square-foot concrete-and-brick structure was a bunker of a school: Low ceilings and winding, windowless corridors made for dark and uninviting interior spaces. It lurked on its hilly site, high above a middle-class African-American suburb.

Elegantly renovated and expanded to 350,000 square feet by Perkins+Will's Atlanta office, a "new" and more welcoming Mays was completed in January 2012, bringing daylight and air to the school's 1,600 students—all on a tight budget. "There are some students who'll fall asleep no matter what you do," jokes Dr. Tyronne Smith, an administrator who's been with APS for 30 years and has served as Mays's



IN THE SPOTLIGHT A double-height canopy (top) marks Mays's new and improved entrance, which leads into the refurbished, open lobby (opposite). This sense of lightness carries into spaces for instruction, including a visual-arts classroom (this photo).



SECTION A-A

0 50 FT.
15 M.

- | | |
|----------------------|----------------------|
| 1 MAIN ENTRANCE | 9 GYMNASIUM |
| 2 LOBBY | 10 PRACTICE GYM |
| 3 MEDIA CENTER | 11 THEATER |
| 4 CAFETERIA | 12 BAND ROOM |
| 5 CLASSROOM | 13 MUSIC INSTRUCTION |
| 6 SCIENCE LAB | 14 COURTYARD |
| 7 LEARNING COMMUNITY | 15 KITCHEN |
| 8 LECTURE HALL | |

credits

ARCHITECT: Perkins+Will – Barbara Crum,
Jack Allin, design team

ENGINEERS: Breedlove Land Planning (civil);
Uzun & Case (structural); Spurlock & Associates
(m/e/p)

CLIENT: Atlanta Public Schools

GENERAL CONTRACTOR: Winter Construction

SIZE: 350,000 square feet

COST: \$32 million

COMPLETION DATE: January 2012

SOURCES

ROOFING: Hydrotech

GLAZING: Oldcastle BuildingEnvelope

WINDOWS & DOORS: Kawneer (windows,
entrances); Steelcraft (metal doors); Algoma
Hardwoods (wood doors)

FINISHES: Armstrong (acoustical ceiling,
suspension grid, resilient flooring); Sherwin-
Williams (paints and stains); InterfaceFLOR (carpet)

ELEVATORS/ESCALATORS: ThyssenKrupp



tion supports Mays's curricular goals. The school was named after the prominent civil-rights activist and former president of Atlanta's historically black Morehouse College and, as such, is organized around four collegiate-style "academies" or "learning communities." Students can choose among science and mathematics, business and entrepreneurship, mass communications, and public affairs

"When it's bright and airy and the temperature's good, the kids function better."

and administration. "Each 'house' has an administrative office in the front," Crum explains; computer labs and other shared spaces, like lecture halls, are centrally located within each learning community, and flexible rooms for instruction occupy the perimeter of the building. Science labs, which require special equipment and storage, sit at the building's heart. The school's robust arts and athletics programs also have dedicated spaces. "The strings program is huge," explains Dr. Smith. "We have 80 kids in the orchestra."

In the months since Mays reopened, the students have taken a noticeable pride in their new school, Dr. Smith reports. "We haven't had graffiti," he says. "I think the building earns respect—it is more conducive to learning." But as students amble in the hallways as classes change, with the squeak of sneakers and excited voices rising in the entrance lobby, Smith has a word of advice for the architects' future

principal for 12. "But most of them, when it's bright and airy and the temperature's good, function better."

Transparency and a sense of openness were Perkins+Will's first set of priorities, but for budgetary reasons, scrapping the grim old building wasn't a viable option. A statewide penny-on-the-dollar sales tax, called SPLOST, for Special Purpose Local Option Sales Tax, generated only enough revenue for a renovation (which totaled \$32 million). So the firm began by demolishing the old building's core, removing the existing cafeteria, media center, and courtyards, and erecting a new steel frame inside the void with a height 7 feet above the original roofline. The design team relocated the main entrance, which previously sat in the center of the rectangular plan, to a space adjacent to the existing theater, and removed support columns and other structural elements to create a double-height entrance hall.

"Before, it was really a rat maze," says Barbara Crum, who leads the K-12 education-design practice at Perkins+Will's Atlanta office. "You didn't have these straight-through corridors," she adds, gesturing down a long, daylit, double-loaded hallway lined with classrooms. Each classroom has views out to the woods beyond the school and clerestory windows into the halls that let natural light in. "From a security and management standpoint, it's better," says Jere Smith, director of construction for APS, pointing out that dead-end corridors and a lack of windows could prove hazardous in a variety of emergencies.

In addition to addressing safety concerns, the reorganiza-



HERE COMES THE SUN The new media center (top) occupies a space at the school's core that was once gloomy and low-ceilinged like the old cafeteria (above).

education projects: "High-school kids like to congregate, and whenever they drop whatever it is they're eating or drinking, it stains the concrete," says Smith, referring to the area beneath the entrance canopy. "I don't know what's in that food, but when it gets into the concrete, it will not come out," he adds with a laugh. "What's in that buffalo sauce? I've told some of the kids they should look into it!" ■

Avenues: The World School | New York City |
Perkins Eastman and Bonetti/Kozerski Studio

Paving the Way

A private school with plans for global expansion develops a flagship campus on the High Line.

BY LINDA C. LENTZ



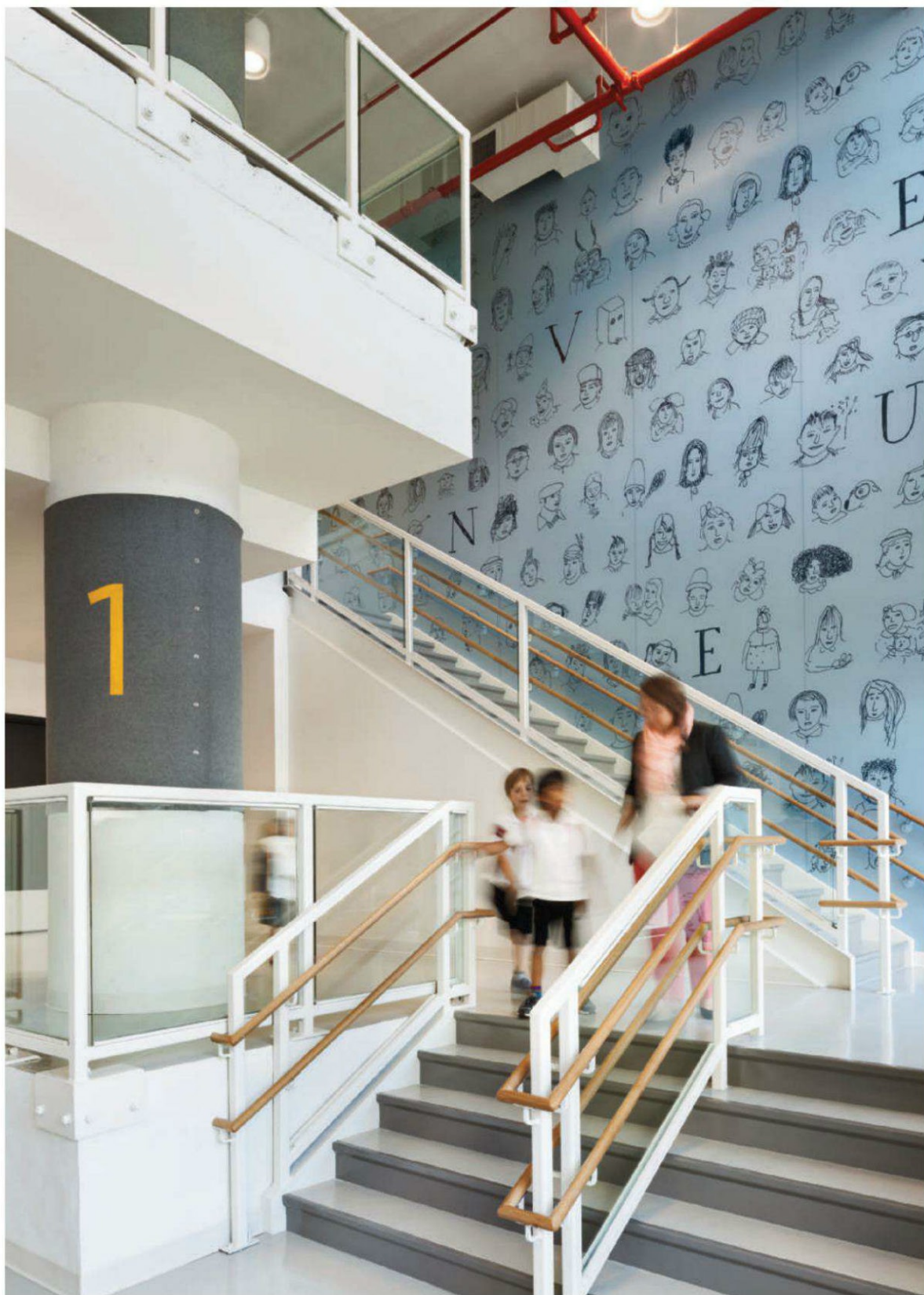
YOU KNOW exactly where you are when you walk through the newly opened Avenues: The World School. There are spectacular views of Manhattan at all levels and from just about every space in the 1928 former warehouse designed by Cass Gilbert for the R.C. Williams Company, a grocery wholesaler. The skyline, the High Line park, and the bustling, gritty streets of West Chelsea are at its doorstep, providing just the type of contextual setting the school's three founders, its leadership council, and the design team had in mind when they selected the 10-story, poured-in-place-concrete structure as the first of 20 international campuses they plan to roll out over the next 10 or more years.

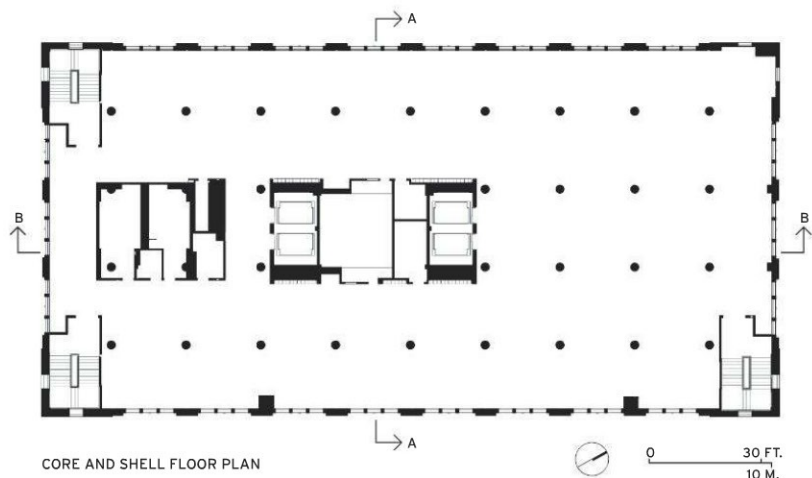
According to Avenues' chief facilities officer, architect Raymond Bordwell, each facility will reflect its location, whether that is New York City, or Beijing or São Paulo (the next two campuses, both scheduled to open in 2015). There will be similar programmatic elements, however. Developed with a corporate-like



ADAPTING HISTORY

The new school occupies a 1928 Cass Gilbert warehouse—the first to receive deliveries from High Line trains (above). The Early Learning Center lobby, entered from a side entry, features a playful mural by artist Maira Kalman (right).





CORE AND SHELL FLOOR PLAN

- | | |
|-------------------------|----------------------|
| 1 LOBBY | 11 MECHANICAL PLANT |
| 2 MUSIC ROOM | 12 PLAYGROUND |
| 3 EARLY LEARNING CENTER | 13 BLACK-BOX THEATER |
| 4 CAFETERIA | 14 PROJECT ROOM |
| 5 LOWER SCHOOL | 15 STAFF AREA |
| 6 LOWER SCHOOL/COMMONS | 16 FITNESS CENTER |
| 7 MIDDLE SCHOOL | 17 GYMNASIUM |
| 8 MIDDLE SCHOOL/COMMONS | |
| 9 HIGH SCHOOL | |
| 10 HIGH SCHOOL/COMMONS | |

SECTION A-A LOOKING NORTH
THROUGH MAIN STAIR

SECTION B-B LOOKING WEST THROUGH SHAFT

credits

ARCHITECT: Perkins Eastman
– Bradford Perkins, partner;
Christine Schlendorf, principal
in charge; Sharon Arrindell,
project manager; Cynthia
Panganiban, project director;
Dean Jacobson, contract
administrator

INTERIOR DESIGNER:
Bonetti/Kozerski Studio
– Enrico Bonetti, Dominic
Kozerski, partners in charge;
Nick Anderson, project
manager; Motomi Morii,
project designer

ENGINEERS: STV (structural,
m/e/p); Langan Engineering
(civil)

CONSULTANTS: Cerami &
Associates (acoustics); Flick
(kitchen); Susan Hochbaum
(graphics)

CLIENT: Avenues: The World
School

SIZE: 215,000 square feet
(gross)

COST: approximately \$60
million

COMPLETION DATE:
September 2012

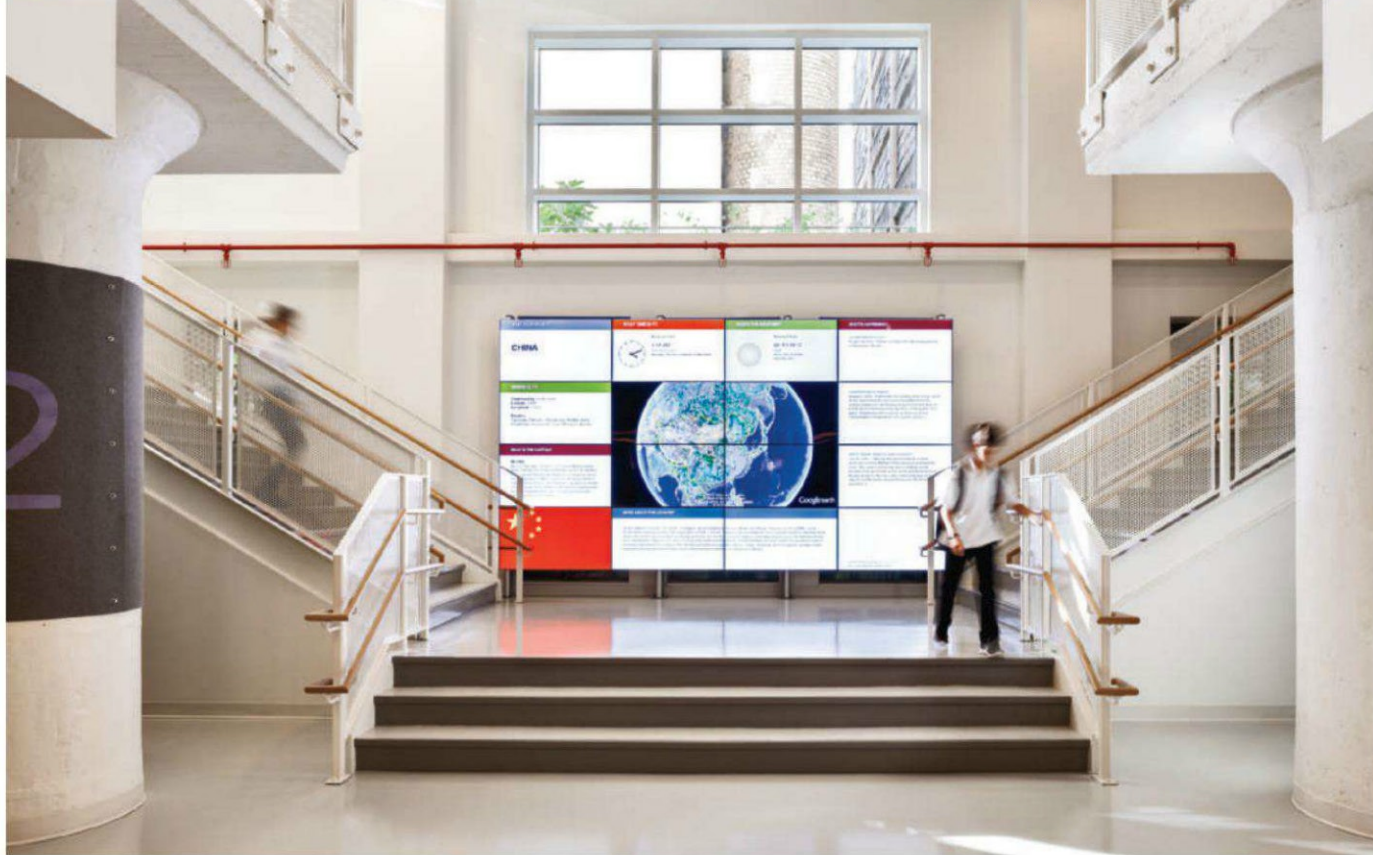
SOURCES

WINDOWS: Skyline; St. Cloud

INTERIOR FINISHES:
Trikeenan Tileworks, Lea
Ceramiche (tile); Armstrong,
Pyrock (ceilings); Bolyu, Dur-A-
Flex, Prialpas, Kähns (flooring);
Abet Laminati (lockers)

DOORS: Oldcastle
BuildingEnvelope (entrance);
Mohawk (wood); McKeon
(overhead); Renlita
(upswinging)

HARDWARE: Dorma, Trimco
ELEVATORS: ThyssenKrupp

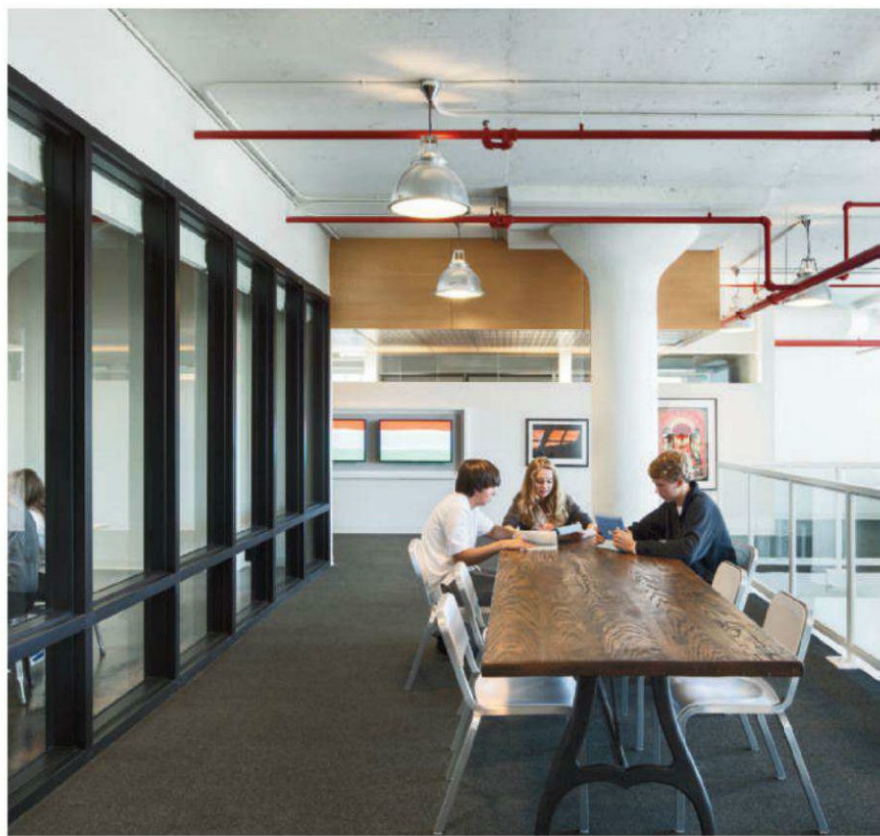


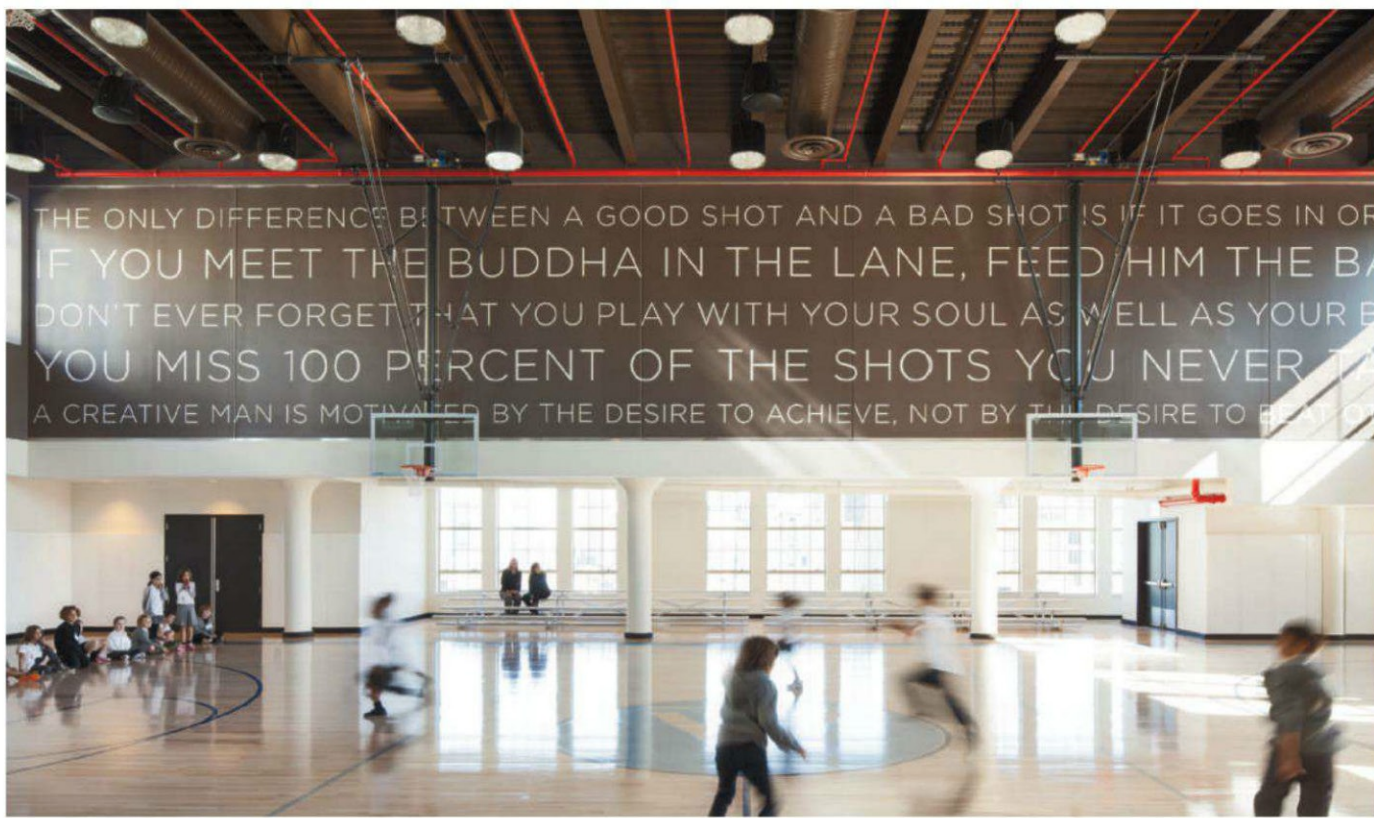
UPWARD TRAJECTORY An interactive media wall dominates the grand stair that leads to the cafeteria and the High Line (above). Double-height windows, exposed by a cut in the slab, fill a shared middle/high-school project room and common gathering space with ample daylight (right). The interior designers juxtapose tradition and innovation with a table made from old wood bleachers alongside digital displays for student work.

approach, the privately funded institution aims to provide real-world experiences for its pre-kindergarten through 12th-grade students. The curriculum revolves around self-directed, project-based learning with a multinational emphasis that includes language immersion. New York students spend half their day in English-speaking classrooms and the other half learning and attending classes in either Mandarin or Spanish. Eventually, children and teachers will interact with other Avenues campuses via distance-classroom cameras and foreign-exchange programs.

Bordwell collaborated with Perkins Eastman and the New York-based design firm Bonetti/Kozerski Studio to create a flexible core-and-shell model that would loosely translate to other locations and architectural styles. Delivered empty and in sound condition after its most recent stint storing soap-opera costumes and sets, the existing 215,000-square-foot warehouse required a complete overhaul.

