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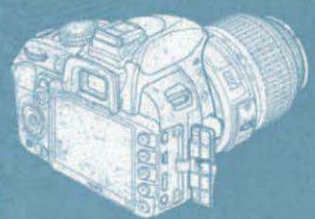

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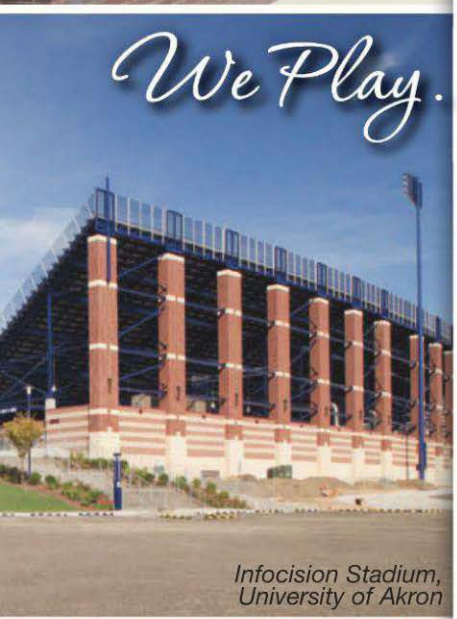

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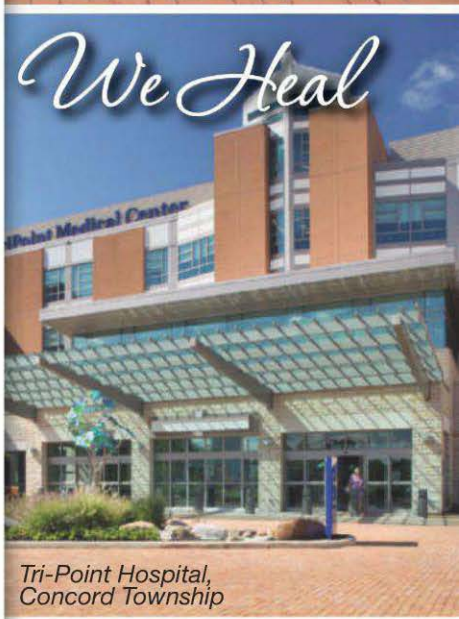

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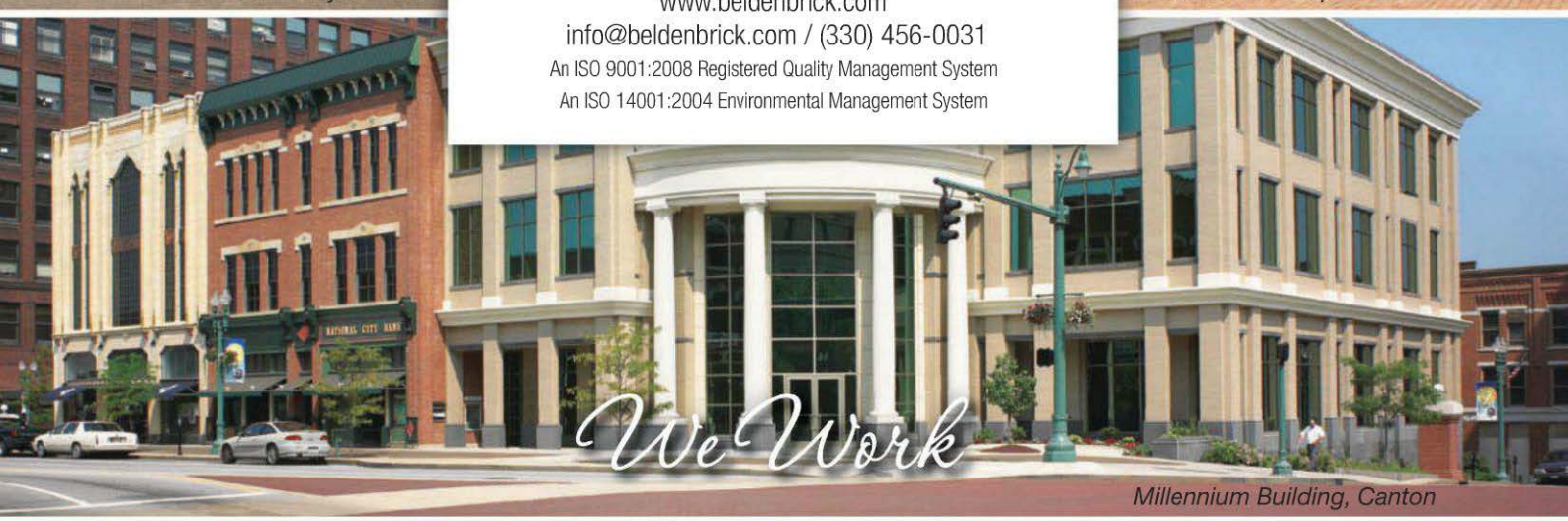