Occupying one full block on 10th Avenue between 25th and 26th Streets, the building is categorized as a contributing property within a historic district. After obtaining the necessary permissions, the design team gutted the building down to its substantial columns, 12-inch-thick concrete shell, and 11-inch-thick slabs, replacing the windows with operable double-glazed units and insulating the walls and ceilings for noise protection and energy efficiency. They replaced two



**WORK AND PLAY**

The architects raised the roof of the top floor to provide a double-height gym for shooting hoops. Then the interior designers surfaced the perimeter with inspiring graphics depicting basketball verse and famous plays (above). Clerestories, in-room lockers, and throw rugs over existing concrete floors make lower-school classrooms (left) feel cozy, while distance-learning cameras and interactive boards provide the latest technologies.



DINING IN STYLE

The third-floor cafeteria features an enviable dining perch for middle- and high-school students that opens to the High Line with glazed overhead doors (left). Encased in deep-green-glazed tile, the food-service station (below) is open on two sides to dish up the day's specials on marble counters to both upper- and lower-school children. Small teaching kitchens allow intimate cooking classes.

central stairs with new stairways in three corner locations; swapped out two large freight elevators for four passenger-size destination-dispatch versions; and raised the roof on a section of the top floor to create a double-height gym. Then they expanded the sidewalk out front by transforming the loading docks into a portico with recessed glazing and a new entrance that leads visitors into the main lobby—an elegantly tiled space that immediately treats them to glimpses of the High Line at the top of a grand, processional stair. A second entrance and lobby on the side street provide secure, private access to the Early Learning Center.

The tile continues around the core throughout the upper levels, where the designers took advantage of the building's two-way slab construction by slicing through intermediary floors to create open, dual-level spaces within distinct lower-, middle-, and high-schools-within-a-school. "Since it is a vertical school, we wanted to connect the floors in different areas with a visual link," says Perkins Eastman principal Christine Schlendorf. Unimpeded east and west window banks, supplemented by clerestories along perimeter classroom walls on the north and south sides, infuse internal study and library common areas and glass-enclosed project rooms with daylight. State-of-the-art digital learning and communication tools, and the use of such classic materials as marble and wood, balance tradition and innovation. At the same time, "we exposed as much as possible of the old building to retain the industrial quality," says interior designer Enrico Bonetti.

The school's architecture and mission have struck a chord. Despite a steep \$40,000-per-year tuition, the New York campus attracted over 700 inaugural students through grade nine, and can accept more than 1,600 as the upper grades populate. Inherently adaptable by design, Avenues offers alternate paths to consider for all urban schools. ■

"Since it is a vertical school, we wanted to connect the floors in different areas with a visual link," says Perkins Eastman principal Christine Schlendorf.



Sandy High School | Sandy, Oregon | Dull Olson Weekes Architects-IBI Group

A Walk in the Woods

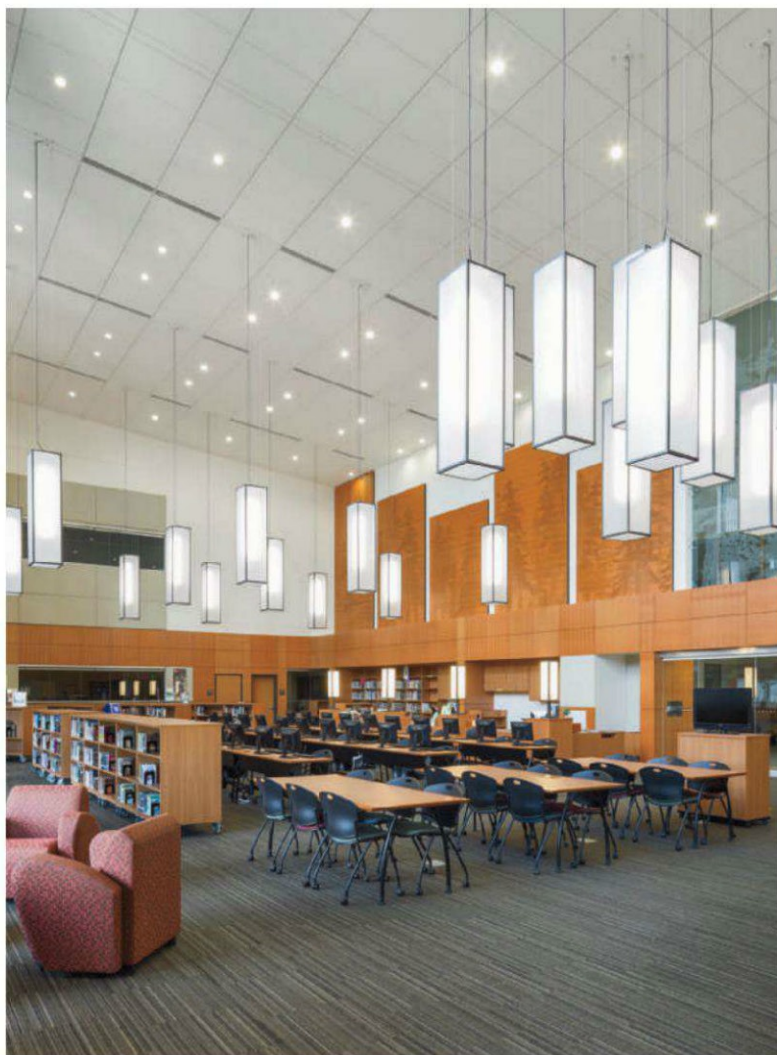
By breaking a large program into a set of components, a Portland firm creates a high school that hugs the land and minimizes its carbon footprint.

BY CLIFFORD A. PEARSON

CASCADIA MODERN

To fit in with the local tradition of rustic lodges and farm structures, the architects used a sawtooth roof over the gym and cedar siding above the main entry (right). A classroom wing looks onto the wooded site and provides a large balcony where students, or even entire classes, can meet (above). The two-story library (opposite) can stay open to the public when the rest of the school is closed.





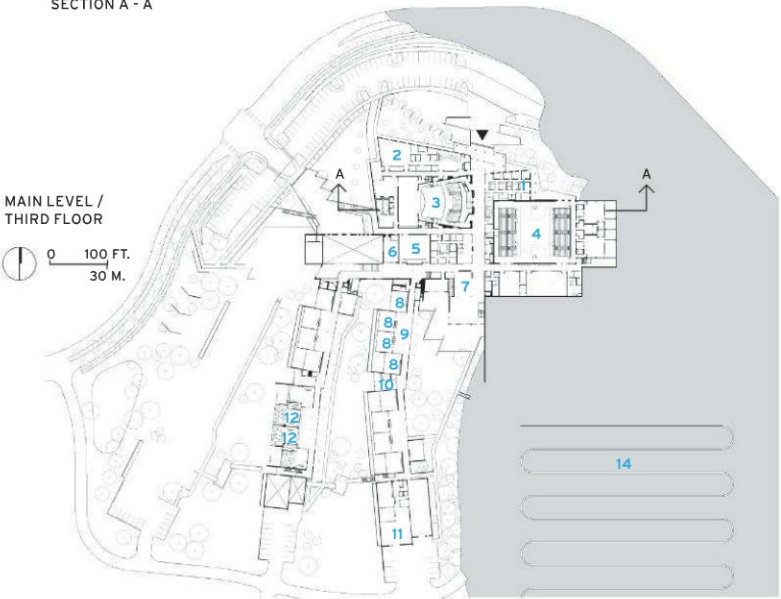
IN A TOWN OF just 8,000 people, a 310,000-square-foot building is a big deal, especially if it's the new high school. But such a project could easily overwhelm a rural town like Sandy, Oregon, halfway between Portland and historic Timberline Lodge on Mount Hood. So the design team at Dull Olson Weekes Architects-IBI Group (DOWA-IBI) broke the mass of the building into a number of pieces and tucked them into the sloping, wooded site. The architects also employed a broad range of sustainable-design strategies that reduce the school's carbon footprint and tie it to the environmental ethos of the Pacific Northwest.

"It's a big building in a small town," says John Weekes, one of the firm's principals, "and we wanted it to fit in." Thirty miles from Portland, Sandy High School draws its 1,400 students from a sprawling, 425-square-mile district that encompasses national forests and scrappy farming towns where money is often tight. The steel-frame building opened in the fall of 2012 to replace a 90-year-old facility down the road that was cramped and outdated.

The challenge was to fit the project into its physical, environmental, and social context. The architects started by organizing the school as if it were an ancient Roman town—with two axes at right angles and the most public spaces at the intersection. One axis runs north-south and serves as a corridor linking shared elements such as a gym, an auditorium, and a dining "commons" that are sometimes open to the public. A 600-foot-long east-west axis takes students and faculty from the public areas to a trio of classroom wings extending out to the south and to a double-height library to the north. The 82-acre site drops 80 feet from east to west, so the architects stepped the long student axis and the classroom wings down the slope. As a result, each of the school's four floors has direct access to the outdoors and hugs the hill. By reducing the amount of excavation needed, the scheme also saved the client several million dollars, says Jerry Waters, the senior designer for DOWA-IBI on the project. And by wiggling the classroom wings between existing trees, it preserved the wooded character of the site.

The local development code requires new buildings to follow a loosely defined "Sandy style," which incorporates elements of Cascadian architecture such as the pitched roofs and heavy timbers found at Timberline Lodge. Instead of borrowing such things literally, DOWA-IBI adapted them—for example, in the form of a sawtooth roof over the gym and wood louvers that block the sun on the classroom wings.

The architects pursued an aggressive environmental agenda in designing the school, using both passive and active solar strategies. "The building needed to live in nature, just as the people around here do," says Weekes. So in addition to pushing much of it up against the hill for protection against heat and cold, DOWA-IBI installed a 300-kilowatt photovoltaic solar array on the roof, along with a solar preheat system for hot water. Green roofs top two of the classroom wings, and a 500,000-gallon rainwater-storage



- | | |
|---------------------|----------------------|
| 1 ADMINISTRATION | 8 CLASSROOM |
| 2 MUSIC | 9 EXTENDED LEARNING |
| 3 AUDITORIUM | 10 TEACHERS' OFFICES |
| 4 MAIN GYM | 11 MANUFACTURING LAB |
| 5 BLACK-BOX THEATER | 12 SCIENCE CLASSROOM |
| 6 COMPUTER LAB | 13 AUXILIARY GYM |
| 7 COMMONS | 14 GEOTHERMAL LOOP |

COMMUNITY SPIRIT A 600-foot-long axis connects the three classroom wings to the shared facilities such as the gym, auditorium, and library, while stepping down an 80-foot-high hill (above). An extended-learning area serves as an extension to a cluster of five classrooms or can be a casual place for students to relax (opposite, top). Daylight from clerestory windows in the gym reduces the need for electric lights (opposite, bottom).



tank supplies water for irrigation and toilets. A 3-mile-long loop of geothermal piping runs beneath the athletic fields, providing heating and cooling, while a displacement-air system moves air up and out so germs don't hang around and infect other people.

Daylighting is another important factor in reducing the building's energy use. The school's distinctive sawtooth roof brings sunlight into the gym through long clerestories, and large skylights along the student axis do the same there. All the classroom wings have single-loaded corridors lined with glazing, and classrooms themselves have plenty of windows looking both outside and into the corridors. So even on a rainy late-November afternoon, there were few electric lights on in most parts of the school. Where shading is needed, the architects used deep overhangs and a combination of vertical and horizontal cedar louvers. Overall, the building will perform about 54 percent more efficiently in terms of energy use than the Environmental Protection Agency's baseline for high schools in this area, says Waters.

To break down the learning areas into smaller sections, the architects created two "cabins" in each wing and placed a small block of teachers' offices between them. Each cabin consists of four or five classrooms clustered around an open "extended-learning area." This arrangement offers teachers the chance to combine classes in the more casual extended-learning areas and students the opportunity to hang out there between classes. Each wing ends with a large space for learning practical skills such as automobile repair or agriculture.

Tim Werner, Sandy's principal, says everyone is still getting used to the new building. While students and staff have to walk farther now, since the school is twice the size of the old one, they appreciate all the daylight and impressive facilities like the gym and the double-height library, he adds.

Getting from one end of the school to the other may be a bit of a hike, but the building's strong relationship to the land makes it feel almost like a walk in the woods. That's not only good for the body, but good for the environment. ■

credits

ARCHITECT: Dull Olson Weekes Architects-IBI Group – John Weekes, Keith Johnson, Jerry Waters, Eric Buschert, Mathew Braun, Nancy Rad, project team

ENGINEERS: KPFF Consulting Engineers (structural); Interface Engineering (m/e/p)

CONSULTANTS: Mayer/Reed (landscape); Altermatt Associates (acoustics); PLA Designs (theater)

CLIENT: Oregon Trail School District

GENERAL CONTRACTOR: Hoffman Construction

SIZE: 310,000 square feet

COST: \$75.4 million

COMPLETION DATE: August 2012

SOURCES

WINDOWS: Kawneer

WALL TILES: Daltile

PHOTOVOLTAIC SYSTEM: Energy Unlimited

CEDAR SIDING: Enyeart Cedar Products

Blair International Baccalaureate Middle School | Pasadena, California | GKKWorks

Learning Curve, California Style

The design of a new middle school within a residential community uses a classical plan to achieve modernist goals. **BY JAMES GAUER**





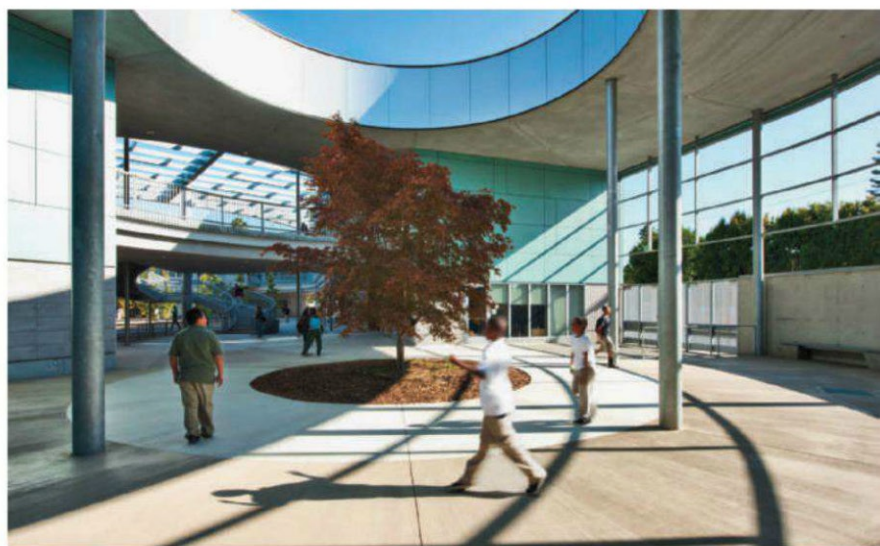
ON A SUNNY afternoon in Pasadena, California, an energetic sixth grader runs between the ginkgo trees in the large circular courtyard of Blair International Baccalaureate Middle School. Asked what he likes best about it, he stops, stretches, and replies, “The shape. It’s fun.”

At first glance, the new building by GKKWorks seems to be thoroughly modern, with lots of curves and openness, transparency modulated by fritted glass, and a taut and colorful skin of concrete rainscreen panels over a steel moment frame. It has earned LEED Silver certification. But a closer look reveals that those seemingly organic curves—or fun shapes—originate in a rigorously symmetrical axial plan.

According to design principal Edmund Einy, “The geometry of the plan stems from the idea of a protected open space.” It also comes from, and helps to resolve, the irregular site. Flanking the large courtyard are rectilinear bars of classrooms. These are played symmetrically about a central axis, which links the large courtyard to a smaller one, also circular, and to a park and views of the San Gabriel Mountains. The classrooms are orthogonal, but the spaces between them derive their forms from the radial geometry of the courtyards. This elegant strategy recalls classical precedents, such as French *hôtels particuliers*, which created geometrically regular spaces on irregular urban sites. It also recalls a baseball diamond.

The 34,930-square-foot school accommodates 650 students, grades six to eight. It includes 26 classrooms, food service, and administrative offices—all organized around the large courtyard. Part of a broader campus, the new middle school shares gymnasium and support services with Blair High School and will eventually sit within the adjacent park, as the city plans to close the street between them in 2014.

Einy and senior project designer Devan Mitchell collaborated with the Pasadena Unified School District (PUSD) to challenge conventional assumptions about school design and to establish how this school could advance the district’s educational goals. Foremost among these was to improve student performance by creating an atmosphere that enhances alertness and attentiveness. To that end, the architects utilized two primary program elements:



the universal-classroom model, which emphasizes flexibility, and plenty of multipurpose outdoor space.

Classrooms, typically 30 by 32 feet with 10-foot ceilings, maximize both daylight and interaction among teachers and students. The daylight comes from generous glazing on two parallel walls. On the courtyard side, the glass is fritted with a bright-red dot screen to obscure views, thereby minimizing distractions. Doors connecting adjacent rooms encourage casual contact between teachers. Student tables and chairs can be grouped in small or large pods or in traditional rows. Three of four walls are equipped with whiteboards, tackable panels, and projection screens, so teachers are free to move around. According to Einy, “The more teachers move and change the environment in the classroom, the more students are encouraged out of their comfort zone, to participate and become empowered in the learning process.”

Multipurpose outdoor spaces, well suited to the mild climate, encourage teaching, learning, and socializing in the open air. The large circular courtyard, planted with ginkgos

COMPOUND CURVES
A large, round central courtyard, surrounded by covered walkways, is a hub of activity (opposite). The color of the concrete panel skin shifts from sea-foam green to silver and terra cotta to articulate a curved corner entry (top). A smaller round courtyard serves as both main entry and outdoor reading room (above).

to evoke a forest, is designed to foster social learning. It accommodates graduations, assemblies, exhibits, and performances, as well as daily lessons for which students simply bring their chairs outside. Between classes, kinetic crowds of students animate the grounds with activity. Other outdoor spaces include a semi-enclosed lunch shelter, as well as the smaller courtyard—with a mature maple at its center and benches at its perimeter—doing double duty as main entry and reading room. On the second floor, open spaces between classrooms frame mountain views.

Because of the central courtyard, there are no double-loaded corridors and no separation of programs. Students and teachers enter and exit classes here and enjoy the abundance of light, air, and room-to-move it provides. This open space also frees the school of hierarchy. With all program elements weighted equally around it, everyone is visible, and the school functions as a cohesive social unit. Students can interact among grade levels.

The two-story building defers to its low-rise residential setting with a one-story base of warm gray ceramic tiles surrounded by a ground plane planted with grasses, shrubs, and cypress trees. In contrast to this neutral backdrop, concrete panels wrap much of the remaining structure in

sea-foam green (a variation on the school color), with a terracotta hue in the courtyard. Some street-facing panels are permanently pivoted open to reveal large windows, providing focused views and light, along with protection from the sun. A rounded corner, behind which sits the smaller courtyard, marks the main entry. Here the panels are interrupted by large openings in which a galvanized-steel grid maintains both the elevation's panel module and the plan's radial shape. This rhythm of voids and solids allows the building to strike a delicate balance between enclosure for students and teachers and accessibility to the neighborhood.

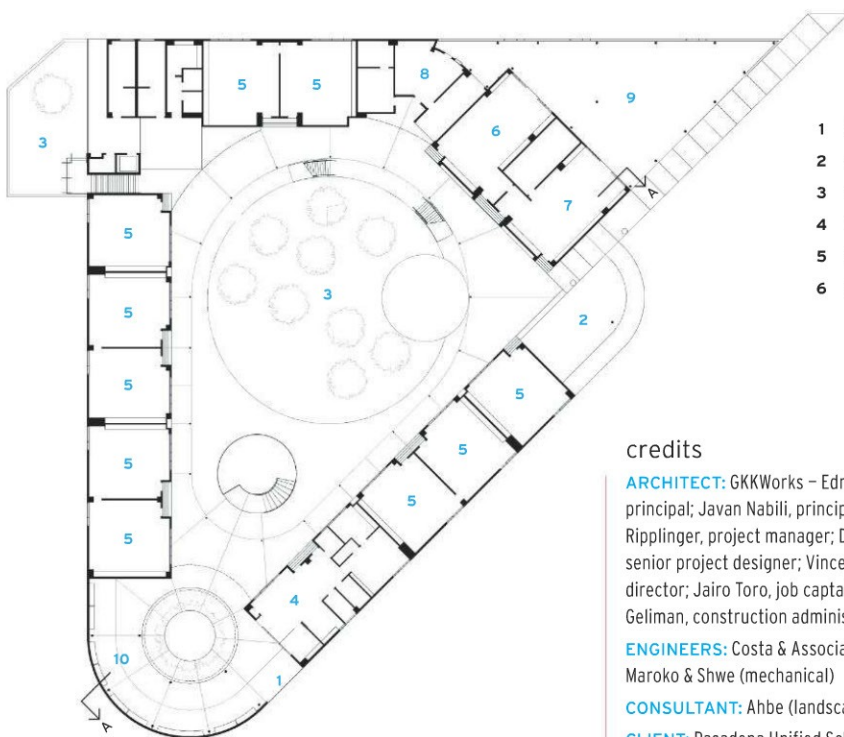
Teachers give the school high marks. "I appreciate the light and openness and the geometry of the design," says an art teacher. "The kids like it too. To them it's playful, like a toy." According to a history teacher, "The quality of the building signals a quality education. The environment makes students feel valuable. The kids are proud to be here." That's what happens when you combine the modernist virtues of space, light, and air with the classical virtues of firmness, commodity, and delight. ■

James Gauer is an architect based in Victoria, B.C., and the author of The New American Dream: Living Well in Small Homes.

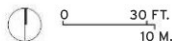
FLUID BOUNDARIES
Second-floor walkways allow students to survey the full depth and breadth of the school's open spaces—from the small courtyard, whose center is marked by a mature maple, to the large courtyard, whose circular shape is reinforced by a steel trellis (opposite, top). A skylit flexible classroom overlooks the indoor-outdoor lunch shelter (opposite, bottom).



SECTION A-A



FIRST FLOOR



- | | |
|----------------------|-------------------------|
| 1 CAMPUS ENTRANCE | 7 ART ROOM |
| 2 PLAY AREA ENTRANCE | 8 FOOD SERVICE |
| 3 COURTYARD | 9 LUNCH SHELTER |
| 4 ADMINISTRATION | 10 OUTDOOR READING ROOM |
| 5 GENERAL CLASSROOM | 11 SCIENCE ROOM |
| 6 FLEXIBLE CLASSROOM | 12 OBSERVATION DECK |

credits

ARCHITECT: GKKWorks – Edmund M. Einy, design principal; Javan Nabili, principal in charge; Blair Ripplinger, project manager; Devan Mitchell, senior project designer; Vince Patito, production director; Jairo Toro, job captain; Octavian Gellman, construction administration

ENGINEERS: Costa & Associates (structural); Maroko & Shwe (mechanical)

CONSULTANT: Ahbe (landscape)

CLIENT: Pasadena Unified School District

GENERAL CONTRACTOR: C.W. Driver

SIZE: 34,930 square feet

COST: \$13 million

COMPLETION DATE: September 2011

SOURCES

CLADDING: Swisspearl (concrete panels)

TILE: Royal Mosa, Daltile

GLAZING: Oldcastle BuildingEnvelope (low-E)

SKYLIGHTS: Super Sky

ENTRANCE: U.S. Aluminum, Lang+Fulton

WINDOW COVERINGS: MechoSystems



Uto Elementary School | Uto, Japan | CAT

A Breath of Fresh Air

A Tokyo firm replaces an outdated schoolhouse with a vibrant, flexible facility that satisfies stringent seismic codes and provides a healthy environment.

BY NAOMI R. POLLOCK, AIA



IN JAPAN, where the birthrate is dropping and the elderly population is rising, more schools are closing than opening. But in Kumamoto prefecture on the nation's southernmost island, Kyushu, the city of Uto was faced with an aging elementary school and nearly 800 youngsters to educate. Under the aegis of Kumamoto Artpolis, a prefectural program that engages architects for public works, Uto's Board of Education held a proposal competition and awarded the commission for a brand-new building to the Tokyo firm and de facto school specialists CAT.

"Our design for the new school was inspired by the old building," explains CAT principal Kazuhiro Kojima. The existing 40-year-old, government-issue structure was encased by glass on two sides, enabling dual exterior exposures for the classrooms. Yet it was neither compliant with the



PHOTOGRAPHY: © SADA O HOTA



current earthquake code nor able to accommodate students with special needs, and outdoor balconies were the only classroom access routes. The remedy: scrap and rebuild.

CAT's replacement capitalizes on the idea of generous glazing but improves accessibility and flow with a long, two-story structure that features a sequence of courtyards running down the middle. Surrounded by a blend of paddy fields and residential blocks, the building has five entrances, enabling students to approach it from multiple directions. The main doorway is on the north, facing an expansive sports and play field. It leads to a reception area flanked by administrative offices and a teacher room. Double-height gymnasium and library spaces, plus rooms for science, music, home economics, and other special subjects occupy the remainder of the ground floor here. The north side's

second floor and both levels on the south side contain 28 classrooms, including four for special-needs kids.

Typically, Japanese public-school classrooms are defined by four walls and aligned along a single-loaded corridor. Here the classrooms consist of semi-enclosed teaching areas organized on a 9-foot-square grid and partitioned by open-ended, L-shaped walls with rounded corners and windowlike openings. A circulation spine loosely ties the classrooms together, but, unlike most school halls, it is an ambiguous space that shrinks and swells along its length, incorporating informal assembly areas, clusters of tables, and the requisite blocks of sinks at every grade level.

Less contained than their conventional counterparts, the classrooms open both to the circulation area and to adjacent spaces used for small-group learning and storage. Teachers

MOUNTAIN VIEW
Blurring inside and out, connected courtyards bind the school's two sides together (opposite). Jutting out above the south-facing elevation of the north side's second floor, hefty steel beams anchored by steel tension rods secure the roof of the gymnasium (above left). Leafy deciduous trees separate the school from nearby houses (above).



can arrange their 753-square-foot learning spaces freely since the rooms have no predetermined “front,” and movable furniture—blackboards on wheels, rolling cubbies, custom bean-shaped tables, and standard desks—slides easily.

In addition to delineating space, the L-shaped walls are integral structural elements. Made of reinforced concrete, the 16-inch-thick planes carry vertical loads and counter lateral and earthquake forces. Together with steel columns ringing the building’s perimeter, they support the flat, void slabs overhead to yield 33-foot-long, clear spans. Extending the entire building height, the hefty wall segments poke through the roof and incorporate operable clerestory windows that draw fresh air up through the school. As in all Japanese public schools, there is no air-conditioning system.

To mitigate the area’s hot, humid summers, the architects wrapped the building with full-height, folding fenestration. Developed for Japanese-style archery ranges, the aluminum-framed window walls are easily pushed aside, turning the building into a giant *engawa*, or traditional covered porch.

The windows work in tandem with the courtyards that capture breezes blowing in from Mount Haku to the west. Each of these five connected gardens has a different character: One is dotted with fruit-bearing trees, another hosts playground equipment. Outdoor tables and built-in benches

make every exterior space kid-friendly. Four covered bridges spanning the courtyards link the school’s two sides.

Enclosed by the operable window walls, these decked paths provide protected yet airy traffic flow—even when it rains.

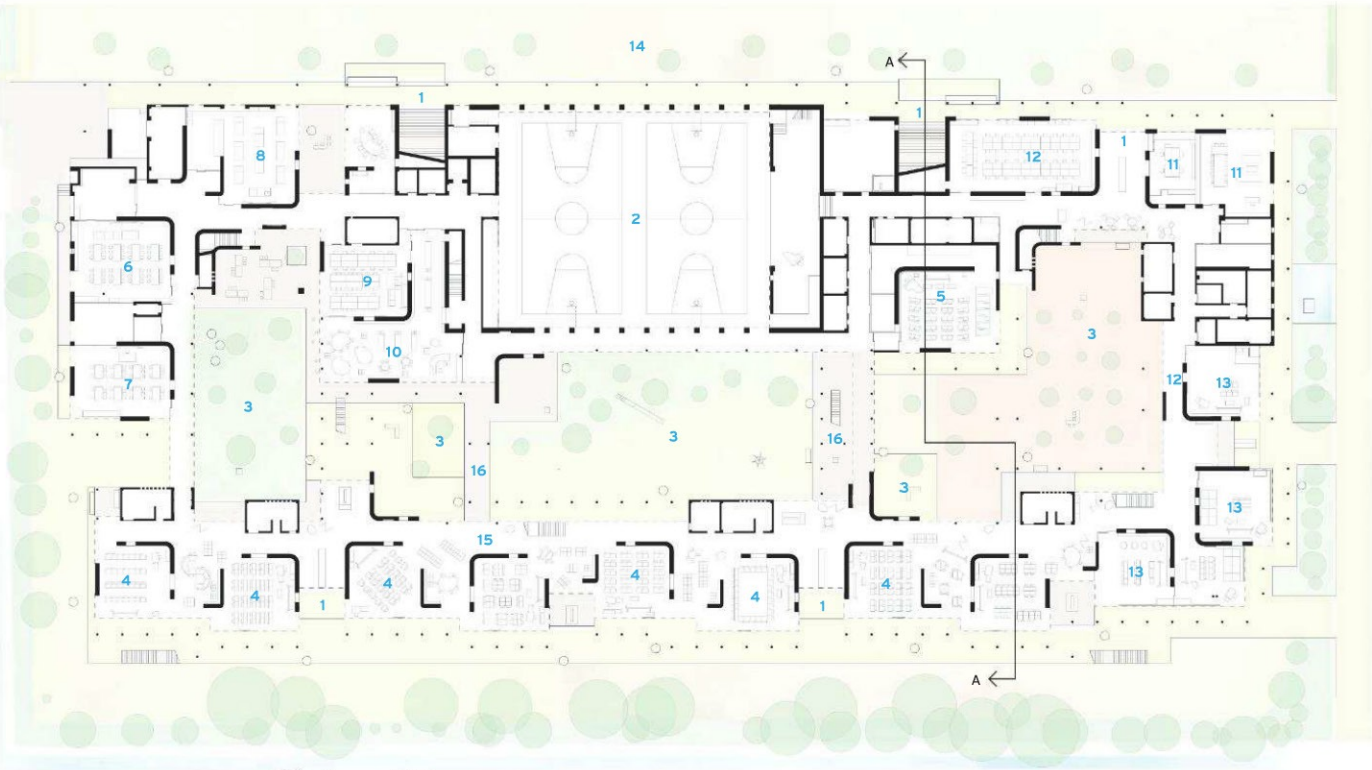
The school’s permeability not only responds well to the climate, but it has the potential to loosen the rigid pedagogical conventions prevalent in Japanese public schools. Though such an open plan makes it difficult to control noise, according to CAT principal Kazuko Akamatsu, the positioning of the perpendicular walls minimizes sound transfer, and installed acoustical insulation in the ceiling and at classroom entrances helps muffle sound not absorbed by the concrete walls and solid birch floors. Careful scheduling also prevents boisterous activity from disrupting quiet study.

Teachers not used to the visual exposure, or unsure of how to use the flexible space, might need to adjust to the quasi-open classrooms. “For conservative teachers it can be difficult,” remarks Akamatsu. “But for others it is exciting.” Maybe the school’s most discerning critics are the students themselves. “The kids enjoy their school so much,” says Kojima. “Maybe that is a problem for some teachers.” ■

Naomi R. Pollock, RECORD’s Tokyo-based special international correspondent, is author of *Made in Japan* (Merrell Publishers, 2012).

WINDOW WALLS

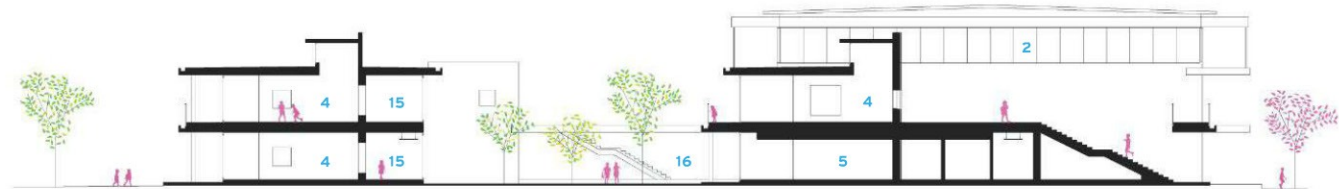
Lightweight yet sturdy enough to withstand Kyushu’s torrential typhoons, folding windows eliminate the need for mechanical air-conditioning, while canopies shield the interior from the sun (above). The school’s swimming pool, used during the summer months, is to the west of the building, next to enclosed concrete changing rooms (opposite).



GROUND FLOOR



- | | | | |
|-------------|------------------|-----------------|----------------------------|
| 1 ENTRANCE | 5 MUSIC ROOM | 9 MEDIA ROOM | 13 SPECIAL-NEEDS CLASSROOM |
| 2 GYMNASIUM | 6 SCIENCE ROOM | 10 LIBRARY | 14 SPORTS/PLAYGROUND |
| 3 COURTYARD | 7 ART ROOM | 11 OFFICES | 15 CIRCULATION SPINE |
| 4 CLASSROOM | 8 HOME ECONOMICS | 12 TEACHER ROOM | 16 BRIDGE |



SECTION A-A



**UNDER COVER**

Bifolding glass doors turn the covered porch into an extension of the classroom (this photo); windowlike cutouts in the L-shaped walls connect teaching and circulation areas and display student work (below).

credits

ARCHITECT: CAT – Kazuhiro Kojima, Kazuko Akamatsu, design principals; Kazuma Yamao, Shinya Omura, Shuhei Ito, Yoshinobu Shimoyama, Mitsuru Hamano, Koji Misaki, Ai Oishi, associate architects

ENGINEERS: Structural Design Office OAK (structural); Setsubi Keikaku (electrical); Scientific Air-Conditioning Institute (mechanical)

CONSULTANT: GA Yamazaki (landscape); Kaname Yanagisawa (planning); Kanako Ueno (sound); Environmental Simulation (wind)

CLIENT: Uto City

SIZE: 92,247 square feet (gross)

COST: approximately \$18.5 million

COMPLETION DATE: July 2011

SOURCES

FENESTRATION: Toko Shutter (folding windows); Fuji Sash (aluminum sash)

CEILINGS: SK Kaken (insulation materials)

VENTILATION: Mitsubishi Electric



Kumon | Kyoto, Japan | Takashi Yonezawa and Naoki Nomura

Pitch Perfect

Cooler than a storefront, this after-school learning center couldn't be much smaller, but the architects packed it with big ideas.



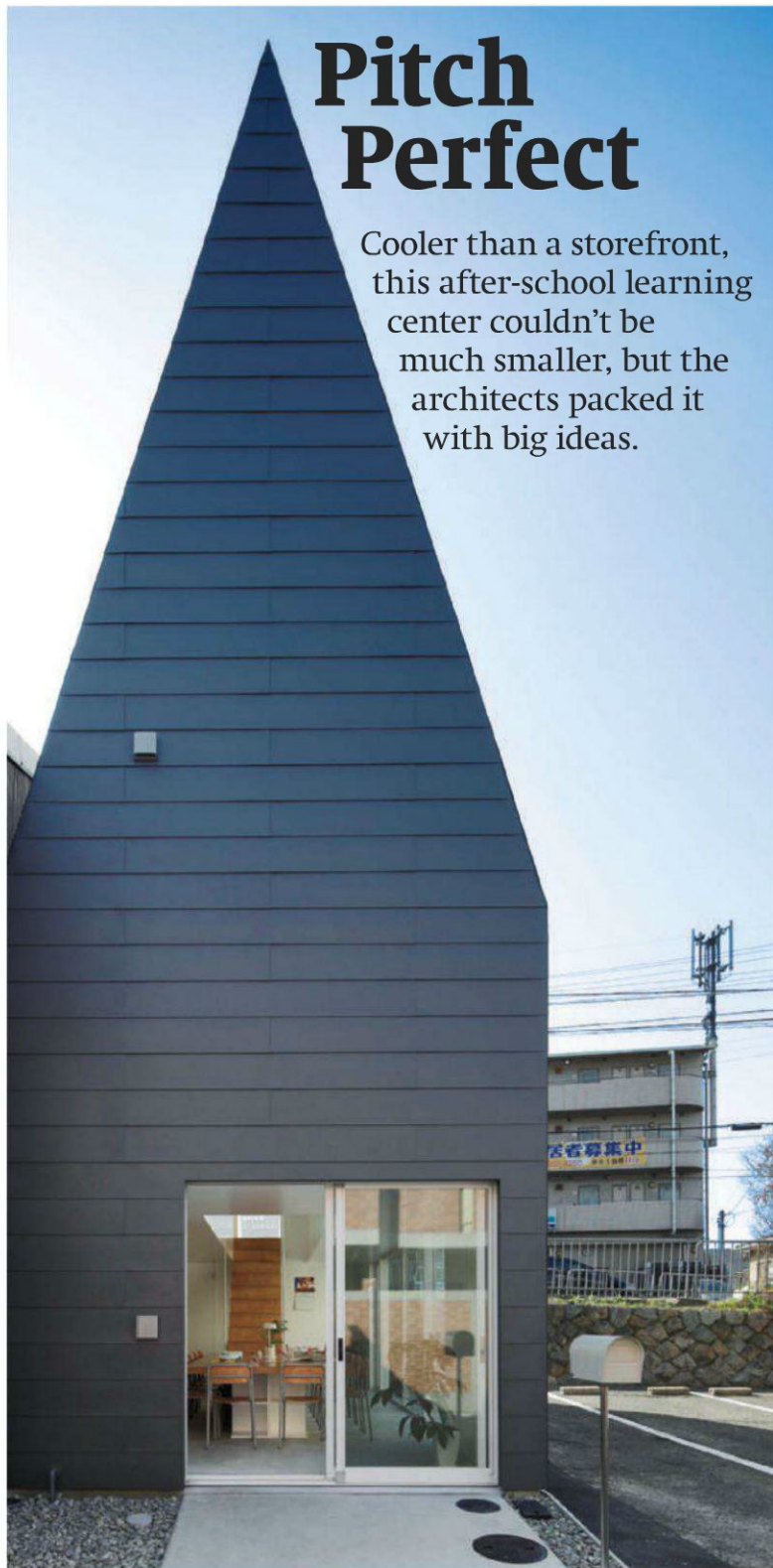
FOR OVER 50 years Kumon's learning centers in Japan have attracted students eager to enrich their formal pre-K-to-12 education with its motivating programs. The curriculum is controlled, but there are no rules about space. So when asked to create a facility in Kyoto, architects Takashi Yonezawa and Naoki Nomura saw an opportunity to give architectural expression to the school's systematic study method.

Capped with a steeply pitched roof, the 657-square-foot, pixie-like building straddles a busy boulevard and a quiet residential street that drops down 7 feet. There is one entrance and one room per level. The classroom is on the upper floor; the ground level serves as a multi-use space for community art classes and activities. An internal stairway links the levels, while an ingenious glass table or work surface upstairs joins them visually.

Made of two thick sheets of glass supported by steel plates, the table is "so strong, kids can jump on it," says Yonezawa. But most of the time they use it to work on their exercise sheets. A built-in counter wrapping the room's perimeter provides additional desk space. Overhead, the ceiling soars to 23 feet at its apex, but views are conspicuously absent. "On the upper floor, concentration is important for study," explains Yonezawa. "The lower floor is for fun."

In contrast to the pristine, exposed-steel structure above, earthy materials, such as concrete for the floor and wood for the table, dominate the lower level. Shelves for work sheets line one long wall; sliding glass doors open to a parking area and fill the room with daylight, forging a connection to the neighborhood—a densely built area on the city's south side packed with narrow, Kyoto-style townhouses. Against this backdrop, the steeply gabled, galvanized-steel-and-aluminum-clad building both blends in and stands out. *N.R.P.*

TO THE POINT The tiny building is clad in metal from the tip of its 72.6-degree pitched roof to its concrete ground level (left). A glass work table, supported by quarter-inch-thick steel plates, hovers over the floor below (top).





Handled With Care

As schools for students with autism move from makeshift or retrofitted quarters to new buildings tailored to their specific programs, architects and educators focus on what makes the best places for learning. **BY SARAH AMELAR**

BACK IN 1975, when the Eden Institute was founded in a New Jersey church basement to serve children with autism, the disorder was considered relatively rare, then estimated at a nationwide rate of 1 in 10,000 births. But by the time Eden settled into its new facility last year, the prevalence of autism, as reported by the Centers for Disease Control, had risen exponentially to 1 in 88.

It's unclear exactly how much of that dramatic increase reflects environmental or genetic causes, and how much is due to increased awareness and detection resulting from autism's broadened reclassification. Autism spectrum disorder (ASD), as it's now widely known, refers to a large category of complex, mild-to-severe brain and developmental impairment, manifested by communication and social-interaction difficulties and patterns of repetitive behavior. The spectrum runs from socially awkward, miscued, but highly functioning individuals to those with complete withdrawal, no verbal capacity, motor deficits, and a host of other disabilities. Overwhelming sensitivity to sensory stimuli (or perhaps the inability to process them) is often present. "ASD is so complex and varied," says Patrick H. Dollard, president and CEO of the Center for Discovery (CFD), a residential school in New York state with a large autistic population.

"You could probably safely say, as many children who have it, that's how many forms of the disorder there are."

With increased diagnoses, autism-specific schools multiplied. The umbrella definition, as autism expert John Brown points out, altered the "size and nature of the pool" to include



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Learning Objectives

- 1 Define autism spectrum disorder (ASD).
- 2 Discuss possible reasons for the

dramatic increase in the number of individuals diagnosed with ASD.

3 Outline different theories about what makes the optimal learning environment for students with ASD.

4 Explain how these philosophies are manifested in the architecture of each of the four schools presented in this article and sidebar.

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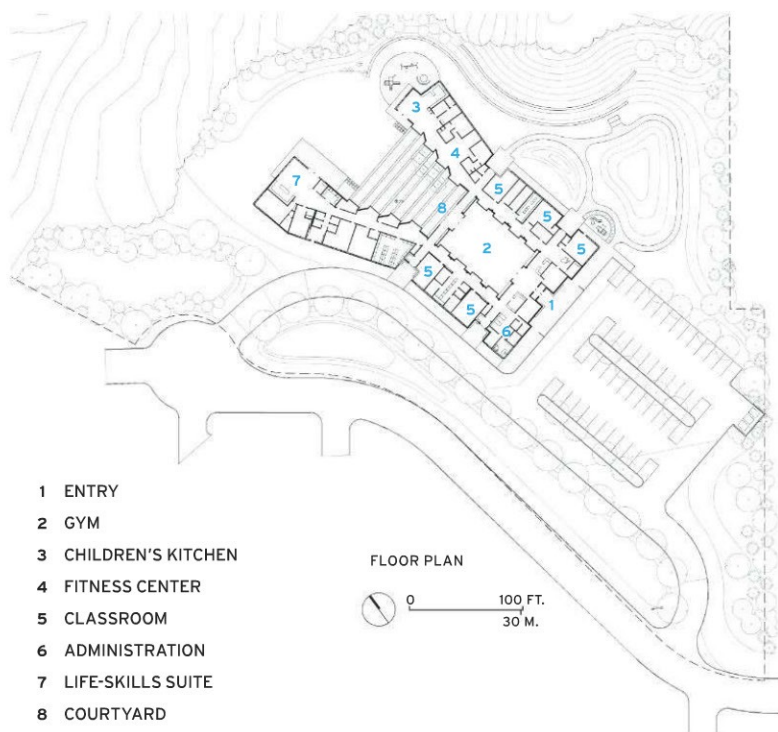
not only profoundly autistic and severely incapacitated people requiring hospitalization, but also higher-functioning groups in need of special learning environments.

Many first-generation programs that began in humble, makeshift, or retrofitted quarters have recently created new facilities from the ground up—among them CFD's Ridge Campus, as well as REED Academy and Eden, both in New Jersey. These projects have given institutional leaders and their architects the chance to zero in on what makes good design for students with autism.

But just as ASD's causes, mechanisms, and cures are not yet well understood, architecture's potential in this context remains semi-hazy. Educational philosophies (and design goals) diverge, most notably on essential questions of whether to tone down, "sanitize," or largely eliminate auditory, visual, and other sensory stimuli—or to expose autistic students to more challenging "real world" conditions.

The argument for "sensory diets" is to shelter ASD students from stimuli that might trigger traumatic responses or simply make it difficult for them to focus. So the idea is to create safe, calm environments, free of distractions that could cause pain or anxiety and derail learning. Recommended measures have included muted colors; ultra-simplified detailing; meticulous soundproofing; avoidance of direct fluorescent lighting, sharp angles, or abrupt transitions; and, in general, consistency rather than variety.

But advocates of the "real world" approach point out that



people with ASD often have difficulty generalizing, or transferring a skill learned in one setting to another (even something as mundane as using a restroom). And so, the argument goes, coddling these students in sensory-controlled "bubbles" hinders their integration into society.

The latter philosophy, rooted in a behavioral approach, underlies REED Academy's new home, a 25,300-square-foot, bowed-roof structure in a suburban office park. Regarding sensory input, "we don't intentionally mute or reduce it to prevent 'distraction.' That's not real life," stresses Leah Fanning, the principal of REED, which, like the other examples in this article, is a private nonprofit, receiving referrals and funding from public-school sources.

Brown, now a professor with Hunter College's Autism Center, was REED's executive director when the project began. Working closely with WXY Architecture + Urban Design, he envisioned simulating conditions of the outside

world to help students "engage it, live in it, relate to other people, and find employment there." So instead of banning direct fluorescent lights or maintaining lockstep uniformity, he advocated mixing "every type of lighting fixture you'd find at a typical workplace." He favored diverse finishes and colors, and mismatched bathroom fixtures to familiarize students with everything from automatic faucets to air hand dryers and towel dispensers.

Ultimately, however, the budget was cut deeply (to \$175 per square foot) and the building completed with suppliers' remainders, sacrificing ambitious variations in finishes and fixtures. Nonetheless, the strength of the spatial and programmatic concepts remains.

An irregular R in plan, the one-story building centers around an airy, light-filled multi-use gymnasium with clear glass walls and a high bow truss above. Wrapping around and extending beyond this space are long, meandering

REED Academy Oakland, New Jersey

The luminous bow-truss, sawtooth roof over REED's multipurpose gym (opposite) is the dominant form on both the interior and exterior (above). The building, economically clad in fiber-cement board, is entered through a protected forecourt. As at other schools for ASD students, therapeutic indoor recreation includes bicycling and exercises with large, bouncy balls.

corridors, with classrooms on one side and quirky nooks on the other. Circulation is purposely serpentine, punctuated by treats, such as a mockup grocery store with a real cash register and checkout, in the alcoves en route. The goal is to promote independence and social interaction among the 32 students, aged 3 to 16. (Transparencies, sightlines, and mirrors let teachers supervise without encroaching on the atmosphere of self-reliance.) Movement through the space becomes at least as important as the “destinations”—or as Brown puts it, “the path is the point.”

Like Eden and CFD, REED (which has a 1:1 student-faculty ratio) teaches academic subjects and life skills simultaneously. So the building itself becomes a learning tool, with every space performing at least double duty. For example, the nurse’s office is both a place to receive care and a “mini-classroom,” where fearful students practice the experience of a medical visit. The bathrooms serve as teaching sites for everyday skills like tooth brushing, urinal etiquette, or toilet use. A laundry room, a kitchen, and vocational-training spaces like REED’s model hotel suite are functional and instructional areas.