Millennium Building, Canton

ARCHITECTURAL RECORD

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TRANSFORMING THE AMERICAN CITY

THIS PAGE: FRANKLIN D. ROOSEVELT FOUR FREEDOMS PARK, NEW YORK CITY, BY LOUIS I. KAHN. PHOTO BY PAUL WARCHOL.

ON THE COVER: HOT METAL BRIDGE, PITTSBURGH. PHOTO BY JAMES EWING FOR ARCHITECTURAL RECORD.

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CIRCLE 36

American Cities: The Next Chapter

Reinventing the urban realm for the 21st century.

DETROIT WAS the first real city I knew. I grew up less than an hour's drive away, and am old enough to remember when downtown Detroit had beautiful stores and restaurants, and where my parents might take me to shop for school clothes, followed by a fancy lunch. Later in the 1960s, I remember the news of cities burning and the term "white flight"—the race-based exodus that sealed the steady decline of industrial urban America.

But for some years now, the country has been turning away from the suburban nation it became in the second half of the 20th century. New census data released in June showed that for the first time in 90 years, urban population growth outpaced suburban growth. Housing prices in some major cities are beginning to pick up—even in Detroit. "The change in living patterns could in part reflect evolving preferences for cities over the space and privacy of suburbs," suggested a story in the *Wall Street Journal*. A recent study of 10 top international cities conducted by *Urban Affairs Review* found a link between urban living and happiness: People like easy access to public transportation, shops, arts and sports facilities—and they like social connectedness.

Urban neighborhoods across the U.S. continue to gentrify and revitalize, often in small but significant ways, by building pocket parks, adding bike lanes, establishing farmers' markets—creating a kind of hipster chic, where any entrepreneur with a bucket of bright paint, planters bursting with flowers, and a few café tables can turn a gritty streetfront into an urban oasis. The U.S. pavilion at the current Venice Architecture Biennale, which earned a special jury mention, is showcasing 124 temporary or ad hoc civic projects—from the prototype day-labor station by Public Architecture in San Francisco to Fresh Moves, a mobile grocery in Chicago—that reflect the diverse passions and concerns of designers and citizens for contemporary urban life (page 46).

This era may well become known as the Century of the City, if we can only figure out how to build on what we have.

In this issue of RECORD, we explore the ongoing transformation of three American cities through architecture, urban design, and planning. Mayors and municipal governments have been leading the nation in policies that promote sustainability and quality of life, often partnering with local corporations, foundations, and institutions.

Oklahoma City (page 80) is thriving, in part thanks to the oil and natural-gas business, and the energy companies have come forward to help promote good architecture—check out the Devon Energy Center by Pickard Chilton—and an urban realm enhanced for pedestrians and the public at large. The aging Rust Belt cities of Cleveland and Pittsburgh face more daunting challenges. But Pittsburgh (page 94), as its economy begins to rebound, is emerging as one of our greenest cities, with sustainable initiatives in landscape and architecture, including the construction of PNC Bank's new headquarters by Gensler, which will be the tallest naturally ventilated office tower in the U.S. Like Pittsburgh, Cleveland (page 104) has a legacy of great institutions in health care, education, and culture that are key to current planning and architecture, in such projects as Uptown, an urbane new mixed-use development designed by Stanley Saitowitz/Natoma Architects on land owned by Case Western Reserve. With inexpensive rents and enough of a cool factor—a music scene, art galleries, microbreweries—Pittsburgh and Cleveland are attracting high-tech companies and young people, who demand and perpetuate a cosmopolitan way of life.