By contrast, CFD’s Ridge Campus, by architect Turner Brooks, occupies the dynamic middle ground between sensory-modulated and “real world” approaches in seemingly unorthodox ways. At first glance, the rambling constellation of rural buildings—three clusters, each with three five-bedroom residences and a separate classroom-dining-exercise structure—appears to fly in the face of conventional wisdom about the soothing effects of subdued hues. Housing a total of 45 students, aged 8 to 20, the cottages, clad in fiber-cement board, are painted vermilion, mango, or bottle green, each a different color from its neighbor. Ostensibly daring, they apply an intuitive logic of bold color coding that, anecdotal findings suggest, may actually provide ASD individuals with far more accessible way-finding means than conventional written signage. (Three years after the project’s completion, the brightness is not at issue, but the color-sequence replication from one cluster to the next sometimes gets users lost—so the solution may be more variety, not less.)

While CFD’s program integrates substantial “real world” features—such as a working organic-biodynamic farm, where students can participate in raising all the chicken, beef, eggs, and vegetables for the school’s kitchens and community food cooperative—Dollard and his staff also value sensory tuning of the built environment.

Here he is most concerned about the soundscape—the echoes and reverberation. “For people with autism, sensory stimulation like bad acoustics is pure torture,” Dollard says. “Once you create an environment that calms the kids, then learning can happen.” The key, he adds, is to gradually introduce less protected or predictable conditions.

Brooks’s design rests on the idea, gleaned from his readings and conversations with school staff, that people with ASD experience space viscerally, with all their senses operating full throttle at once, causing them to recoil from abrupt transitions, jarring angles or sounds, complicated mullion patterns, or large, undifferentiated spaces. “Straight-shot hallways cause anxiety, but gradual turns seem more calming,” says Dollard. So the thresholds are gentle, with nooks, bends, and incidental seating ensconcing the body while providing views out to communal realms. (CFD also has small

“sensory rooms” with spinning swings and soft, body-hugging devices to relax excessively stimulated students.)

At the crux of the campus are its paths, weaving between buildings, around trees, and continuing indoors, expanding and contracting in choreographed sequences to guide the body and eyes. Trails also connect to CFD’s other facilities. The quieting, therapeutic value of rambling walks has been observed by staff, and, as at REED (which has its own small

Philosophies diverge on the question of whether to eliminate sensory stimuli in spaces for students with autism.

hiking trail), the character of paths both indoors and out generates opportunities for social interaction.

At Eden, the balance between the outside world and the school’s safe harbor takes on yet a different character. In contrast to CFD’s bucolic woods and farmland, Eden is in a mixed-use complex, with retail, offices, a hotel, and restaurants. The site was chosen for a purpose. Eden’s previous home, in a former telephone-switching station, was isolated. “We wanted the students to be part of a larger community,” says chief operating officer Carol Markowitz, describing frequent “generalization” exercises in which pupils venture



into the neighboring food court and stores or work in some of the restaurants. The complex also allows the school to share resources, such as a health-club swimming pool.

Unique to Eden is its mini Wawa convenience store, staffed by supervised students and open part-time to the public. (The Wawa chain is a corporate partner of the school.) So the interface with the outside world is very real. But at the same time, the building also makes sensory accommodation.

Designed by KSS Architects, the 38,300-square-foot facility incorporates an existing 12,900-square-foot houselike, gabled structure. KSS retained the intimate scale and form, giving the new section a contrasting flat roof and modest massing. The configuration, which accommodates early-intervention and outreach programs along with the day school for 62 students, aged 3 to 21, centers around a courtyard with a protected outdoor play area and a multipurpose gym. As in all these schools, exercise is important for both its calming effects and motor-skill development.

While the wide, daylit corridors are straight shots, changes in floor-tile colors signal classroom entrances. The flexible teaching rooms, as at REED and CFD, are designed for round tables, high faculty-student ratios, and ample maneuvering space, rather than blackboard-oriented lecture seating. These classrooms also have rows of small side rooms, offering a scale shift for more focused learning.

An unusual feature is each classroom's home-style kitchen



- 1 DINING AND CLASSROOM BUILDING
- 2 DORMITORY

Center for Discovery Monticello, New York

At the Center for Discovery, architect Turner Brooks created a new campus with three rambling clusters, each a trio of residential buildings with a separate classroom-dining-exercise structure. Bright, contrasting colors (left) offer potentially intuitive way-finding means. The indoor "bus stop" seating area (above) is one of many devices designed to ease spatial transitions and encourage social interaction.

Responding to Its Surroundings and Its Students

THE LEARNING Spring School (LSS), in New York City, differs from the other ASD schools featured here in its narrower age range (grades K–8), high-functioning student body, and context: The school's home is an eight-story building in a dense urban area. Yet LSS addresses some of the same issues.

The leadership, working with Platt Byard Dovell White Architects, sought to create a calming setting. "We saw how distracting and detrimental to learning our previous physical environment was," says head of school Margaret Poggi of the office building that once housed LSS. "We wanted enough sensory control to make the students feel optimally comfortable."

With ample daylight and natural materials like bamboo, the school (which achieved LEED for Schools Gold certification) was designed with close attention to consistency: The same desk chair, for example, appears throughout, graduating in size for older children. Cleanly detailed, closed storage minimizes visual clutter. And acoustic controls apply to partitions, finishes, street noise, and HVAC systems. Sound-absorbing cork covers hallway floors, and the library carpet has a circle pattern, selected for reputedly soothing effects. A generous \$900 per square foot afforded the 34,000-square-foot building quality materials and details.

As in other ASD schools, student interaction is a priority. Corridor seating encourages social activity. (But small, padded quiet rooms allow overstimulated students to decompress.)

To teach life skills, the building has a kitchen and model studio apartment. And to help students transition to less restrictive environments, the upper grades include mainstream school features: lecture-style classrooms (but never with more than 12 pupils), hallway lockers, and a science lab.

"It was important to create a building the students would feel proud of," says Poggi. When it first opened, one child, surprised to encounter an impressive science lab, proclaimed: "Oh, it's a real school!" S.A.



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Learning Spring School, New York City

On a dense urban site, Learning Spring's eight-story home (left) has a high-performance skin combining a curtain wall with a terra-cotta rainscreen and louvered aluminum sunshades. A recreational roof deck tops the structure's lower section. The library's clean-lined cabinets (below) minimize visual clutter.





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- 9 CAFETERIA
- 10 CLASSROOM
- 11 THERAPY ROOMS
- 12 COURTYARD
- 13 WALKING PATH

Edén Institute Princeton, New Jersey

The massing (right) incorporates an existing gable-roofed structure that now includes life-learning space, where students practice everyday skills like making beds or doing laundry. The building configuration forms a protected and highly visible courtyard playground for younger children (below).



(in addition to the school's professional cafeteria kitchen, where vocational training occurs). Here the daily life-learning curriculum actively involves students in lunch preparation, from grocery shopping to dishwasher loading.

While Edén's visual connections to daylight and surrounding greenery are strong, its sensory controls are subtle. They include indirect lighting, high-rated acoustic separations, muted natural colors, a large frosted window in the gym to diffuse distracting views, and an alarm system with a strobe specially synchronized to reduce jarring effects.

Despite their differences, these schools have significant aspects in common. In purely practical terms, all three were built on remarkably low budgets. (Slightly higher than REED's \$175 per square foot, both Edén and CFD weighed in around \$225.) And to varying extents, they all occupy a middle ground between "real world" and stimulus-controlled approaches. (Even REED, one could argue, shields its pupils from mainstream sensory challenges, if only by housing its student body of 32 in 25,300 square feet.) None of these environments is sensory-sterile or austere.

And all three share a mission to promote social interaction among people with autism. Suggesting a broader trend toward socialization, Brown describes how he trained at a program that originally provided one isolating, 10-by-10-foot classroom per student. By the 1990s, some of the walls had come down, opening up the spaces. Now they're all gone.

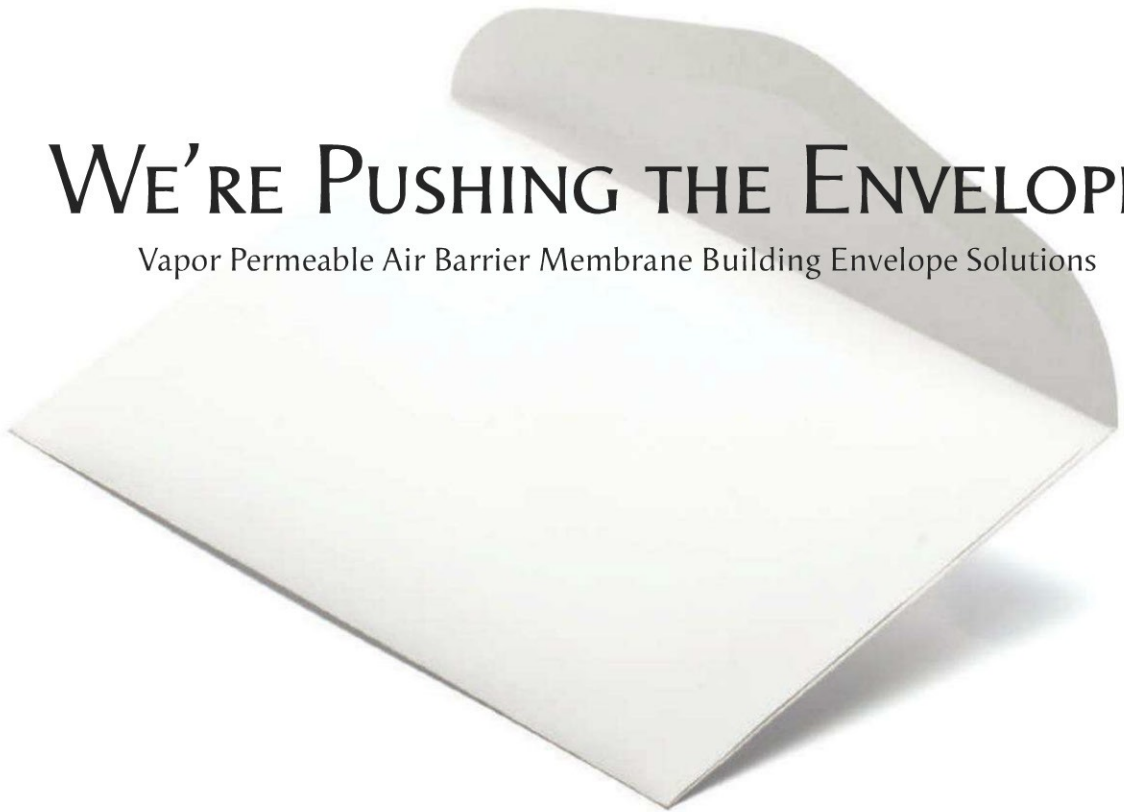
Even with signs of progress, "there's so much we still don't know about ASD," says Dollard. "We haven't yet created the metaphoric ramp into architecture for people with autism. But it's our mission to figure that out." ■

Sarah Amelar is a contributing editor to ARCHITECTURAL RECORD.



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By Rita Catinella Orrell



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Designed by Portland, Oregon-based Ziba Design for Sedia Systems, JumpSeat is a compact, flexible chair that can be used in theaters, auditoriums, or anywhere space is a concern. JumpSeat's cantilevered structure is made of a backbone of plywood and steel. Folding to less than 4" thick when not in use, the seat allows for the maximum amount of people in the minimum amount of space. Armrests and writing surfaces are optional.

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Lady Bird Johnson Middle School: Metal Cladding

The 152,000-square-foot Lady Bird Johnson Middle School in Irving, Texas, which opened in 2011, is the largest net zero public school in the country. The architectural firm Corgan Associates applied more than 72,000 square feet of Fabral to roofing, wall panels, and a system of sunshades and light shelves to add functional and sustainable benefits to the building. A large canopy covered in Fabral metal cladding towers over the west-side classroom windows and wraps around the building to shade the south-facing library windows. fabral.com CIRCLE 212



Sarah E. Goode Academy: Curtain Wall

In September the Sarah E. Goode STEM Academy in Chicago welcomed its first class of freshmen into a six-year program focused on science, technology, engineering, and mathematics. The three-story, 207,000-square-foot facility by STR Partners is pursuing LEED Gold certification. Contributing to the school's sustainable design, Wausau Window and Wall Systems provided high-performance windows and curtain-wall systems emphasizing daylight, views, interior comfort, condensation resistance, energy efficiency, and thermal-performance requirements. The school's art room (shown) features an aluminum-framed window and curtain-wall system from Wausau, laminated glass from Oldcastle BuildingEnvelope, and colored films from Vanceva.

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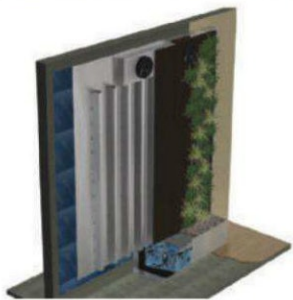
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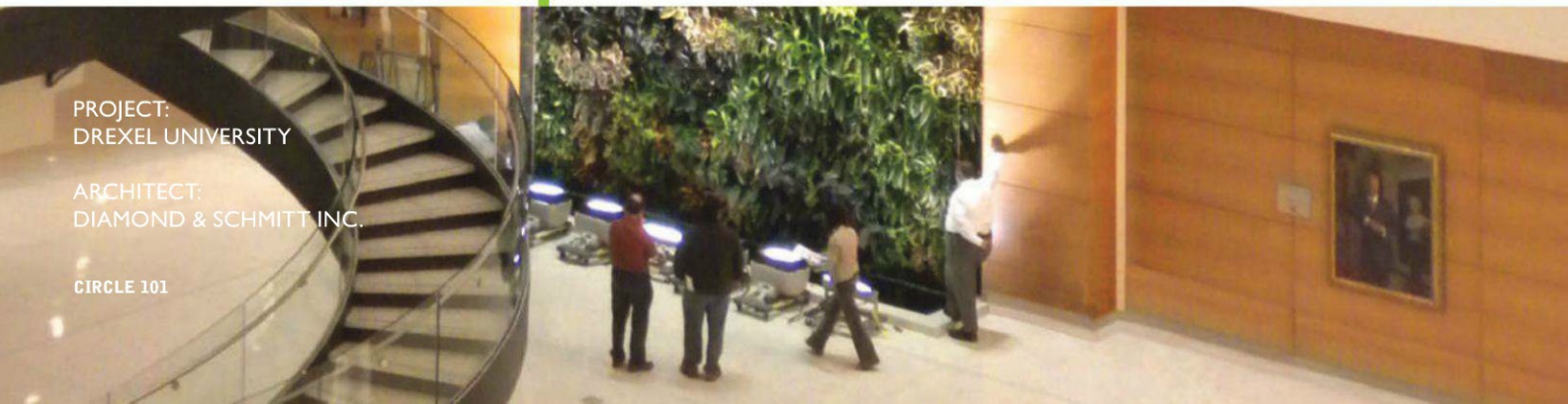
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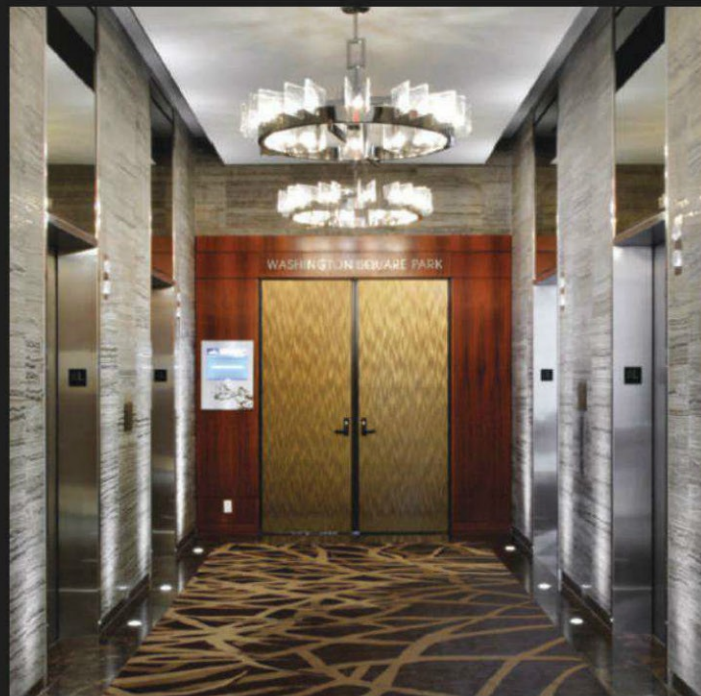
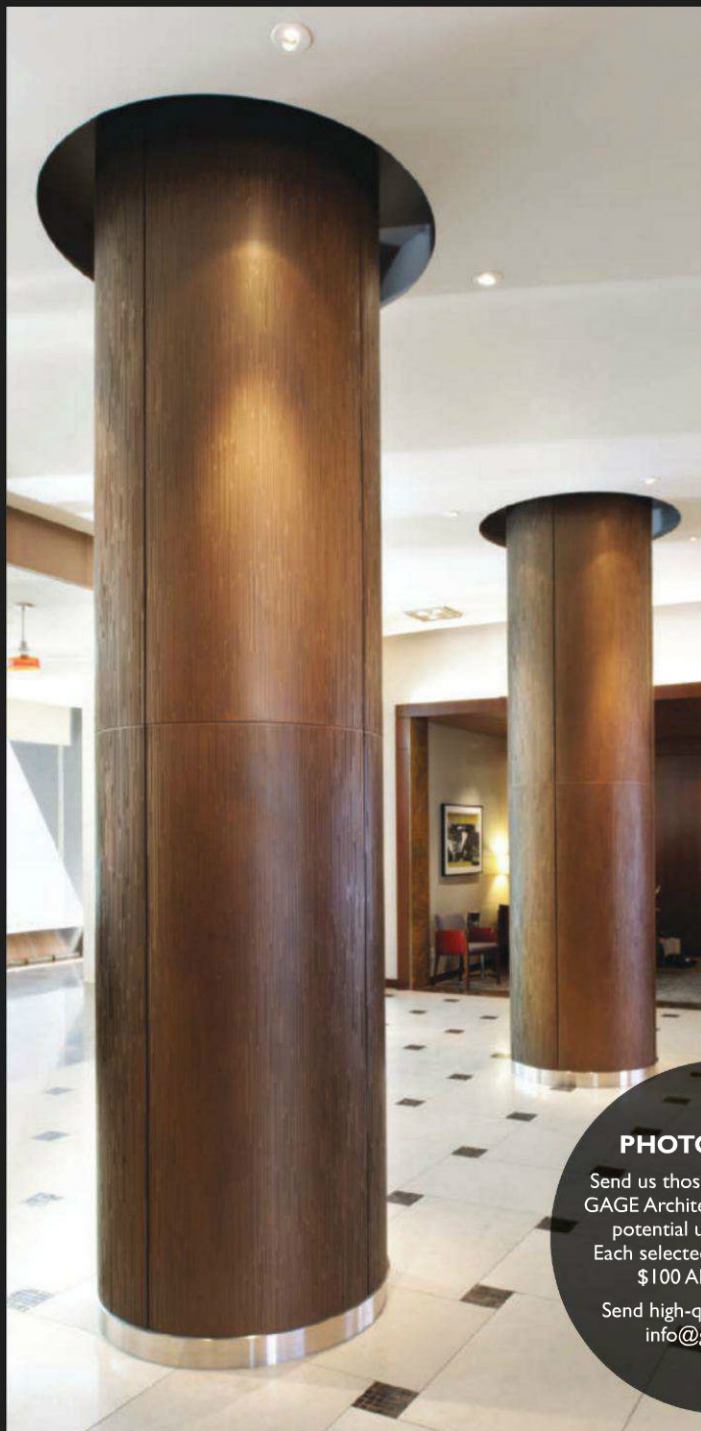


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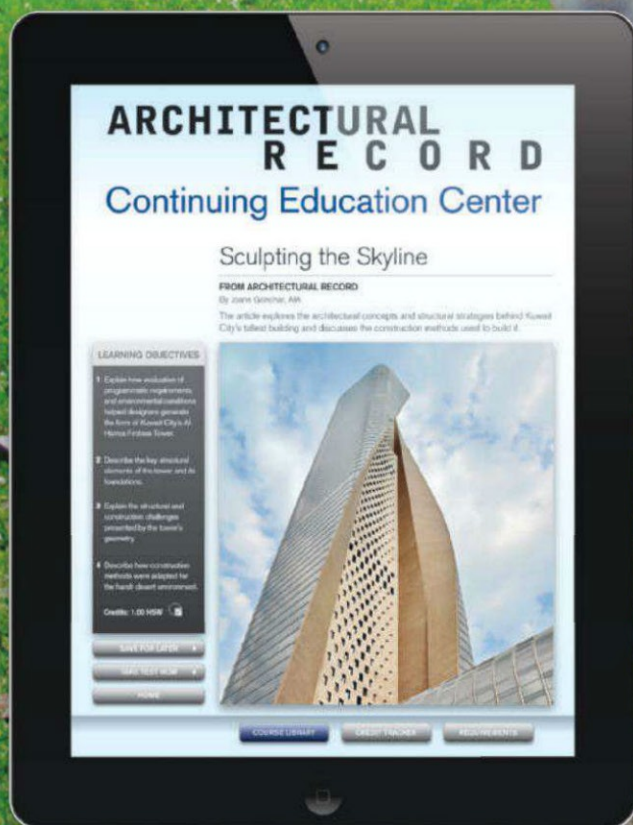
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p158

Design Considerations for Vegetated Permeable Pavement

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Architectural Technologies for K-12 Buildings

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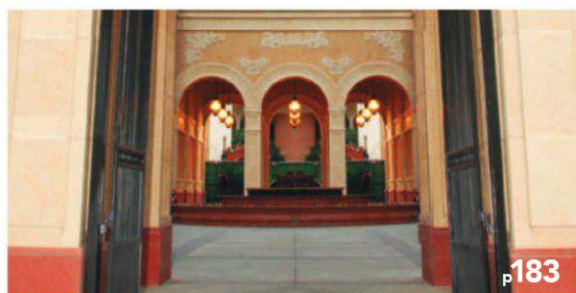
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School Hallway Lockers Made of High-Density Polyethylene (HDPE)

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Manufactured Techniques for Architectural Colors and Textures

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Design Considerations for Vegetated Permeable Pavement

Creating open, multifunctional spaces and providing green benefits

Sponsored by Soil Retention Products, Inc. | By Angela D. Dye, FASLA, LEED AP

Permeable paving systems, in general, continue to grow in scope and practicality as we search for ways to reduce our carbon footprint, improve water quality, diminish flooding and erosion, reduce the “urban heat island” from reradiated (building and pavement) heat in our cities and environment, and add attractive open space to building sites and neighborhoods. The current varieties of permeable pavements are permeable asphalt, permeable concrete, permeable interlocking concrete pavers, and vegetated permeable pavements. Most research on any permeable pavement considers all these types to “substantially and significantly” reduce stormwater runoff.¹ Results from a study in 2007 at the North Carolina State University (NCSU) Permeable Pavement Research Lab showed that “all permeable pavements significantly and substantially reduced surface runoff volumes and peak flow rates when compared to standard asphalt...”

Vegetated permeable pavement will be the focus of this article, exploring some of the current environmental regulations, codes, and guidelines that incorporate their application, design

considerations, modular options, and sustainable landscape benefits to help you make an informed decision. The main types of vegetated permeable pavements are flexible concrete mats, concrete grid slab, concrete grid paving units, and plastic geocells, each of which can be planted with turf or groundcover, or filled with aggregate or crusher fines.

DEMONSTRATING ENVIRONMENTAL LEADERSHIP

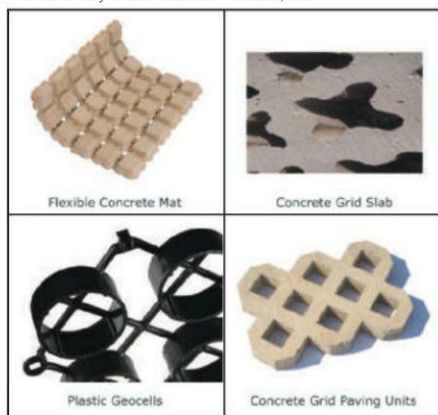
Using permeable pavement, whether vegetated or not, is one of several strategies within a comprehensive site design and green infrastructure approach to creating more functional and sustainable landscapes. The Environmental Protection Agency (EPA) considers “stormwater runoff in urban and developing areas to be one of the leading causes of water pollution in the United States.”² Since 2007, using Section 438 of the Energy Independence and Security Act, EPA has required federal agencies to reduce stormwater runoff from federal projects, compelling agencies to “lead by example” to clean up water

resources by using “green infrastructure and low-impact development” techniques. In 2011, the EPA compiled a list of green infrastructure case studies nationwide. As part of a national rule-making process to create an EPA program to reduce stormwater runoff, 47.3 percent of the 479 case studies used some type of permeable pavement system, with just over half of the projects being retrofits of existing properties. Various projects are represented, from commercial, institutional/education,

WHAT IS PERMEABLE PAVING?

Permeable paving is a range of sustainable materials and techniques for permeable pavements with a base and subbase that allow the movement of stormwater through the surface. In addition to reducing runoff, this effectively traps suspended solids and filters pollutants from the water.³

Photo courtesy of Soil Retention Products, Inc.



Main types of vegetated permeable pavements

open space/parks, and transportation. The EPA's website *Green Infrastructure* provides information on each case study, its location by region, and research associated with infrastructure types.

"The primary motivation for using permeable pavement," according to Neil Weinstein, executive director of the non-profit Low Impact Development (LID) Center in Washington, D.C., "is that it doesn't eat up the land (like surface retention basins, bioswales, and filtration basins do). This is especially important in urban areas where sites are smaller and must meet stormwater regulations." The LID Center works with many government agencies including the EPA, various universities, and the National Academy of Sciences to set standards of practice for use of permeable pavement of all types. Weinstein goes on to point out, "since stormwater regulation is so prevalent, use of permeable pavement is becoming much more known and used more often as a matter of course (to meet national pollution and stormwater requirements). It's available and has become more attractive." LID finds the largest users are commercial properties such as offices and shopping centers with large parking areas. However, transportation and residential applications are also becoming more commonplace.

Reducing Flooding and Erosion While Cleaning Our Water

All permeable pavements have shown their ability to clean polluted urban runoff water before it reaches local streams and rivers by filtering out heavy metal contaminants such as lead, zinc, cadmium, and copper as well as acid rain and phosphorus. Individual projects, whether public or private, can potentially use them to meet local and federal flood control and stormwater pollution regulations under the Clean Water Act's National Pollution Discharge Elimination System (NPDES). According to EPA's website, "the NPDES permit program controls water pollution by regulating point sources (pipes and ditches) that discharge pollutants into waters of the United States.

Industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters." Cities with separate stormwater systems, known as MS4s (Municipal Separate Storm Sewer Systems), are now required to control the quality of what flows off parking lots and other sites into their stormdrains. The value of permeable pavement systems to mitigate the flow of this type of pollution has increased its role in green infrastructure design, helping cities and private landowners alike to comply with these regulations. These pavements are strong enough to carry the loads from vehicles yet allow for rainfall infiltration through the pavement surface. This infiltration quality lessens the potential for flooding and erosion as well as cleaning stormwater.

Following on EPA's leadership in green infrastructure, many of the most recent and developed handbooks for best management practices (BMPs) and stormwater regulations are at the municipal level, in locations near bodies of water—streams, rivers, lakes, and coastal areas. This is where permeable pavement has seen its greatest public benefit—the cleaning of urban runoff into fisheries and water supplies. Areas with BMPs, guidelines, and regulations include the East Coast seaboard around Chesapeake Bay, Virginia; North Carolina; Washington, D.C.; and Maryland; the Great Lakes region especially around Lake Michigan; the City of Chicago; and the West Coast cities of Seattle, Portland, San Francisco, and San Diego, to list a few.

Research on the use of permeable pavement for stormwater and erosion control is extensive and compelling. Non-profit organizations such as LID Center and American Rivers tout permeable pavement and green infrastructure investment as important to the rebuilding of our aging national infrastructure. Several examples exist in the United States where local and state governments have adopted regulations, codes, BMPs, and guidelines specifying the use of permeable pavements.

The North Carolina Department of Environment and Natural Resources (NCDENR) guidelines adopted in 2008 consider permeable pavement as a stormwater design feature, giving credit for pollution prevention for runoff reduction. For NCDENR, permeable pavement is now considered equal to the permeability of turf, requiring 20 percent of parking lots be permeable pavement (or a suitable, environmentally friendly, alternative stormwater management practice).

The City of Santa Monica, California, recently adopted a municipal code to reduce stormwater volume and improve water quality from existing properties and new development into Santa Monica Bay. Developers must now reduce by 20 percent any projected runoff through an Urban Runoff Mitigation Plan,

achieved by increasing permeable areas such as parking lots and driveways, while also increasing the percentage of green space. This is a perfect application for vegetated permeable pavement. A source for stormwater BMPs is the Stormwater Managers Resource Center (SMRC), a website established by the Center for Watershed Protection through an EPA grant. The SMRC is "designed specifically for stormwater practitioners, local government officials, and others that need technical assistance on stormwater management issues."

BENEFITS OF VEGETATED PERMEABLE PAVEMENT

When permeable pavement is vegetated with turfgrass or groundcover, the overall effect can be stunning, and serves to integrate a project into its environment. Vegetation over pavement has the ability to absorb carbon dioxide, emit oxygen, and biodegrade pollutants. As a living plant material, its evapotranspiration naturally makes it cooler than inert surfaces such as concrete, reducing albedo and the Urban Heat Island (UHI) effect. The turfgrass surface reduces glare and absorbs noise, while adding to green open space on a developed site.⁴ In addition to this comfort factor, there is a distinct design advantage to vegetated permeable pavement systems since hardscape can be disguised and better integrated into the project's environment and ecology. Using vegetation or "soft" materials such as sand, gravel, or decomposed granite, for instance, the otherwise

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Learning Objectives

After reading this article, you should be able to:

1. Define permeable pavement including vegetated permeable pavement types, applicable government regulations, and best management practices for their use.
2. Recognize the environmentally friendly attributes of vegetated permeable pavement systems.
3. Identify basic design considerations of vegetated permeable pavement.
4. Contrast the attributes of the four main types of vegetated permeable pavements.
5. Apply sustainable design considerations for vegetated permeable pavements to project types, including their application to LEED® and SITES® credits.

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Photos courtesy of Soil Retention Products, Inc.



overwhelming effect of parking lot concrete or asphalt can be mitigated. Another advantage is that valuable space can now be considered multifunctional, creating a better aesthetic appeal and often a better neighbor without sacrificing buildable land (see photo 1 above).

Suitable for a variety of scales, vegetated permeable pavement is typically not used for major streets, except perhaps for parallel parking spaces. These pavements' ability to add vegetation into the voids, and even to cover the paved area, creates site area that becomes more a part of the landscape. Many applications are perfect for site areas infrequently used, such as fire lanes, utility easements, and drainage ways. Areas like these which use large amounts of space, but are seldom used, leave an under-utilized vacant area in a project. Vegetated permeable pavement is especially helpful to the designer and developer when site design or city code dictates accommodating these facilities. Critical when site area is limited, vegetated permeable pavement can add green space, giving additional landscape and usable area back to the project (see photo 2).

In one of the most recent examples of the

effectiveness of vegetated permeable pavement, a 2008 study responded to the need to clean up beachfront runoff. An Oceanside, California, fire station tested the viability of using vegetated permeable pavement for washing fire trucks. The fire station is near one of the most polluted beach outlets in southern California. The test was prompted by a mandate of the San Diego Regional Water Quality Control Board to clean runoff from the washing of fire trucks several times a day. The trucks were washed on the asphalt driveway in front of the station, which drained directly into the San Luis Rey River just upstream. The installation of a vegetated flexible concrete mat was used to resolve both polluted runoff and sustain daily truck loads. Placed over a bed of granular infill and base material, the site experiences no runoff, storing up to 0.40 inch of water at the surface and infiltrating at a rate of more than 3.0 inches per hour (see photo 3).

DESIGN CONSIDERATIONS FOR VEGETATED PERMEABLE PAVEMENT

Design of a vegetated permeable pavement system for any site is a multidisciplinary effort. Once a project is envisioned, important site planning factors must be considered for building layout, access, circulation, and parking, not to mention federal, state, and local code requirement compliance. Vegetated permeable pavements can satisfy several objectives for stormwater management, while adding value and aesthetics to the project.

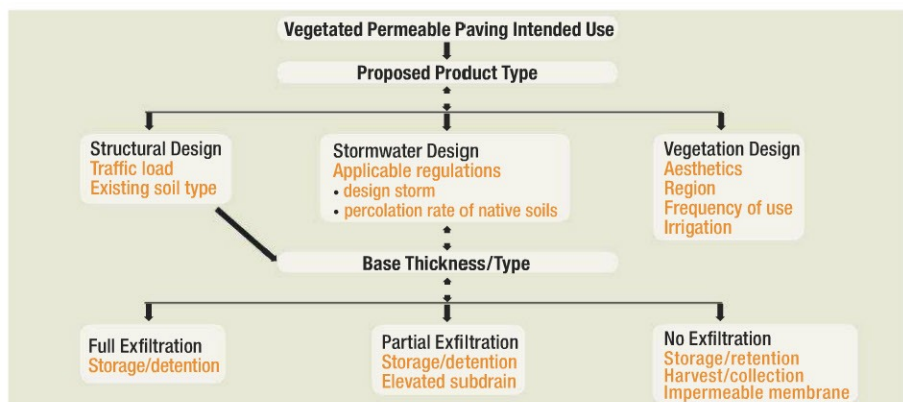
Structural and Stormwater Design

In one of the most concise summaries to date, a 2008 Australian conference paper, by engineering professors at the Universities of New South Wales and South Australia, lays out several distinct objectives to ask early on: "Flood mitigation/stormwater retention or detention? Water quality improvement, whether filtration or retention? Water conservation for collection and reuse? And ability to carry the intended site traffic." In the chart below, a design decision flowchart clearly illustrates the process for

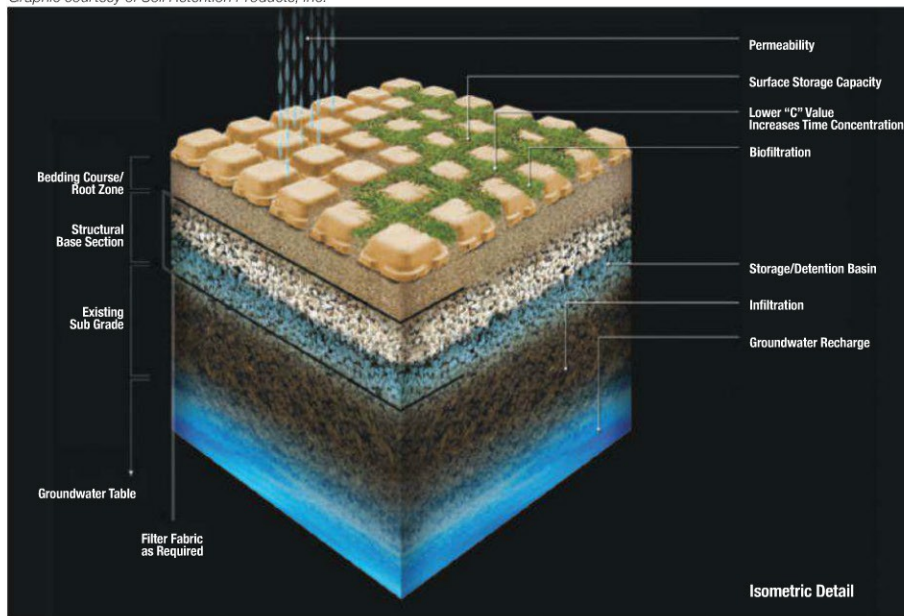
designing a vegetated permeable pavement. A key design consideration is the composition of the subgrade (native soils below the paving section) and their infiltration rates. Depending on the composition of the subbase (structural base material), in some cases enough rainfall can be collected to offset and store a percentage of the increased runoff from site development. For some projects, this may eliminate an expensive and separate "hard" drainage system. For other projects, with native soils with low infiltration, excess water could be detained and stored. Use of this excess stored water may have to be considered. For example, this excess water could be harvested for reuse, or alternatively, piped away with an elevated underdrain. The paper points out another key design question, in addition to pavement system design life, rainfall absorption, infiltration, and retention: how thick the pavement should be to carry the intended traffic. Permeable pavement thickness may be slightly thicker for managing stormwater than for load bearing, but there is usually an associated economic benefit for its use.

Turfgrass Considerations

Vegetation, specifically turf, is commonly used as a surface for applications with light pedestrian traffic, such as parks or ballfields. For it to be a viable cover under vehicle traffic, the pavement design fundamentally needs to prevent soil compaction so that the living root zone for these plants is both porous and permeable to both air and water. Vegetated permeable pavement has void spaces between a load-bearing pavement material, which distributes the imposed load to the underlying base and/or bedding materials. "A reinforced turf surface bears traffic equally directly, ... (and) assists the turf in resisting wear and compaction."⁵ This support condition allows the plants the ability to stand up to increased traffic weight and volume. Root zone areas for vegetated permeable pavements vary by type of pavement, but the more access to root space, the more likely the turfgrass will survive.



Graphic courtesy of Soil Retention Products, Inc.



The soil area between cells is also an important factor to turfgrass health. Vehicle tires are flexible, so when void spaces are too large and overfilled, soil compaction will occur, which cuts off the air and water needed for plant growth. For example, choosing sod to top the permeable pavement for a fire lane (hopefully never used) may be an appropriate design choice. However, if the use is daily parking, applying turf by seed, and not over-filling the void space, is likely to give greater protection to the emerging root system. Choosing the appropriate method of turf establishment for the intended use can be especially critical when the pavement is saturated. With heavy and/or constant traffic, significant compaction in the void space can occur along with turf damage.

Another aspect of turf establishment and maintenance is to realize that the width of the load-bearing portion of any vegetated permeable pavement system is important to retaining turfgrass as well as carrying the traffic load. The greater area of contact between the pavement and the vehicle tire, the better the pressure is distributed and the root zone is protected. A relevant ingredient for healthy turfgrass is a bedding course, defined as the underlying sandy material between the pavement and its often heavily compacted base, which allows for a continuous symbiotic root zone and moisture for the plants. The depth of

pavement can also have an impact on the ability for roots and moisture to spread along with similar-sized materials for infill and bedding course. That is because root zones are complex systems, with physical, chemical, and biological components. Each of these components together determines the quality of the turfgrass. Pavement systems which maximize the root zone area, while allowing for filtration and aeration, are likely to result in the best long-term vegetative cover.

Specifying the type of grass species or groundcover, and whether to seed or sod turfgrass over the pavement surface depends greatly on the location and intended use. Many geographic locations receive sufficient moisture to support turf without irrigation. Choosing the appropriate vegetation for the site conditions, and anticipating cold climate factors such as freeze/thaw cycle are also important design considerations. A pavement system can be designed to capture rainwater and collect the runoff for reuse as irrigation. If the vegetated permeable pavement also serves to enhance stormwater regulation, this may be considered an appropriate application of water in an arid environment.

Selection of a turf species must take into consideration microclimates like shade, slope, temperature variations, and seasonal conditions. Parking can create a microclimate that casts shade for a portion of the day over the turfgrass. This may

affect the density and growth of some turfgrasses; therefore, specifying the correct species can be an important long-term maintenance decision.

Whether to use a warm-season grass or cool-season grass, bunchgrass or spreading grass type, one that is salt tolerant to de-icing or is shade tolerant, are all design considerations that are site and project specific. Ferguson, in his book *Porous Pavement* (2005), states that a warm-season grass such as Bermuda stands up well to traffic as does Tall Fescue (cool-season). However, some grasses may be considered an invasive species to native ecosystems. Local cooperative extension agents, state agricultural offices, and landscape architects can offer advice on which species are best.

Maintenance Concerns

As with any new construction, concern is always expressed for long-term maintenance and durability of the product. The non-profit organization LID Center has found that as with all the pavement systems—permeable concrete, permeable asphalt, permeable interlocking concrete pavers, and vegetated permeable pavements—“maintenance is low and has been shown to be quite resilient over time, as long as the openings remain permeable.”⁶ The pollution-trapping benefit of vegetated permeable pavements is apparent, but there may be some concern about this diminishing over time. With maintenance, these systems can reasonably last up to 20 years, according to several sources.

Here are some tips on keeping these systems functioning: 1) make sure drainage from other areas with sediment loads does not flow over the pavement, clogging the voids; 2) perform periodic inspections following storms greater than ½ inch in depth to observe any standing water; 3) consider choosing salt-tolerant grasses where de-icing is common, and adding Teflon runners to snow plow blades to prevent damage; 4) monitor the turfgrass for diseases, fungi, and insect infestations, using biological controls such as ladybugs and organic controls; and 5) consider implementing “resting periods” that vary access points and parking stall use to reduce wear on turf and giving it time to recover from heavy use; and 6) consider the benefits of overseeding and top dressing to promote healthy living turf. The City of Chicago, for instance, recommends special care during snow removal and might even require mowing turf at times.

See endnotes in the online version of this article.

Continues at ce.architecturalrecord.com



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School Hallway Lockers Made of High-Density Polyethylene (HDPE)

New fire code-approved HDPE plastic lockers provide green school advantages

Sponsored by Scranton Products | By Peter J. Arsenault, FAIA, NCARB, LEED AP

Lockers used in a K-12 school corridor have a lot of demands placed on them. They need to hold up to heavy daily use and sometimes abuse, they need to be easy to maintain, and they need to work within the overall design scheme for the school building where they are located. When they are used in green school designs, they are subject to the scrutiny of additional requirements including material usage choices and contributions to indoor air quality. The traditional selections of metal and wood lockers are now being supplemented by products made out of high-density polyethylene (HDPE) which address all of these common and green building demands. Further, recent material improvements make them fire code approved for use in hallways while offering design options suitable for many school building designs.

PERFORMANCE CHARACTERISTICS OF LOCKER MATERIALS

All lockers used in schools are made to address issues of strength, durability, maintenance, cost effectiveness, and related criteria. Some

perform better than others in meeting these criteria with the difference commonly coming down to the materials used for their fabrication. This is illustrated in the following discussion comparing metal, wood, and HDPE lockers.

Metal Lockers

Lockers made out of painted metal have been a common and long-standing choice among many school districts and architects. They are typically viewed as a low-cost option and a standardized product. However, the cost benefit is limited to the initial purchase cost of the lockers only. Over time, they have been shown to require significant maintenance and attention which translates to more costs for several reasons. While metal is seen to be fairly durable, it certainly bends and is susceptible to dents and other damage. Sometimes that damage interferes with the proper operation of the locker meaning it must be repaired right away to continue to be usable. Other times it may simply be unsightly, or may cause damage to the paint covering the metal as well. When the paint is compromised, then the metal

is unprotected and that can lead to further damage such as corrosion or rust. This creates issues of both security and appearance if the damage occurs on the outside of the locker. It can also be a significant issue on the inside of the locker, particularly if wet boots or other items are placed on the metal locker bottom, scraping the paint off and causing rusting of the bottom. That rust could eventually require the bottom or the whole locker unit to be replaced. Additionally, it could stain adjacent surfaces that would then require corrective maintenance.

In addition to the durability limitations of painted metal lockers, there are issues with keeping them clean and attractive, particularly in hallway locations. Painted metal has very low resistance to graffiti, scuffs, and stains. Removal of any of these is typically not an easy task and may require the use of solvents that can damage the painted surfaces. The choice of available cleaners may also be limited by indoor air quality concerns, particularly in a green school building. In certain cases, removal may not be readily possible and the only option is to repaint. It is no surprise then that the cost



HDPE is identified with the SPI RIC (Resin Identification Code) of 2 and comes in many formulations for household and construction uses.

of repainting metal lockers is often factored into school operating and maintenance budgets because it is regularly required and anticipated. While this repainting might be needed because of any of the damage or vandalism issues discussed previously, it might also be attributed to fading over time, particularly if the lockers are subjected to direct sunlight. Whatever the reason, it adds costs to the use and operation of the lockers which aren't always recognized when the focus is only on initial up-front costs.

When it comes to the actual opening and closing of metal lockers, it should be noted that the metal is a noisy material. Locker doors banging or just operating normally can generate a notable noise level, particularly if many of them in a corridor are being accessed at the same time.

Wood Lockers

Lockers made out of wood are used in a number of higher-end settings and less often in schools, but they remain an option. They share many of the same durability issues as painted metal but don't perform as well since wood is typically more susceptible to damage from direct impacts than metal. If laminated plywood is used, that material may experience delamination if water or other liquids are able to seep between the layers. Repairing such damage is also not easy if the intent is to maintain a high level of appearance.

Perhaps the biggest issue with wood as a locker material is the fact that it is porous. That means that it will absorb and retain not only stains from water or other liquids, it will absorb odors as well. The odors can compound and create an unwelcome situation not only within a locker, but within a room or corridor where they are located. The porosity of the wood speaks of its organic nature and its ability to contribute as a food source for the growth of mold. As has commonly become recognized, mold requires three things—a food source (such as wood), moisture (such as from wet things placed into a locker), and a suitable temperature (such as conditioned indoor spaces). Since all three of these can be readily present in school situations, the likelihood of mold being present from the use of wood lockers is high unless considerable

time, effort, and expense are initiated to overcome it.

Wood lockers will similarly require repainting or refinishing over time for a variety of reasons related to use, fading, wear, and tear. Their ongoing maintenance costs may well be more than metal, then, and may be quite difficult to justify. Hence wood is much less attractive and a less desirable material all around for school locker situations.

HDPE Plastic Lockers

Not all plastics are created equal. Some plastics are brittle, some are more toxic than others, and some are suitable for only certain purposes. To put HDPE in context, it is one of the most durable and commonly used plastics available and has also been found to be one of the safest. Common safe uses for this material include milk jugs, plastic bags, and yogurt cups when used in thin-layered material. In building design and construction, thicker-layered HDPE is used in the manufacture of residential composite or plastic decking, outdoor furniture, and playground equipment. It is commonly found in harsh outdoor environments such as at marinas, pools, and spas where durability and safety is needed. In fact, it is also commonly used for creating very durable bed liners in pick-up trucks and other workplace locations.

To understand more about the life-cycle nature of plastics and HDPE in particular, we can turn to the trade association for the plastics industry known simply as SPI. They introduced the Resin Identification Code (RIC) system in 1988 at the urging of recycling proponents around the country. The RIC was developed to meet recyclers' needs while providing manufacturers with a consistent, uniform system to identify the different types of plastics that are used nationwide. Because municipal recycling programs traditionally have targeted packaging—primarily containers—the coding system offered a means of identifying the resin content of bottles and containers commonly found in the residential waste stream. The familiar embedded insignia of three arrows in a triangular shape with a number in the middle

is the way that manufactured plastic items are identified using the RICs. HDPE is identified with the RIC code of number 2.

The advantages found in the various common uses of solid HDPE products apply to their use in school lockers as well. Since HDPE is inherently moisture impermeable and non-porous, lockers made of this material will never rust, corrode, or delaminate, meaning that the maintenance issues and costs associated with those problems simply are not present here. From the standpoint of general durability, an impact test conducted following ASTM standards showed that HDPE plastic lockers had 59 times greater resistance to impacts when compared to metal lockers. The nature of the material is to absorb and disperse any impact, meaning that dents are not likely and it is more resistant to abuse. Further, since the material is manufactured with solid coloring throughout, it makes scratches difficult to see, helping to retain its appearance under normal wear and tear conditions.

From a general maintenance standpoint, the qualities of HDPE that make it impermeable and non-porous mean that dirt, marker, paint, and other items don't stick to it. So, a would-be graffiti artist is quickly and readily overcome with a simple cleaning that removes anything sitting on the surface of the locker. In similar fashion, stickers, decorations, and contact paper

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Learning Objectives

After reading this article, you should be able to:

1. Identify and recognize the durability and sustainability characteristics of HDPE plastic lockers as compared to other material choices for lockers.
2. Investigate the design options in using HDPE plastic lockers that make them suitable for school hallway locker installations including acoustic indoor environmental quality benefits.
3. Assess the contributions of HDPE plastic lockers to green building and product programs such as the LEED for Schools program and GREENGUARD Schools and Children certification.
4. Specify HDPE plastic lockers with green attributes and recycled content for use in K-12 school corridor settings.