But no one is thinking these cities will be restored to the boomtowns they once were. Cleveland's population continues to shrink—from a high of nearly 1 million in the 1950s to around 400,000 today—and like a mini-Detroit, huge swaths of the metropolis are almost empty, sprawling silently between more vibrant neighborhood hubs. And let's not forget that such aging cities are full of people who aren't sampling boutique beer or checking out the latest iPhone app: They are poor and disenfranchised.

Some ideas of how to tackle urban problems may emerge, ironically, from Detroit itself. At the end of this month, the planning report from the Detroit Works Project will be released, after years of research, with input from a wide range of community stakeholders (page 31). In the short run, the report will recommend urgent steps to respond to the needs of its citizens—but over the long term it is likely to suggest the evolution of a new kind of city, with an urban fabric that is intermittently dense and porous and an infrastructure that is flexible and sustainable. The next chapter for American cities should build on our strongest institutions and historical structures while bringing innovative ideas and design tools to create an urban form of new possibilities. ■

Cathleen McGuigan

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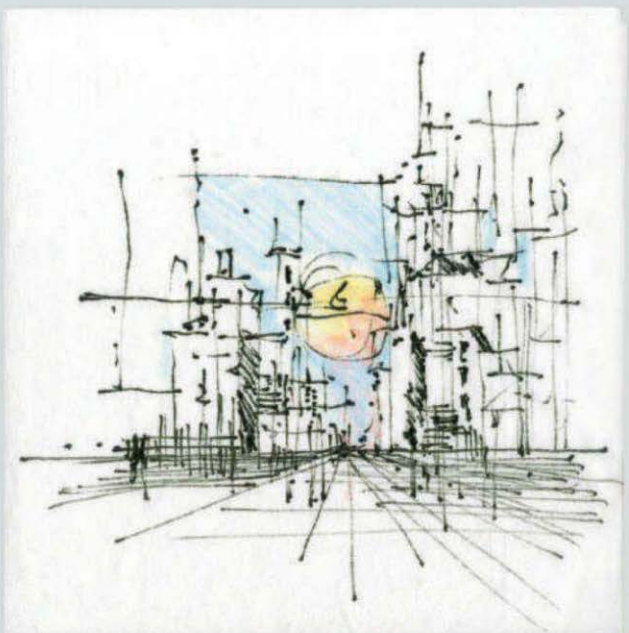
ARCHITECTURAL RECORD Announces the Winners and Runners-up of the

2012 COCKTAIL-NAPKIN SKETCH CONTEST

RECORD was deluged with submissions for its third annual cocktail-napkin sketch contest. The jury of editors evaluated nearly 1,000 napkins from over 300 entrants. In addition to individual submissions, many firms sent large packages stuffed with napkins drawn by employees—principals, associates, designers, interns, and other office staff. This year, we created a special award to highlight one firm with the best body of work. We also invited two well-known architects to join in.