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are easily removed due to the same inherent non-permeable qualities. In the event that more thorough cleaning is needed or desired, HDPE lockers are fully able to withstand power washing and even steam cleaning. In short, worry-free maintenance is a real possibility when HDPE lockers are installed.

From an indoor environment viewpoint, using HDPE lockers in school hallways provides some clear advantages as well. Just as they are impermeable to liquids, paints, and stains, they also don't absorb odors meaning those odors aren't trapped in the locker or in the surrounding space. Further, the solid material does not act as a food source for mold or mildew, so there is no likelihood of its development. Finally, the nature of the material is to be quieter to operate and use than metal which means that noise generated in a hallway is reduced.

Life-Cycle Cost Comparison

As suggested earlier, current market conditions are such that the initial cost of purchasing metal lockers is slightly less than the initial cost of purchasing HDPE lockers. However, there is little if any difference between the labor costs to install one compared to the other, so the actual difference is limited to the cost of the manufactured products. One indirect cost difference is the packaging used between the two. Since HDPE is so durable, it only requires a layer of corrugated cardboard to protect it during shipping as opposed to more involved protection that may be used for metal lockers. That translates into less waste onsite and less cost to dispose of or recycle that waste.

Of course, as made clear earlier, there is more to the cost of lockers than just the initial price. When comparing metal lockers to HDPE lockers in use over a 20-year period, significant savings are realized due to notably less repair and maintenance costs. The chart below

acknowledges the relatively small initial cost difference between metal and HDPE lockers during the first year. By the second year however, the cost of maintenance, repairs, painting, and cleaning, including graffiti removal, are more for metal lockers, so much so that any initial cost savings are lost. By the fifth year, these painting, maintenance, and cleaning costs are notably higher for metal lockers and continue to increase significantly through the 10th and onto the 20th year to the point where they exceed the original cost of the lockers, perhaps several times over. Hence the accumulated overall life-cycle savings of HDPE lockers compared to painted metal lockers are substantial.

FIRE CODE CONSIDERATIONS

When lockers are used in most enclosed rooms such as a locker room, they are regarded as furnishings or fixtures. From a code compliance standpoint they are treated as movable items and regulated differently than permanent finishes or items in a space. In a corridor, particularly one used for general egress in schools, any materials used generally receive greater scrutiny for safety and fire resistance.

A commonly cited test standard for fire resistance in buildings is the National Fire Protection Association standard NFPA 286 titled "Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth." This standard describes "a method for determining the contribution of interior finish materials to room fire growth during specified fire exposure conditions." This method is commonly used to evaluate the flammability characteristics of wall and ceiling interior finish, other than textile wall coverings, where such materials constitute the exposed interior surfaces of buildings. Note that this fire test method is not intended to evaluate the fire endurance of assemblies, nor is it able to evaluate the effect of fires that originate within a wall assembly.

In the case of using plastic lockers in a corridor they must pass the NFPA 286 test to be in compliance with the 2012 edition of NFPA 101, the Life Safety Code. When specifying plastic HDPE lockers you should request NFPA 286 test results from manufacturers you are considering to include in the specification. Only those that pass this test can reasonably be considered for code-compliant installations that address safety, particularly in schools.

GREEN BUILDING CONTRIBUTIONS OF HDPE LOCKERS

The green building movement in this country has given rise to several rating systems either for manufactured products or for entire building projects that seek to establish specific levels of achievement in the creation and performance of green buildings. The best known of these green building rating systems has been developed by the U.S. Green Building Council and known as the LEED® rating system. This is actually a family of ratings that apply to different building situations (e.g. new or existing buildings, core and shell, interiors) and in some cases, building types. The LEED for Schools rating system was developed to specifically address the green design and construction of K-12 schools. Based on LEED for New Construction, it focuses on classroom acoustics, master planning, mold prevention, environmental site assessment, and other issues important to these educational buildings. As such, LEED for Schools provides a comprehensive tool for those who wish to build green using measurable results by recognizing the uniqueness of school spaces and their occupants.

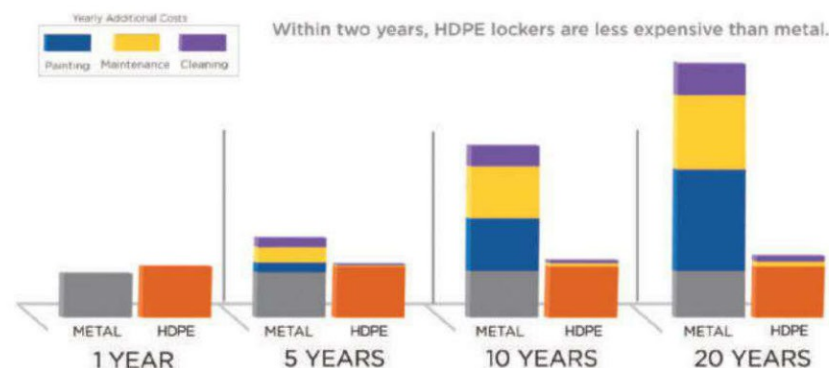
All of the LEED rating systems have been subject to ongoing changes and updates since their inception, but the basic categories of defining green buildings have remained the same across the different versions over time. The contributions that HDPE lockers can make to green school building design fall into several categories.

Materials and Resources

Among the most common sustainability features of plastic products used in buildings, recycled content is near the top of the list. HDPE lockers can be specified and manufactured from between 25 percent to 100 percent of pre-consumer recycled content. Further, the beauty of the material is that its strength is retained throughout its useful life so it is fully 100 percent recyclable when its service life is finished.

Beyond recycling, HDPE lockers are also able to contribute to the minimization of construction waste. As noted earlier, they are commonly shipped in corrugated cardboard covering which is fully recyclable and minimizes the amount of packing material used. Further, since they are available from manufacturers located in the U.S., regional material contributions are possible.

Image courtesy of Scranton Products



The actual ongoing cost of cleaning, painting, and maintaining metal lockers compounds notably year after year while comparable costs for HDPE lockers stay low. Within two years, the total cost is virtually equal. By 10 or 20 years, metal lockers start to cost several times more.

Indoor Environmental Quality

The LEED for Schools program has a particularly strong focus on this category. It is the first rating system to address acoustical control for example and uses an industry standard developed by the American National Standards Institute (ANSI) to identify specific background noise levels between classrooms and corridors and between other common school spaces. This is relevant to our discussion here, because HDPE locker doors have been tested and shown to be up to 6.4 decibels quieter than steel lockers doors when being operated. Since a 3-decibel increase equates to a noise that is twice as loud, this testing shows that metal lockers are actually three times louder than HDPE lockers. This is a significant difference that can help to dramatically improve the acoustic environment and noise levels within schools.

The other important indoor environmental quality focus in LEED for Schools is the quality of the air being breathed. Since HDPE lockers use no paints, coatings, adhesives, or sealants, any potentially harmful effects from those are eliminated. That includes elimination of volatile organic compounds (VOCs) and urea formaldehyde, two of the most common indoor air pollutants. Further, HDPE resists mold, mildew, and fungus, meaning these potential threats to indoor air quality are reduced, if not eliminated outright.

Since HDPE is inherently moisture impermeable and non-porous, lockers made of this material will never rust, corrode, or delaminate.

GREENGUARD Certification Programs

Beyond LEED, one of the better-known programs for certifying manufactured products as meeting green building standards is administered by the GREENGUARD organization. Originally established in 2001, GREENGUARD was acquired by UL Environment, a business unit of UL (Underwriters Laboratories) in 2011 in the interest of further advancing its mission of promoting global sustainability, environmental health, and safety. There are two green building product certification programs that they administer which are primarily focused on indoor air quality. The basic GREENGUARD Certification Program helps manufacturers create, and buyers identify, building products

Photo courtesy of Scranton Products



HDPE lockers can contribute to green school design particularly since some carry the GREENGUARD Children & Schools Certification for indoor air quality.

and materials that have measurably low levels of chemical emissions, thus protecting the quality of the air in which the products are used. All certified products under this program must meet stringent emission restriction standards based on established criteria for human chemical exposure.

The GREENGUARD Children & Schools Certification ProgramSM establishes even stricter air quality criteria for products intended for use in schools, daycares, or other environments where children spend significant periods of

pollution based on their body weight. To account for this greater inhalation exposure to young children, a body burden correction factor is used and applied to the basic GREENGUARD Indoor Air Quality Certified[®] allowable levels. In order to achieve GREENGUARD Children & Schools Certification, these lower allowable emissions criteria first must be met.

Chronic Reference Exposure Levels (CRELs).

The exposure of children to individual volatile organic compounds (VOCs) is also addressed under the GREENGUARD Children & Schools Certification. The basic allowable exposure levels to achieve certification have been notably adjusted to allow no more than 1/100 of the currently published Threshold Limit Values (TLVs) and no greater than one-half of the California's Chronic Reference Exposure Levels (CRELs). In many cases, the 1/100 safety factor reduction of TLVs results in the most stringent requirements for an extensive range of VOCs. Further, a total VOC (or TVOC) maximum allowable limit is used that takes into account the complex mixture of all VOCs found to be emitting from a product, whether or not they are identified under a TLV or CREL. Hence, certification indicates a dramatically reduced VOC emission from the tested product.

time. It is referenced by both the Collaborative for High Performance Schools (CHPS) and the LEED Rating Systems. Products certified to this standard are also suitable for use in environments where children and others work, play, or reside. There are HDPE lockers that have been certified under this GREENGUARD Children & Schools program based on their ability to address all of the following factors:

Body Burden Correction Factor. It is understood that children are more sensitive to environmental exposures than adults. Their young bodies including their brains are still growing and developing. Children breathe faster than adults and in return receive a higher dose of indoor

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Peter J. Arsenault, FAIA, NCARB, LEED AP, practices, consults, and writes about sustainable design and practice solutions nationwide. www.linkedin.com/in/pjaarch



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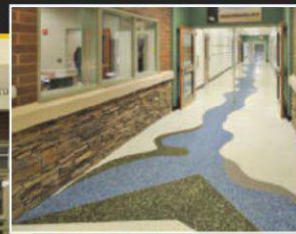
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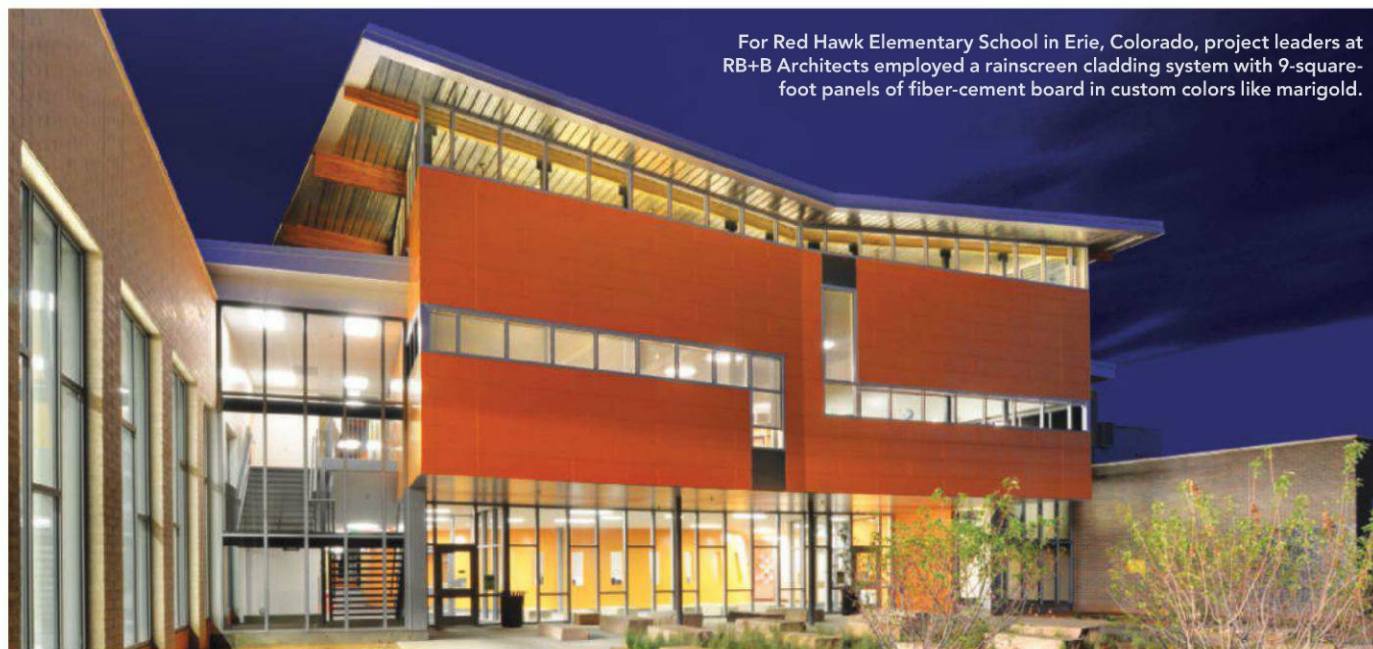
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For Red Hawk Elementary School in Erie, Colorado, project leaders at RB+B Architects employed a rainscreen cladding system with 9-square-foot panels of fiber-cement board in custom colors like marigold.

Photo courtesy of Nichiha USA, Inc.

The news that post-Hurricane Sandy Staten Island, New York, would soon have a net-zero school—one that uses energy-efficient technologies with renewable power to return electricity to the grid—came as a surprise to many architects and educators. The very idea of net-zero buildings is challenging enough. But a public school?

“We want to push the envelope on this advanced green project, which will be our ‘sustainability lab,’” says Bruce Barrett, vice president of Architecture & Engineering at New York City’s School Construction Authority. “Using this unique project as a vehicle...we have challenged ourselves to go beyond building code and design standards to realize innovative energy and carbon reductions exceeding our current achievements.”

Arguably, say critics, the project could influence school design for years to come. But not all school districts share these goals.

Primary among the more widespread challenges facing architects is the task of suiting school designs to clients’ tight budgets and high expectations. Educational projects represent a particularly thorny typology in

this regard. Consider the numerous potential stakeholders for a typical K-12 project: administrators, the school board, parent-teacher groups, the town council, state agencies, trustees of private schools, church officials at parochial schools, and more—not to mention the future occupants—students and their teachers.

“The client for a school is the community it serves,” says Scott Bacon, global product and business development director for CENTRIA, a manufacturer of metal wall and roof systems. “And what does the client, the community, want? They want value and performance, because their taxpayer dollars are being spent.”

The challenge is to start with a “meaningful conversation” with the school and its community, says Steve Turckes, AIA, LEED AP, K-12 education global market leader for Perkins + Will, “which we conduct through a series of workshop discussions on topics ranging from the economy to the needs of future students,” he says. “Before we get down to programming and designing a school, we want to know the big goals and needs.”

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Learning Objectives

After reading this article, you should be able to:

1. Discuss how green building performance attributes positively impact educational environments.
2. Describe strategies for enhancing learning environments using retrofit or renovation strategies to improve daylighting, flexibility of use, or energy efficiency.
3. List the durability and life-cycle benefits of various building materials that contribute to a sustainable building design.
4. Explain how material selection and building system designs can affect indoor environmental quality (IEQ) in schools.

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Photo courtesy of NanaWall Systems, Inc.



Flexible space concepts, as at the Carrie Busey Elementary in Savoy, Illinois, allow the sharing of common areas with classrooms zones when they are separated by opening glass walls.

BUILDING PERFORMANCE, STUDENT PERFORMANCE

In this way, the school mission guides the design team, leading to techniques for improving not just building performance, but student and teacher performance as well. "Schools have a wide range of pedagogical approaches," says Layng Pew, AIA, managing principal for WXY Architecture + Urban Design. "If you take a boilerplate approach to space planning, or even material selection, you miss opportunities. The first step for us is to understand where the client is coming from and how they want to teach."

Like energy-producing P.S. 62 in Staten Island designed by Skidmore, Owings & Merrill, recent forays into educational projects shine new light on how architects can preserve and even create value. The new school models are shattering conventions like concrete block walls and double-loaded corridors, instead using insulated metal and fiber-cement façades, glass interior walls, and low-energy mechanical systems. Underlying the trends is a better understanding of students and teachers, against a backdrop of evolving technologies and specifications.

Clearly it's more than net-zero energy and sustainable design, although new building codes and standards for schools are evolving rapidly state by state, school board by school board. In California, the newly adopted green building code CALGreen is impacting how schools are designed in the state, with stringent rules for efficiency, water conservation, indoor environmental quality (IEQ), and natural daylighting, among others. Other states are planning to adopt the model, reflecting California's outside influence.

And for good reason. Schools with green features enjoy a 32 percent reduction in absenteeism as well as a 68 percent improvement in test score quality, said Harvey Bernstein, vice president of industry insights and alliances for McGraw-Hill Construction, at a Greenbuild 2012 panel discussion. At the same session, another presenter linked improvements in student performance to better air circulation.

"Creating a superior learning environment is seen as a good investment," says Julian Rimmer, product manager for sustainable technologies with manufacturer Price Industries. "To maximize IEQ—air quality, thermal comfort, and acoustics—school design teams are leaning toward displacement ventilation, which is quiet and contributes to superior air quality while

helping reduce asthma conditions and health-related absences."

Of course, Heschong Mahone made the case nearly 10 years ago for improving student performance by using natural illumination. "Schools can't afford to ignore decades of research into what makes students succeed," says Diana San Diego, director of marketing for SAFTIFIRST, a maker of fire-rated glass and framing systems. "Fortunately, architects have new reasons to employ glass separations, especially with today's robust fire-protective and fire-resistive glazing formulations."

At many schools, the key need is a more adaptable floor plan to allow increased use of precious square footage for multiple programmatic needs or evolving curriculums.

Photo courtesy of Price Industries



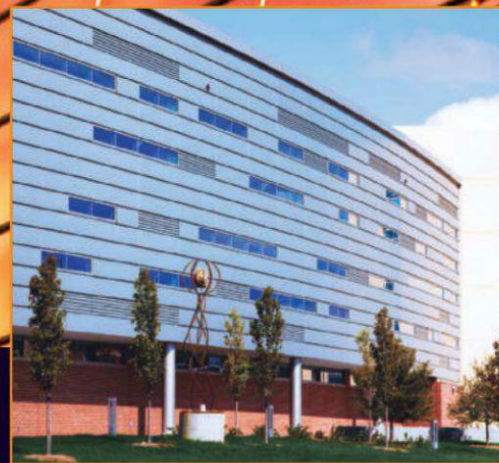
Improved indoor air quality (IAQ) and comfort were the primary drivers for using a displacement ventilation strategy at Legacy Junior High School in Davis County, Utah.

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Photo courtesy of SAFTIFIRST



Fire-rated glass and framing systems have been used by architects to create visually appealing glass separations that use robust, fire-protective and fire-resistive glass.

"In this way, schools are not just opening up their interiors to daylight but also adding more operable partitions to allow true openness along with more flexible uses," says Matt Thomas, marketing manager for NanaWall Systems, Inc., which makes opening glass walls.

GREEN TECHNOLOGIES FOR SCHOOLS

The marketplace itself also exerts an influence on choices for building products. So as newer, greener technologies become more widely available—and as contractors become more widely familiar with the associated installation methods—school boards and other clients find that these newer systems become viable options. This is true for almost every aspect of school design, including even conventional materials like concrete, says Wally Johnson, vice president, marketing and sales, U.S. Concrete. "A school built with a low-carbon concrete mix including fly ash and supplementary cementitious materials can eliminate millions of pounds of CO₂ emissions," he explains. "That's just first cost: Long-term, robust surfaces like exposed concrete reduce maintenance and renovation needs."

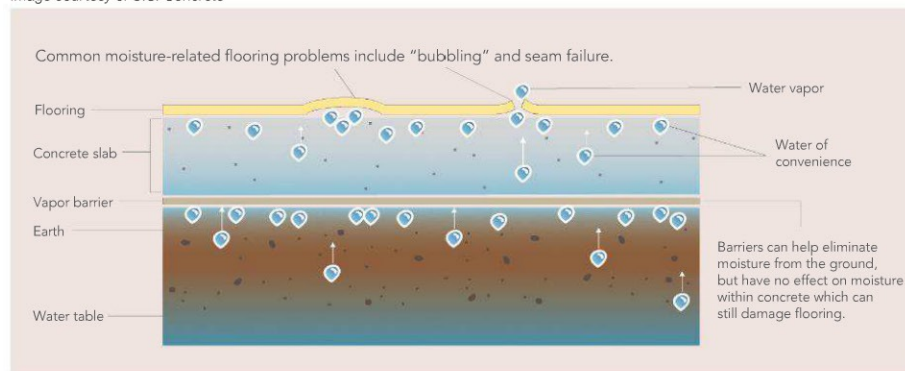
On the exterior, brick and concrete masonry units (CMUs) justifiably have been associated with the image of America's schools. "Masonry is still a very common choice," says Turckes. "It's durable, long-lasting, and aesthetically pleasing. If we're building for a multi-school district, the facility will probably be in their portfolio for 50-75 years, so durability is a major consideration."

Masonry construction is also affordable. But more and more often, architects are cladding schools in alternatives to traditional masonry, including:

- ▶ **Glazed brick.** Other designers report specifying glazed brick, both as solid wall and intermixed with modular brick facing, for schools such as a new elementary facility in Oklahoma, according to Eric Martin, AIA, a principal with Ross Barney Architects in Chicago. The glazed brick was selected for durability and minimal maintenance requirements, though Martin notes the glazed face may have a tendency to chip. Available in a range of colors, glazed brick costs only 20 percent to 25 percent more than face brick.
 - ▶ **Metal panels.** Insulated metal panels (IMPs) have become increasingly popular among school designs. Especially useful for tight construction deadlines, IMPs are also known for their thermal performance in providing continuous insulation (CI), a key requirement in many energy codes and building envelope standards. According to the Metal Construction Association, IMPs add a thermal insulating R-value of R-8 for each inch of rigid polyurethane core, or R-4 to R-5 for each inch of polystyrene core.
 - ▶ **Phenolic wall panels.** Also for use as a rainscreen cladding, solid cladding made from phenolic resin and wood fiber is durable and available in a range of colors, patterns, and finishes.
- Naturally, cladding choices must be project-specific and weigh the concerns of installed cost against life-cycle impacts such as durability, energy use, and effect on students. As end users have learned from decades of one-size-fits-all school construction, there is no single perfect solution for a K-12 exterior. (See "Boards and panels, not CMUs" section online.)
- Improvements have emerged in building surfaces and systems that take a real beating, too. Many solutions are riffs on classic school materials, such as poured-in-place terrazzo. "Terrazzo was originally created in Italy over

- ▶ **Fiber-cement board.** "Studies and field experience show this panel material to be sustainable and relatively easy to install, and it brings the added value of a rainscreen system," says Melba Garriss, marketing manager for Nichiha USA, Inc., a manufacturer of fiber-cement cladding. Rainscreens help reduce trapping of moisture in the wall that leads to mold and mildew, improving IEQ, among other benefits, according to experts in building enclosure design.
- ▶ **Tilt-up concrete.** Turckes reports using site-cast, tilt-up concrete walls for a number of institutional and K-12 projects, calling them "fairly economical and very durable." According to the Tilt-Up Concrete Association, site-cast concrete façades may be ideal for short construction schedules, allowing other trades to begin work sooner, leading to earlier occupancy.

Image courtesy of U.S. Concrete



With water-based adhesives, if the cast concrete subfloor isn't dry enough, water will migrate into the flooring adhesive, causing it to fail. Waiting for the concrete to dry properly can take weeks, leading some project teams to use fast-drying concrete.

Photo courtesy of CENTRIA



This middle school received a 3-inch insulated panel system, which provides an R-value of 21 on top of the insulating value of the wall beneath, which helps schools endure harsh winters and save energy without requiring excessive façade maintenance.

1,500 hundred years ago by Venetian workers searching for a way to use discarded marble remnants—making it one of the world's first 'green' flooring systems," says Richard Bruns, executive director of the National Terrazzo and Mosaic Association, Inc. (NTMA), a nonprofit trade group based in Fredericksburg, Texas. "Today it is valued for its life-cycle characteristics, such as durability and low maintenance requirements."