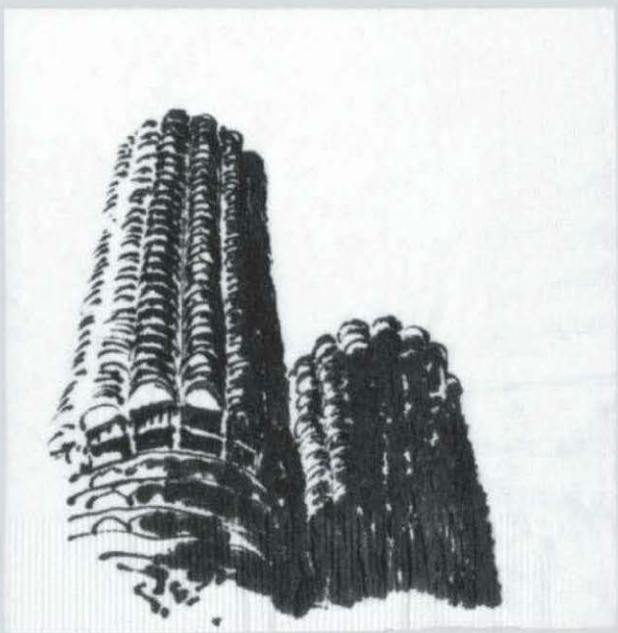
WINNER, PROFESSIONAL



GEOFF PARKER, ARCHITECT, 308 DESIGN COLLABORATIVE; OKLAHOMA CITY
URBAN CITYSCAPE

Geoff Parker, 38, an Oklahoma City native who recently joined 308 Design Collaborative, teaches first- and second-year studio art courses to undergraduates at the University of Oklahoma, where he received his B.Arch. and M.Arch. Parker spent about 10 minutes on his sketch, which he says is a quick doodle of an imaginary cityscape. "I was playing around with perspective and trying to generate some depth," he says. The architect drew the sketch using a fountain pen and colored pencils and explains, "I was intentionally trying to see how fast and loose I could draw it and still make it read." With a father who is also an architect, Parker says he's known from childhood that architecture was his calling.

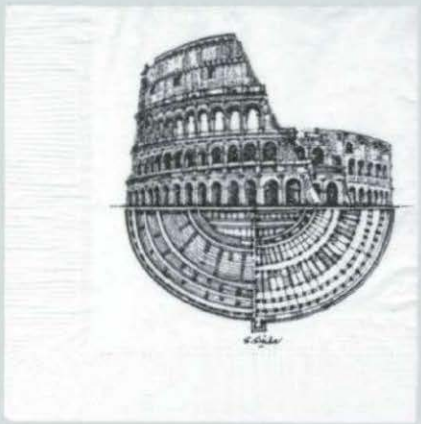
WINNER, NONPROFESSIONAL



BRIAN DROSTE, INTERN ARCHITECT, WIGHT & COMPANY; CHICAGO
MARINA CITY, CHICAGO/BERTRAND GOLDBERG

The winning sketch by a nonprofessional was drawn by Brian Droste, 25, an intern at the firm Wight & Company. While enrolled in the five-year architecture program at Notre Dame, Droste studied in Rome, where a professor introduced him to light-and-shadow drawing studies, the inspiration for his sketch. Droste says he has always been fascinated by the work of architect Bertrand Goldberg, and his Marina City (1964) in particular, because of the way light bounces across the buildings, emphasizing petal-like forms. Droste completed his sketch in about 10 minutes using a fountain pen. "The pen bleeds so quickly—it makes you go so much faster," he says. "You have to commit and not go back, almost like a watercolor."

RUNNERS-UP, NONPROFESSIONAL

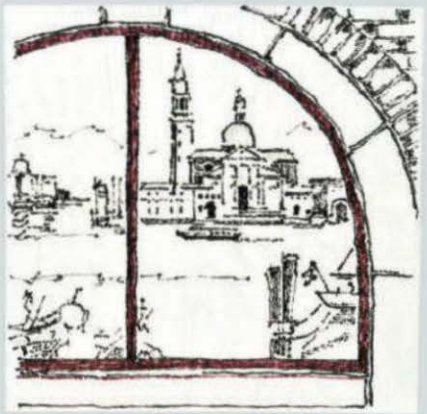


SUBHOJIT SINHA, DESIGN STAFF,
RTKL ASSOCIATES; DALLAS
COLOSSEUM, ROME

EDUARDO PINTOS, DESIGNER,
LOISOS + UBBELOHDE; ALAMEDA, CA
DANCING HOUSE, PRAGUE/FRANK GEHRY

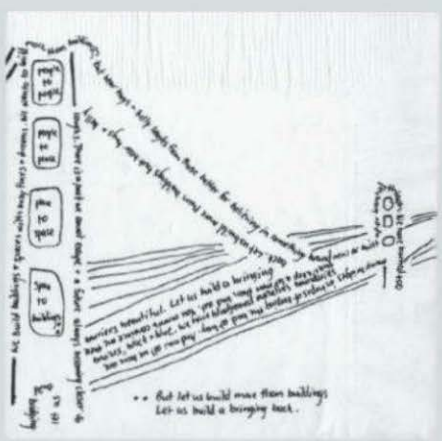
KERRI FERRARA, DESIGNER,
MUFSON PARTNERSHIP; NEW YORK CITY
SAINT MARK'S SQUARE, VENICE

BEST FIRM SUBMISSIONS



RICH COGBURN, ARCHITECT, COOPER CARRY; ATLANTA
VIEW FROM PUNTA DELLA DOGANA, VENICE

MARINA MICHAEL, DESIGNER,
COOPER CARRY; ALEXANDRIA, VA
SALK INSTITUTE, LA JOLLA, CA/LOUIS I. KAHN



TANNE STEPHENS, MARKETING ASSISTANT,
COOPER CARRY; ALEXANDRIA, VA
BRIDGE BUILDING

SPECIALLY INVITED ENTRIES

ANTOINE PREDOCK, ANTOINE PREDOCK ARCHITECT;
ALBUQUERQUE AMERICAN HERITAGE CENTER, LARAMIE, WY

EUGENE KOHN, KOHN PEDERSEN FOX; NEW YORK CITY
MANHATTAN SKYLINE

For a seemingly anachronistic art form in these digital times, it is surprising that a number of architecture firms sent entries from many employees. This year RECORD decided to give the firm with the most memorable sketches its own award category, "Best Firm Submissions." Similarly, RECORD solicited cocktail-napkin sketches from two well-known architects, just to show that leaders in the field still draw. See the rest of their sketches and other notable cocktail-napkin entries online at architecturalrecord.com.

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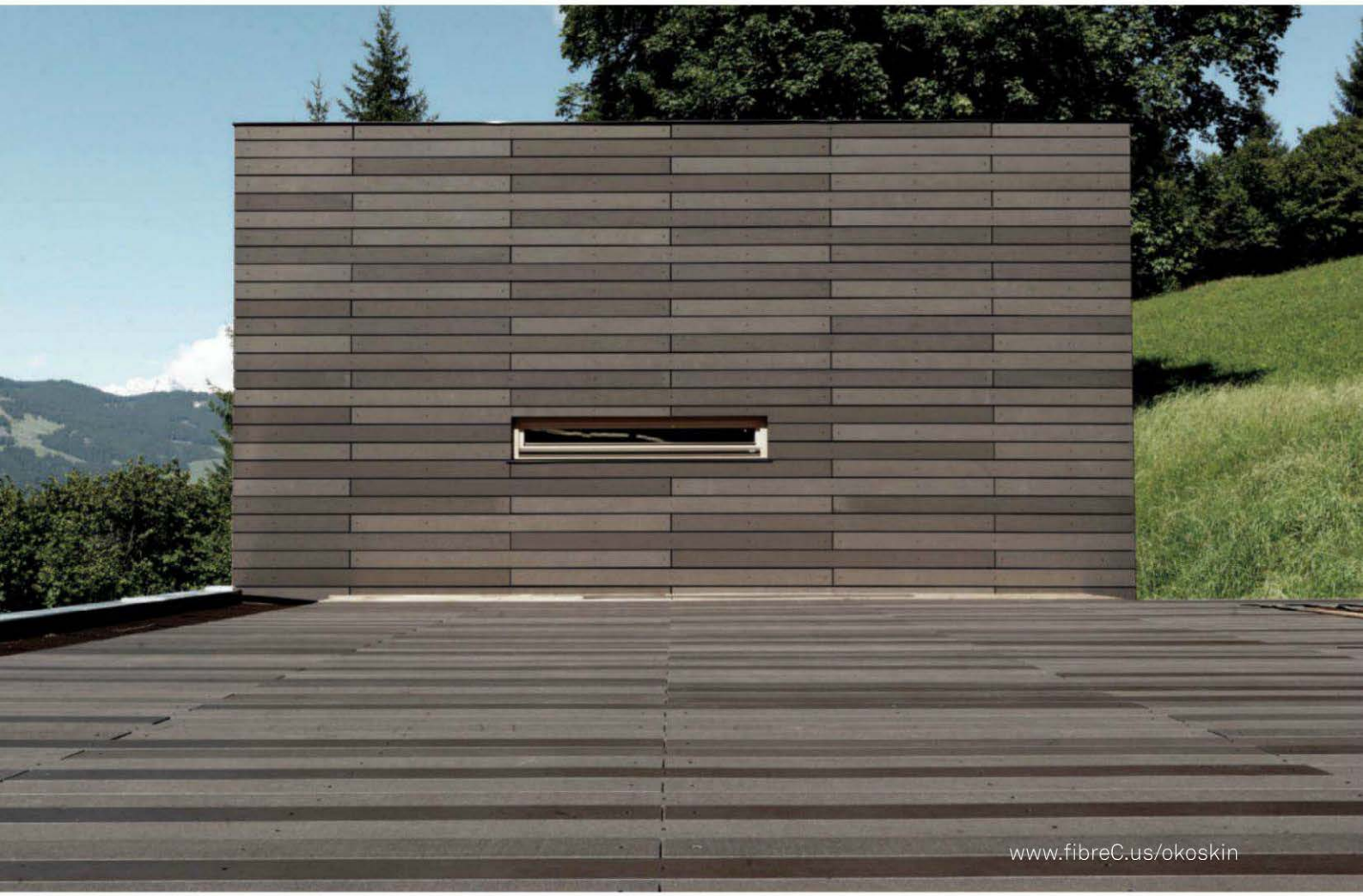