Another example is a new, rapid-drying proprietary concrete mix that dries faster than conventional concrete and can help reduce risks associated with excess moisture vapor in concrete slabs, according to U.S. Concrete's Johnson. "The technique enables faster, more effective floor topping installations," he explains, especially in schools where the use of petroleum-based adhesives has been outlawed since the 1990s. When using water-based adhesives, if the cast concrete isn't dry

enough, moisture will migrate into the flooring adhesive, causing it to fail. Waiting for the concrete to dry properly can take months. So people have had to wait for it to dry.

A school built with a low-carbon concrete mix including fly ash and pier mix can eliminate millions of pounds of CO₂ emissions.

Johnson notes that flooring failures on top of ready-mix concrete subfloors is an industry-wide problem that costs millions of dollars annually.

In addition, says Bruns, more architects are using terrazzo to produce intricate designs with contrasting colors. Some designs mirror the wall or ceiling design, while others show school colors, mascots, and even educational content: One Chicago school, he recalls, inlaid the mathematical formula for Pi to foment awareness and discussion among students.

Another major trend in school construction driven by sustainability and student health is the development of enhanced IEQ approaches for the classroom and other interior spaces. Growing interest in newer techniques such as displacement ventilation and active or passive beams is one outgrowth of the movement. "There are three motivations for this trend, and one is purely cost-driven," says Price Industries' Rimmer. "There is a pent-up demand for better schools and greener schools, because creating a superior learning environment is seen as a good investment." Improved test scores as a result of superior IAQ, the second motivator, can directly impact school funding, he adds, and the third push for using these systems are the benefits of improved energy efficiency.

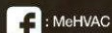
To improve IEQ, more school designs focus on air quality, thermal comfort, and improved acoustics. Displacement ventilation, a room air-distribution technique where low-velocity, conditioned outdoor air is supplied at floor level and extracted above the occupied zone, usually at ceiling height, has been among the most compelling approaches, says Rimmer. Requiring less fan energy, displacement systems tend to be quiet.

In addition, they tend to remove contaminants created by heat sources in schoolrooms, improving IEQ and reducing the prevalence of asthma conditions. Last, depending on the overall building design, massing, and orientation, displacement systems can save energy as compared to standard mixing ventilation, according to the Federation of European Heating and Air-conditioning Associations.

Another benefit to IEQ is the increased use of operable and fixed glazing by many architects, which leads to bringing more daylight and views into school interiors. Both daylight and outdoor views

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Photo courtesy of National Terrazzo & Mosaic Association, Inc.



Corridors in Chicago’s West Ridge Elementary School are cast in terrazzo with ornamental motifs. Metal divider strips are used to separate different terrazzo colors to produce the floor designs.

can contribute to improved student performance, an effect reviewed by Patricia Plympton, Susan Conway, and Kyra Epstein¹ of the National Renewable Energy Laboratory (NREL), Washington, D.C., in “rigorous statistical studies, involving 21,000 students in three states, [which] reveal that students perform better in daylight classrooms.” Full-spectrum light, hormone influences, and improved acoustics (due to reduced HVAC noise) were among the factors made possible by increased daylighting.

Building on this body of knowledge, architects around the country are adopting not just larger windows and more fenestration but also specialized openings and multifunctional glazings to broaden the benefits to IEQ and school function. Among those are glass fire separations, which help bring daylight into more school areas, such as egress hallways and stairwells that traditionally rely on electrical lighting. “For interior separations, new and clever uses of fire-rated glass are helping to draw daylight and day brightness deeper into the classrooms and core areas of school buildings to penetrate further into the building, which also maximizes shared lighting between spaces,” says SAFTIFIRST’s San Diego.

While opaque walls, glass block, and wire glass have long been used for this purpose, the novel transparent and clear-tempered glazings for fire-rated separations are attractive to architects for aesthetic reasons. “These include clear fire-resistant glazing systems that meet the stringent ASTM E-119 wall standard, effectively blocking

flames, smoke, and dangerous radiant heat for up to 2 hours,” says San Diego.

In other situations, operable walls have become attractive to schools requiring flexible sizes for learning spaces. Glass operable partitions provide another level of adaptability, providing access to the outdoors as well as the ability for teachers and administrators to monitor classroom activities. “Using a folding glass wall, for example, allows schools to make better use of limited floor space and change classroom size and use on the fly,” says Matt Thomas, marketing manager for NanaWall Systems, Inc., a manufacturer of the systems. “Some educators also see the glass walls as a way to expand learning opportunities, for example by opening the classroom to an outdoor learning area through a large, hurricane-rated glass opening.”

Indoors, designers are creating multiple-use spaces out of adjoining classrooms using folding glass wall systems to allow for the needed visibility, adaptability, and acoustical separation. “Folding glass walls maximize the view and flexibility of the space when closed or open,” says Konrad Judd, AIA, lead designer with SHW Group Inc., Dallas. “They are also very elegant and simple systems that are safe and easy for students and teachers to use.”

DURABILITY AND LIFE-CYCLE PERFORMANCE

According to the U.S. Green Building Council, a national review of 30 sustainably designed and operated schools showed that construction

budgets for the green schools were only about 2 percent more than those for conventional schools, which translates to about \$3 per square foot. Their financial benefits, however, are at least 20 times as large. (See table below.) Some of those savings accrue directly to the school, says the USGBC, while others are savings enjoyed by the community at large, including “reduced cost of public infrastructure, lower air and water

Financial Benefits of Green Schools (costs per square foot)	
Energy	\$ 9.00
Emissions	\$ 1.00
Water and Wastewater	\$ 1.00
Increased Earnings	\$ 49.00
Asthma Reduction	\$ 3.00
Cold and Flu Reduction	\$ 5.00
Teacher Retention	\$ 4.00
Employment Impact	\$ 2.00
Total	\$ 74.00
Cost of Greening	\$ 3.00
Net Financial Benefits	\$ 71.00

Source: U.S. Green Building Council

Photo courtesy of National Terrazzo & Mosaic Association, Inc.



Terrazzo requires minimal maintenance and has fewer joints than other flooring types. The material also provides for good IAQ by reducing potential locations for mold to develop and grow.

pollution, and a better educated and compensated workforce,” the review concluded.²

While the public benefits of building green are shown to be larger than those for the school itself, school administrators have many reasons to consider building green in order to reduce the costs of school operations. “The study uses conservative accounting practices to show that investments in green technologies significantly reduce the life-cycle cost of operating school buildings,” says Henry Kelly, president of the Federation of American Scientists.

This emphasis on life-cycle assessment (LCA) in the context of financial benefits for school districts has increased the interest in products that provide a long-term benefit like low operating costs, reduced maintenance, relatively low energy requirements, and functional resilience or durability. The Florida Department of Education, for example, issued its own “Life-Cycle Cost Guidelines for Materials and Building Systems for Florida’s Public Educational Facilities” in 2010.³ In the categories of structure, exterior walls, floors, and other components, cast-in-place concrete was shown to have good life-cycle characteristics.

In addition, says U.S. Concrete’s Johnson, LCA includes the embodied energy from production and transport of concrete materials, which should impact the architect’s specification for the school’s concrete mix. “In terms of sustainability, everything we can do to reduce cement content in the concrete is good for the environment, because every pound of cement produces about a pound of CO₂,” he explains. “Cement may make up as much as 6 percent of all carbon emissions in the world.”

Instead, the concrete mix can include locally sourced fly ash and slag and other supplementary cementitious materials, or SCMs.

In the Florida study, interior floor choices were also analyzed ranging from vinyl sheet and carpet to ceramic tile and terrazzo. Concrete and terrazzo were both ranked “good” in terms of LCA, with benefits including lower cost, inherent durability, low maintenance, and replacement needs, as well as the thermal comfort associated with its mass and density. Concrete also benefits IEQ, because the need for flooring adhesives is eliminated and indoor allergens that typically accompany carpeting are eliminated.

Even more significant than the considerable costs of flooring problems is the impact of moisture vapor on IAQ—or more precisely, the critical role of moisture in the growth of mold, notes U.S. Concrete’s Johnson. Mold containing mycotoxins can thrive beneath or within flooring materials when a high moisture condition is present in a concrete subfloor, adding to the drive to produce more environmentally safe building solutions—and adding to the challenge of successfully installing moisture-sensitive flooring materials over concrete subfloors. Mold problems affecting IAQ can begin with moisture migration through concrete slabs on grade. Rapid-drying concrete mixes can help reduce these challenges.

Terrazzo also fared well in the Florida DOE analysis. “In terms of maintenance, schools don’t have to deal with joints and the faster wear associated with materials meant to be replaced more frequently, such as vinyl tile and carpet,” notes Sharon Moreno, marketing director for

NTMA. “In 30 years, a terrazzo floor would never need to be replaced.” Moreno also adds that terrazzo provides for good IAQ because it has no volatile organic compounds (VOCs) and also no grout lines, which may serve as potential locations for mold to develop and grow. These and related facts were highlighted in the study “Health Considerations When Choosing School Flooring,” published by the Asthma Regional Council of New England, Dorchester, Massachusetts.

It is important, however, to properly maintain terrazzo, the Florida study noted: “Harsh cleaners and sealers can damage terrazzo. Only cleaning materials with a neutral pH should be used when scrubbing or mopping. After the polishing is completed, any residue is removed from the surface and a thin layer of sealant is applied.” If these protocols are followed, the authors conclude, “The end result is a colorful floor that will hold up well to heavy foot traffic, be easy to maintain, and will last for many years.”

BUILDING SYSTEMS AND IEQ

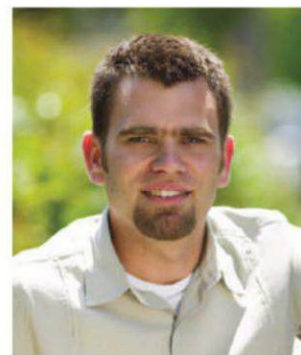
While choosing sensible finishes like terrazzo can help improve IEQ, even more directly supporting the success of students are proper levels of fresh outdoor air and monitoring of CO₂ levels within school spaces. “Evidence continues to mount demonstrating that IAQ directly impacts student academic performance and health,” says the U.S. Environmental Protection Agency (EPA), citing persuasive evidence dating to 2006. “In one study,⁴ students in classrooms with higher outdoor air ventilation rates scored 14 to 15 percent higher on standardized test scores than children in classrooms with lower outdoor air ventilation rates.”

With building envelopes being designed tighter than before, with air barriers and penetration treatments meant to limit outdoor air infiltration to controlled intakes and windows only, architects must work closely with engineers to ensure that enough outdoor air reaches all occupied zones of schools. By using CO₂ and outdoor-airflow monitors that signal when fresh air is needed, schools can earn the LEED-NC credit IEQc1 – Outdoor Air Delivery Monitoring. The standards require that the monitors be programmed according to minimum setpoints defined by Atlanta-based ASHRAE (formerly known as the American Society of Heating, Refrigeration and Air-Conditioning Engineers before a recent renaming), in the standard ASHRAE 62.1-2007. Many municipal building codes mandate the use of outdoor-air monitors for variable-air-volume (VAV) mechanical systems.

See endnotes in the online version of this article.

Continues at ce.architecturalrecord.com

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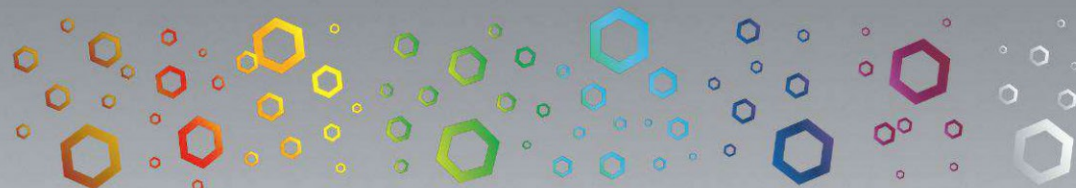
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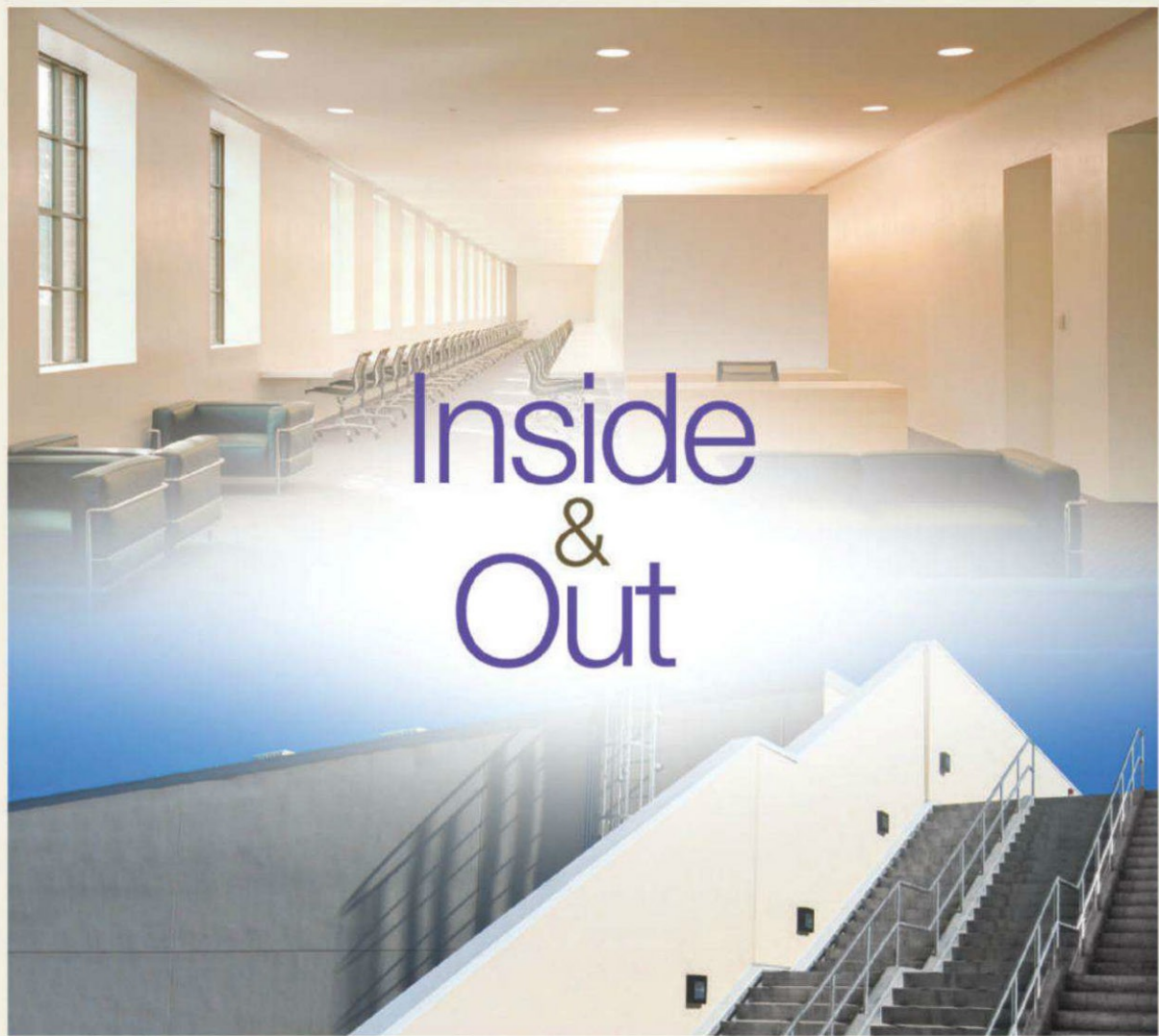
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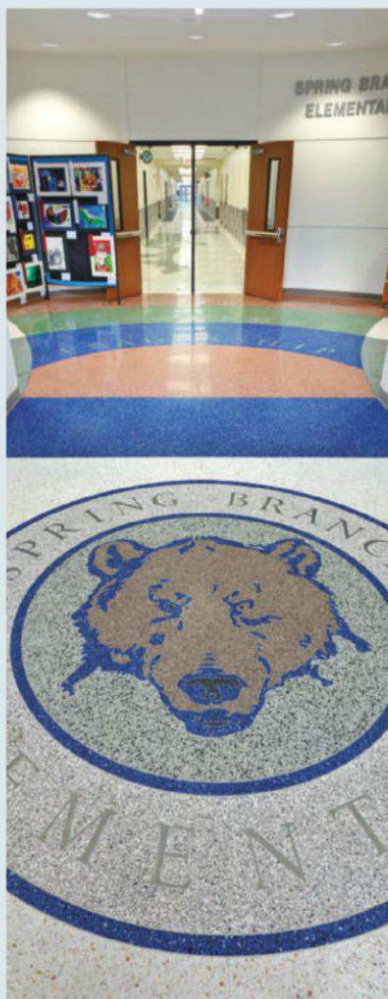
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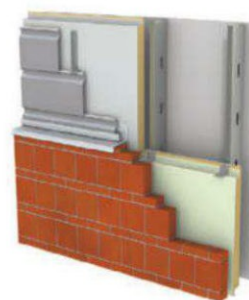
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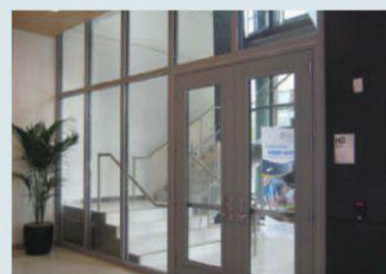
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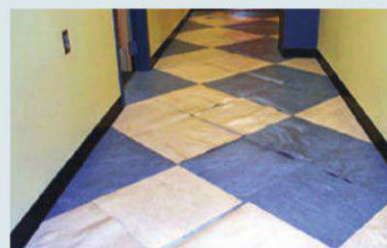
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Manufactured Techniques for Architectural Colors and Textures

Three building technologies add hue and grain to architectural surfaces

Sponsored by Eldorado Stone, Lamin-Art, and Parex USA | By C.C. Sullivan

In the 1999 book *30*, architect Rem Koolhaas wrote, “Maybe color could make a comeback,” suggesting that it passed away in the 1990s. For its return, color would “no longer be just a thin layer of change, but something that genuinely alters perception.”

Building on this idea, this continuing education course examines three sets of manufacturing technologies that—over the last several decades—have significantly expanded the modern palette for building design, indoors and out.

As leading architectural practitioners have explained, the essential considerations for material and surface articulation remain constant regardless of the technology employed. Architectural solutions, light quality, and the integral nature of materiality and visual expression result directly from the building’s objectives. In its own ways, the structural solutions lead to many choices of color and texture; programmatic needs also imply appropriate colors and textures.

In this way, Koolhaas contended, “There are two kinds of colors. The ones that are integral

Photo courtesy of Parex USA



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Learning Objectives

After reading this article, you should be able to:

1. Describe trends in the application of color and texture to typical architectural materials, surfaces, and finishes.
2. List methods for applying color and texture to such surfaces as laminates and glass.
3. Discuss the general effects of color and texture on architecture in both aesthetic and functional terms.
4. Apply trends in end-user needs, building uses, and color/texture selection to building design situations.

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For the University of Southern California’s School of Cinematic Arts, architect Urban Design Group used precast accent stones and ornamental Venetian plasters hand-troweled over gunned concrete in shades of terra cotta, off-white, and muted goldenrod.

to a material, or a substance—they cannot be changed—and the ones that are artificial, that can be applied and that transform the appearance of things. The difference between color and paint. After an initial outburst of the use of paint at the beginning of the century—was it the easiest way to transform, to get rid of history?—at the end of the 20th century, we are committed to the authenticity of materials even more, to materials that announce their own dematerialization.”

Because of their integral nature and direct links to building materials and methods, color and texture should reveal themselves in the early studies and sketches that comprise the conceptualization of the building project, says Daniel Kelley, FAIA, senior partner with MGA Partners Architects, Philadelphia. “Craft is an essential element of architectural process, connecting the hand drawing using the pencil and other tools as a craft-related activity that extends to the craft of actually making a building,” says Kelley. He sees this as reinforcing “the meaning and value of architectural drawings,” especially those made by hand.

Photo courtesy of Lamin-Art



Dimensionality in surface treatment, as with these wood-print laminates, brings a tactile and optical finish that has haptic properties.

To get his firm’s project designs started, Sven Shockey, AIA, LEED AP, design principal in the Workplace Studio at SmithGroupJJR’s Washington, D.C. office, says, “We initially try to get a sense about what the client might need in their space. Some clients want a pure, simple environment while others are looking for warmth and texture.”

Talking to the building’s ultimate occupants or end users can be very valuable, Shockey adds, because often the tenants, students, patients or visitors are looking for something that the project developers or owners may not be expecting. “But then we look for a *parti* or metaphor for the project that can guide decisions throughout the project from overall form to the materials themselves,” he says, ultimately resulting in answers to the question: Which colors and textures are best for this situation?

TRENDS IN COLOR AND TEXTURE

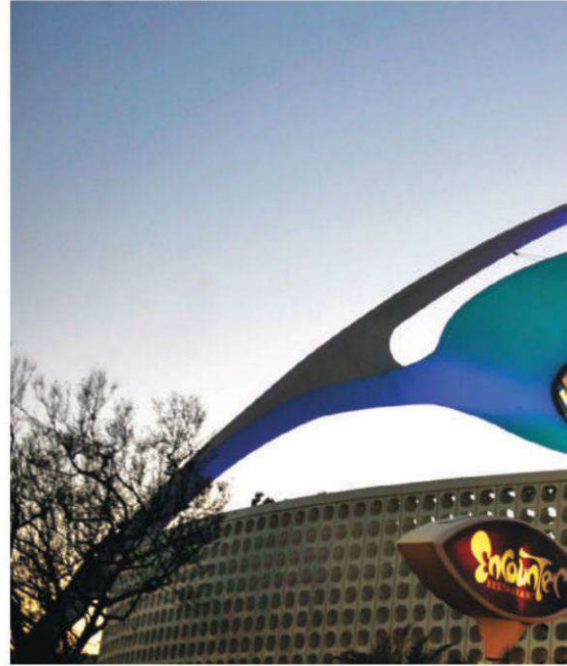
A few macro-level changes are influencing some of these parameters, too. For example, “In an age of globalization, there is an increasing need for rarity, individualism, and uniqueness in the selection of materials that make up our interior spaces and environments,” says Hans Mutzke, design director for Lamin-Art, based in Schaumburg, Illinois. For this reason, architects and designers seek out decorative surface materials “that translate into lasting impressions,” he adds.

Among those effects are sensory experiences including *tactility*, which was shown to be an innate desire of primates in a controversial 1958 experiment by American psychologist Harry Harlow. His seminal study proved that infant rhesus monkeys preferred a cloth-covered surrogate over a similar surrogate without cloth—even when she was holding a bottle of milk.

In architectural interiors, users may select soft surfaces and texture in ways that glass and steel or concrete do not always afford. “In this way, *dimensionality* in surface treatment is a new material selection criterion,” says Lamin-Art’s Mutzke. “That’s why premium wood printed laminates, which have a tactile and optical finish that may be described as having *haptic* properties, interact with light and our movement around a surface.” An early example of the use of the term *haptic*—defined generally as the process of recognizing objects through touch—was in the book *Body, Memory, and Architecture* by Charles Moore and Kent Bloomer, two architects, educators, and authors. More recently, the Finnish architect Juhani Pallasmaa has argued the case for a “haptic, sensuous architecture.”

The integral nature of color and texture in building materials is also influencing design approaches in fashion, interior design, and

Photo courtesy of Parex USA



architecture. Many of the companies that provide annual forecasts of color trending have also begun advising on “texture trends” for the coming year. This new mode has been evinced by Leatrice Eiseman, executive director of the Pantone Color Institute, who expects “earthy textures” to predominate in 2013 along with primarily blue and green hues.

As Koolhaas suggests, texture on interior and exterior surfaces can be inherent to materiality and linked to color, as with a natural stone finish, or it can exist independently of those, as with a more sculptural, moldable material such as a stucco or exterior insulation and finish system (EIFS). “Many architects think stucco is stucco, but there are a broad range of techniques for using EIFS and stucco indoors and outdoors,” says Heidi Larsen, a product and brand manager with Parex USA. “We can achieve textures from ultra-smooth to highly abrasive while conforming to a variety of surface shapes.” As an example, she points to the Encounter Restaurant at Los Angeles International Airport, with its super-smooth, white parabolic arches.

This contrasts with the use of an intentionally textured surface such as a grainy wood veneer or a simulated stone surface made of cast masonry. The latter is a stone-like panel for use in both interior and exterior applications, ranging dramatically in color and surface quality, says Brent Spann, vice president of marketing and product development for Eldorado Stone. “Colored stones, such as the irregular, rustic rubbles with more depth and vibrant hues, have been common for a number



To update Pereira & Luckman's 1961 Encounter Restaurant at Los Angeles International Airport, the renovation clad the signature parabolic arches in a super-smooth, white EIFS.

of years," Spann says. "But today we're seeing more modern stones, which tend toward a more monochromatic palette and may have a more linear quality, like a stacked stone."

In contrast to interior surfaces—which traditionally have been smooth and are now trending toward more grain, pattern, shape, and texture—today experts see exterior surfaces that once were highly textured now moving in the other direction, toward a more sleek, monolithic look, says Jamie Makuuchi, a Parex USA marketing executive with 25 years of experience in building materials. "What's trending now are surfaces with as few joints as possible, such as large panels or smooth troweled finishes that can follow any surface shapes, corners, or curves and remain more seamless than a panelized or mullioned system."

VISUAL AND BIOPHILIC BENEFITS

In all cases, texture and color confer actual benefits to the building user. "In evidence-based design research, the use of color, texture, and natural character have been shown to provide psychological health benefits to building occupants and city dwellers," says New York City architect Andrew Franz, RA, principal of Andrew Franz Architect, PLLC.

Part of the benefit comes from *biophilia*—the instinctive bond between human beings and other living systems—a term coined by German social psychologist Erich Fromm in the early 1960s and later posited as a widely influential sociobiological hypothesis by the

American biologist E. O. Wilson in 1984.

Another aspect of the health benefit of color and texture, say experts in education, comes from the stimulation of the human mind from texture gradients and *tonal variation* in a given space, properties that can be sensed visually or by touch, such as smoothness, dimensionality, and color shift. This can imbue a surface or interior space with a unique kind of authenticity.

"Subconsciously your eye and brain notice these variations, in part because of how light picks it up," says Mutzke. "There is a dynamic interplay that we respond to as building occupants."

Photo courtesy of Eldorado Stone



The intricate detail of small stones with the simplicity of a premanufactured panel gives the impression of a hand-laid, dry-stack set.

As an example, Claire Weisz, AIA, founding principal of New York City's WXY Architecture + Urban Design, points to how subtle aesthetic flourishes can have an important effect on the development of young minds. For the Day School at Christ & St. Stephens in New York, Weisz incorporated the technique of tonal variation, eschewing a single color in favor of using as broad a palette as possible within a single color choice. The Dutch-style tiles in the student washroom, for instance, were sourced in 13 different shades of white.

"Our research indicates that tonal variation encourages the children to add color and texture to their work in the classroom," says Weisz. "It not only fosters imagination, but can promote abstract thinking as well." In this way, color serves the school's primary function—the care and intellectual nurturing of young children—while preserving and celebrating the church's heritage and its important role in the community.

A MORE AUTHENTIC FINISH

Another design idea factoring into the focus on biophilia has been the use of more basic, unadorned materials and natural finishes, as well as the look of long-standing building methods such as bricklaying and lapped siding. The big-picture trend is *authenticity*, says Eldorado Stone's Spann, who reinforces Koolhaas's big idea from a decade ago.

Some designers, like the New York City architect Andrew Franz, have offered the term *living finishes* to describe the use of materials that are allowed to show their natural characteristics and to exhibit the visually attractive effects of wear and tear. "Some technological advances have yielded undesirable results, with plastified, impermeable, and highly sheened surfaces that offer little of the warmth or connection to the natural world that humans naturally crave," says Franz.

Untreated woods and other natural surfaces—cork, stone, metals, wool fabrics, and more—offer a direct way to achieve a more authentic, living surface. But as Spann and others contend, authenticity can also be achieved in manufactured products and faux finishes by using more honest, organic materials or by better expression of those natural elements in the finished product—or both.

This is true even if it's a processed, industrialized, or formed application, says Spann. "We've seen manufactured stone that does not look natural or authentic," says Spann. "The first issue is a lack of visual controls and process controls in those manufacturing plants. Second, the products should be molded from natural stones with proven molds that can capture the most finite details. Third, the molds should not be used for too long, because with overuse the material begins to lose its textural details and crispness." It's important to identify a manufacturer who is invested in creating authentic and believable products, Spann adds.

As a fourth consideration, utilizing artisans trained in the process of applying multiple layers of oxides within each stone results in more visual color depth. "It's well documented: When you have that human element that gives the finish a certain randomness, the observer is attracted to the result over something that looks too consistent and fake, such as when the highlights are applied by a robotic spray-painting arm," says Spann. The human craftsmanship and attention to detail is the key to an authentic product.

In addition to the human touch in production techniques, some manufacturers rely on original materials from nature or from other product areas to add to finishes a special *hand*, defined as its properties that can be sensed by touch, such as resilience or smoothness. This can imbue a surface or space with a different kind of authenticity.

An example is a burlap-textured, high-pressure laminate created originally for Starbucks, says Mutzke. "They asked for a hard surface to suggest old coffee bags. They wanted that turn-of-the-century relaxed, inviting feeling of Americana—of old ships unloading their goods," Mutzke recalls. The solution was to embed a layer of 100-percent jute textile between the laminate layers, yielding the look of organic, natural fibers but with a haptic laminate finish for ease of cleaning. More sophisticated manufacturing techniques that incorporate natural flitches of wood bring out the inherent beauty, look, and feel of the underlying veneer with an *in-registration* finish.

Other textured laminate products use embedded natural banana fibers as an inclusion material; the plant, which only lives for one season, is dried, ground into fine particles, and recycled as the inclusion layer under a transparent sheet in the

laminate sandwich. Again, the particulates of the ground-up leaves transfer to a subtle natural tactile finish; metal filings, coffee beans, and textiles have also been used.

Another unique laminate production method uses embossed papers that transfer photorealistic ticking, knots, and sap lines of an oak, ash, or cherry to the laminate surface during production. The hardened papers are used between press plates in the laminate production, often "in register" with the décor paper design. Some of these techniques can also include variations in gloss levels to enhance geometric or stone designs.

These advanced surface treatments and overlay technologies now play an important role in the design and "development of decorative surface materials, enhancing both the visual and tactile qualities of the products," according to the Composite Panel Association, Leesburg, Virginia.¹

BENEFITS FOR HEALTH AND ENVIRONMENT

Texture in the finished material does more than just please the senses and provide for healthful, mood-elevating biophilia. There are additional, functional considerations. "Textured materials not only add a tactile element to design, but they can also help to disguise wear and tear on different products and surfaces," says Marybeth Orlando, interior design director with The Architectural Team, a 60-person planning and design firm based in Chelsea, Massachusetts. "Textured glass in particular is extremely multifunctional. Uses range from stair treads to room dividers—the glass brings a translucent sparkle to the space, while still allowing light to penetrate and permeate the environment."

Photo courtesy of Lamin-Art



A burlap-textured, high-pressure laminate created originally for a chain of coffee shops was made by embedding a layer of jute textile between laminate layers.

According to Parex USA's Makuuchi, some colored and textured finishes have added components that confer robust qualities to improve life-cycle performance or sustainability, often in unexpected ways. "One new acrylic finish and coating that can be used for EIFS has enhanced hydrophobic and photocatalytic properties, which means it is highly water repellent, heat reflective, and smog reducing. The formula reflects the sun's heat and ultraviolet (UV) rays, lowering surface temperatures and saving energy in a process known as a photocatalysis. Being hydrophobic helps clean building exterior surfaces with rain or other water sources. As water hits the finish, it simply beads off the exterior wall and takes any dirt or soil in its path with it, helping to keep buildings clean, dry, and aesthetically pleasing longer," he explains.

Very different is photocatalysis, which also describes the acceleration of a photoreaction in the presence of a catalyst. The effect, which is similar to photosynthesis in plants, was discovered in 1967 at the University of Tokyo and has since been used for anti-fogging mirrors and soil-resistant tensile fabric structures. "The photocatalytic properties initiate an oxidation process that decomposes organic and inorganic pollutants—components of smog—in the environment," says Makuuchi. "This allows sunlight to literally break down the smog molecules, creating a cleaner environment."

See endnote in the online version of this article.

Continues at ce.architecturalrecord.com

Chris Sullivan is principal of C.C. Sullivan, a communications consulting and marketing agency focused on architecture, construction, and building products. www.ccsullivan.com



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PLAY WORK BUILD

A new exhibition now open at the National Building Museum



Create the tallest towers, the most ridiculous shapes, the truly impossible structures. Children and adults alike are encouraged to put their skills to the test and let their imaginations run wild with blocks—small, big, and virtual—in this new exhibition that also features a selection of architectural and construction toys from the Museum's collection.

PLAY WORK BUILD was developed in partnership with Imagination Playground and is designed by Rockwell Group.



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Ongoing Exhibitions

Joseph André Motte: The Art of Living

New York City

Through February 9, 2013

The first American exhibition devoted exclusively to the work of one of the most highly influential and innovative figures of postwar French design, Joseph André Motte, this exhibition at the Demisch Danant Gallery features rare examples presented in period environments. The exhibition brings together 30 unique pieces, many never before shown publicly, that shed light upon the vision and talent of an overlooked Modernist master. For more information, visit demischdanant.com.

A Long-Awaited Tribute: Frank Lloyd Wright's Usonian House and Pavilion

New York City

Through February 13, 2013

In 1953, six years before the Frank Lloyd Wright-designed Solomon R. Guggenheim Museum opened to the public, two of his structures—a pavilion and model Usonian house—were built on the future site of the museum to house a temporary exhibition displaying the architect's lifelong work. This exhibition at the Guggenheim Museum comprises selected materials from the Solomon R. Guggenheim Museum Archives, highlighting the first Wright buildings erected in New York City. For more information, visit guggenheim.org.

The Lost Vanguard: Russian Modernist Architecture, 1922–32

Chicago

Through February 16, 2013

This exhibition at the Graham Foundation features the work of Modernist architects in the Soviet Union in the years following the 1917 revolution and the period of instability during the subsequent civil war. *The Lost Vanguard* demonstrates that in little more than a decade, some of the most radical buildings of the 20th century were completed by a small group of architects who developed a new architectural language in support of social goals of communal life. For more information, visit grahamfoundation.org.

Echoes of Silence: Philip Trager, Early Photographs, 1967–83

New York City

Through February 17, 2013

Philip Trager is widely acknowledged as one of the foremost photographers of architecture and dance of the 20th century. This exhibition at the New York Public Library Stephen

A. Schwarzman Building focuses on Trager's early work. Included in the exhibition are seldom-seen landscape studies and photographs taken in San Francisco, Barcelona, and Paris. It also includes several selections from an unfinished commission to document the architecture of Frank Lloyd Wright. For more information, visit nypl.org.

Detroit Disassembled

Washington, D.C.

Through February 18, 2013

In this exhibition at the National Building Museum, Andrew Moore examines the tragic beauty of the unsettled and unsettling terri-

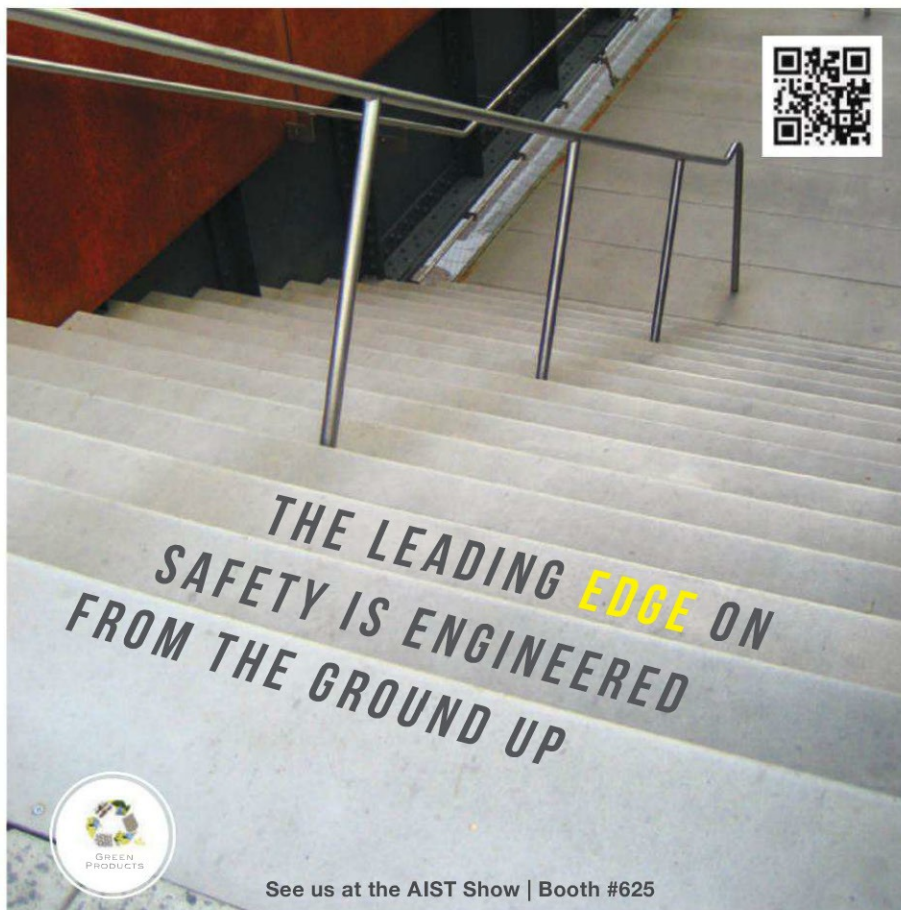
tory of a ruined Detroit. Thirty monumentally scaled photographs depict windowless grand hotels, vast barren factories, collapsing churches, offices carpeted in velvety moss, and entire blocks reclaimed by prairie grass. These images disclose how the forward march of the assembly line has been thrown spectacularly into reverse in Detroit. For more information, visit nbm.org.

Building: Inside Studio Gang Architects

Chicago

Through February 24, 2013

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produced some of the most inventive and award-winning architecture today. Featured not as a survey or retrospective, Studio Gang Architects projects in this exhibition at the Art Institute of Chicago are showcased in an engaging workshop-like environment that reveals the practice's creative processes as they address pressing contemporary issues through architecture. For more information, visit artinstituteofchicago.org.

Tokyo 1955–1970: A New Avant-Garde
New York City

Through February 25, 2013

MoMA presents *Tokyo 1955–1970*, the first museum exhibition to focus on the city of Tokyo during the remarkable period from the mid-1950s through the 1960s, when it transformed itself from the capital of a war-torn nation into an international center for arts, culture, and commerce. For more information, visit moma.org.

Skyline Adrift: Cuban Art and Architecture
Ghent, New York

Through May 2013

This politically and aesthetically groundbreaking show of multidisciplinary, site-specific installations by two Havana-based architects

(Yilena Lourdes Feitó Echarri and Yoandy Rizo Fiallo) and two internationally established Cuban artists (Alexandre Arrechea and Armando Mariño Calzado) will be on display at the OMI International Arts Center. The exhibition reflects current Cuban creative sensibilities across a broad spectrum of sculpture, architecture, and installation art. For more information, visit artomi.org.

Lectures, Conferences, and Symposia

Bloomberg Businessweek Design 2013
San Francisco

January 14, 2013

To be held at the de Young Museum, this conference will feature world-renowned designers and creative executives across a variety of disciplines, such as architecture, graphic design, robotics, city planning, 3-D printing, data visualization, genomics, and corporate branding, who will break out of their silos to discuss the state of the industry, their creative processes, and ways in which design can make the world better, smarter, cooler, and more innovative. For more information, visit conference.businessweek.com/design.

Geodesign Summit
Redlands, California

January 24–25, 2013

The Geodesign Summit is an annual gathering of professionals interested in using geospatial technologies to arrive at the best and most sustainable design solutions. The two-day summit at Esri headquarters focuses on geodesign frameworks and concepts, geospatial technologies that support geodesign, and sharing real-world examples of geodesign in practice. The breadth and depth of sessions, the opportunities for hands-on learning, and the many ways to cultivate skills and relationships make it a must-attend event. For more information, visit geodesignsummit.com.

Wright Way Arizona: Design in the Desert
Phoenix

February 22–25, 2013

This four-day Frank Lloyd Wright Preservation Trust expedition will travel to Phoenix and Scottsdale in the Sonoran Desert to see the glorious results of Frank Lloyd Wright's late-career inspiration. The expedition will explore how Wright responded to the brilliant colors and grand mesas in the Southwestern landscape. The highlight of the trip will be an in-depth tour of Wright's 1937 desert master-



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Public Interest Design Week Minneapolis

March 19–24, 2013

The College of Design at the University of Minnesota and PublicInterestDesign.org are hosting the first Public Interest Design Week. Public-interest design lies at the intersection of design and public service, representing a human-centered approach for the delivery of design services in order for people to live their best lives, regardless of their socioeconomic background. Speakers include *New York Times* architecture critic Michael Kimmelman and D-Rev: Design Revolution CEO Krista Donaldson. For more information, visit design.umn.edu.

Competitions

StreetFest Competition 2013

Registration Deadline: January 18, 2013

This competition asks for designs that envision street tents not only as shelters but also as active elements in the construction and understanding of the city. StreetFest calls for architects, artists, and engineers to reenvision

temporary outdoor structures and their material, social, and educational possibilities. For more information, visit storefrontnews.org.

Ceramics of Italy Tile Competition

Submission Deadline: February 6, 2013

This competition honors the exceptional work of North American architects and designers who have featured Italian ceramic tiles in their institutional, residential, and commercial/hospitality projects. It celebrates the pairing of innovative design ideas and products from leading manufacturers of Italian ceramic tile in creating spaces that are well appointed, versatile, timeless, and sustainable. For more information, visit italiantiles.com.

The Architectural League Prize for Young Architects + Designers

Submission Deadline: February 19, 2013

Young architects and designers are invited to submit work to the annual Architectural League Prize competition. Projects of all types, either theoretical or real, and executed in any medium are welcome. The jury will select work for presentation in lectures, digital media, and an exhibition in June 2013. For more information, visit archleague.org.

Timber in the City: Urban Habitats

Registration Deadline: March 6, 2013

This competition challenges architecture students and young professionals, working individually or in teams, to design a mid-rise, mixed-use complex for a site in the Brooklyn waterfront neighborhood of Red Hook. A panel of judges will award winners with cash prizes totaling \$30,000, and the projects will be exhibited at the Association of Collegiate Schools of Architecture meeting and the AIA convention, both in 2014. For more information, visit acsa-arch.org.

Bentley System's 2013 Design Competition

Submission Deadline: April 5, 2013

University, college, high school, and technical-school students must submit projects designed using Bentley software, along with a short essay describing their work. Project submissions will be judged by an independent panel of educators and industry professionals from around the world. The judges will assess creativity and skill in applying design and engineering principles. For more information, visit bentley.com.

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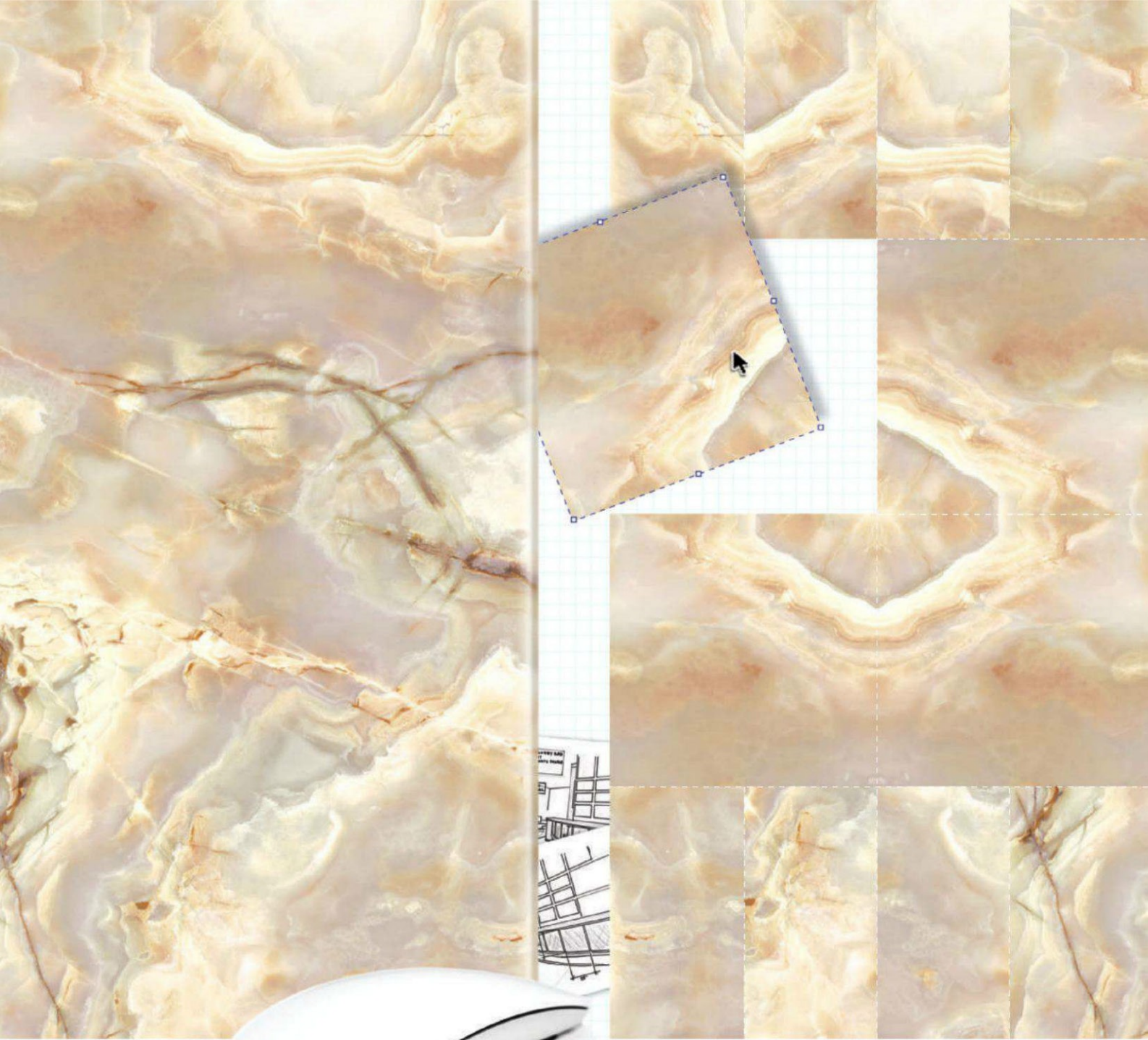
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"HOW MANY works does an architect need to build to be valid? One," said Steven Holl recently, referring to the late Lebbeus Woods's only permanent structure, Light Pavilion, which is embedded in (and juts out from) one of five towers that make up Holl's Sliced Porosity Block in Chengdu, China. The 3 million-square-foot mixed-use complex and public plaza opened in September. Woods's four-story pavilion is lined with mirror-finish stainless-steel panels and pierced by steel columns and beams covered in polycarbonate and illuminated with integral LEDs. Visitors experience the space from stairs and walkways within the sculpture. Holl spoke about the project at Cooper Union in late November at an event hosted by the Architectural League of New York. Woods, Holl's longtime friend, was scheduled to appear at the podium with him, but he died on October 30 at age 72.

The influential architect carved a singular path of resistance through the profession: He lectured, taught, wrote, drew, and created temporary installations, constantly questioning architecture's purpose. Holl told the crowd at Cooper Union that he prefers "Time Light" as a title for Woods's pavilion because it alludes to another dimension of architectural experience—one that is mysterious and ephemeral, yet is effectively conjured by his friend with this work. "He now travels on a beam of light of his own invention," said Holl. *Laura Raskin*



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