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Visualization

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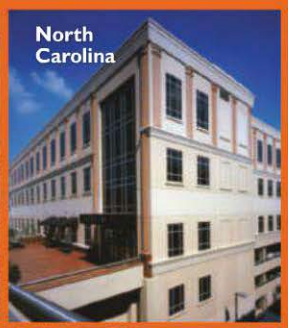
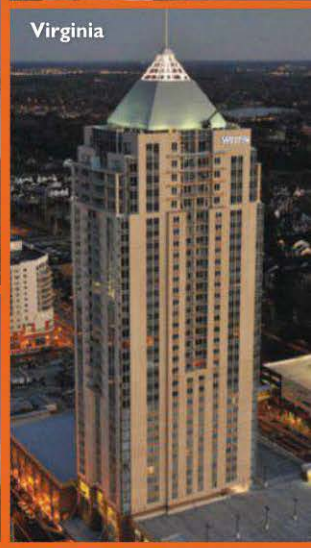
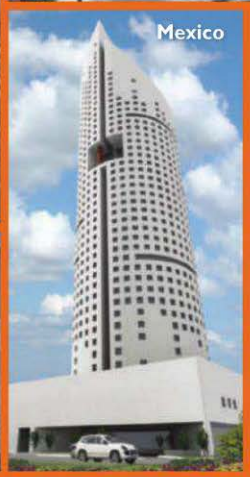
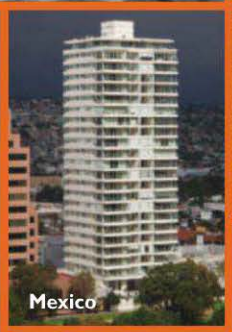
Installation

Changing the Face of North American Skylines









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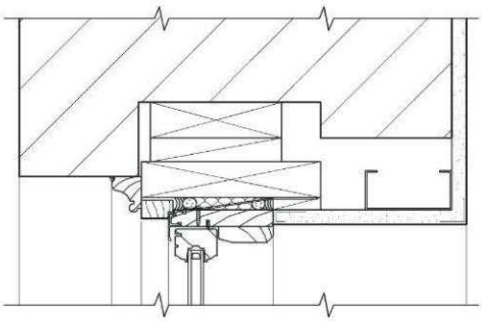

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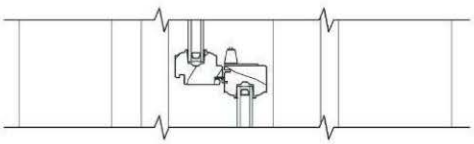
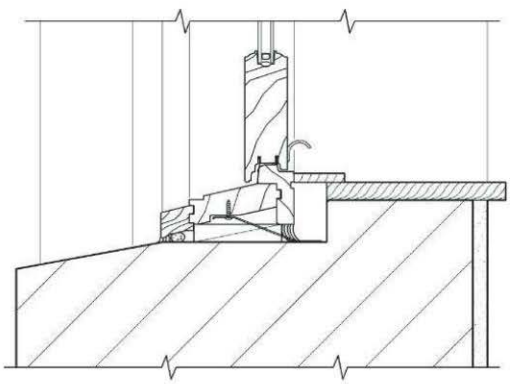
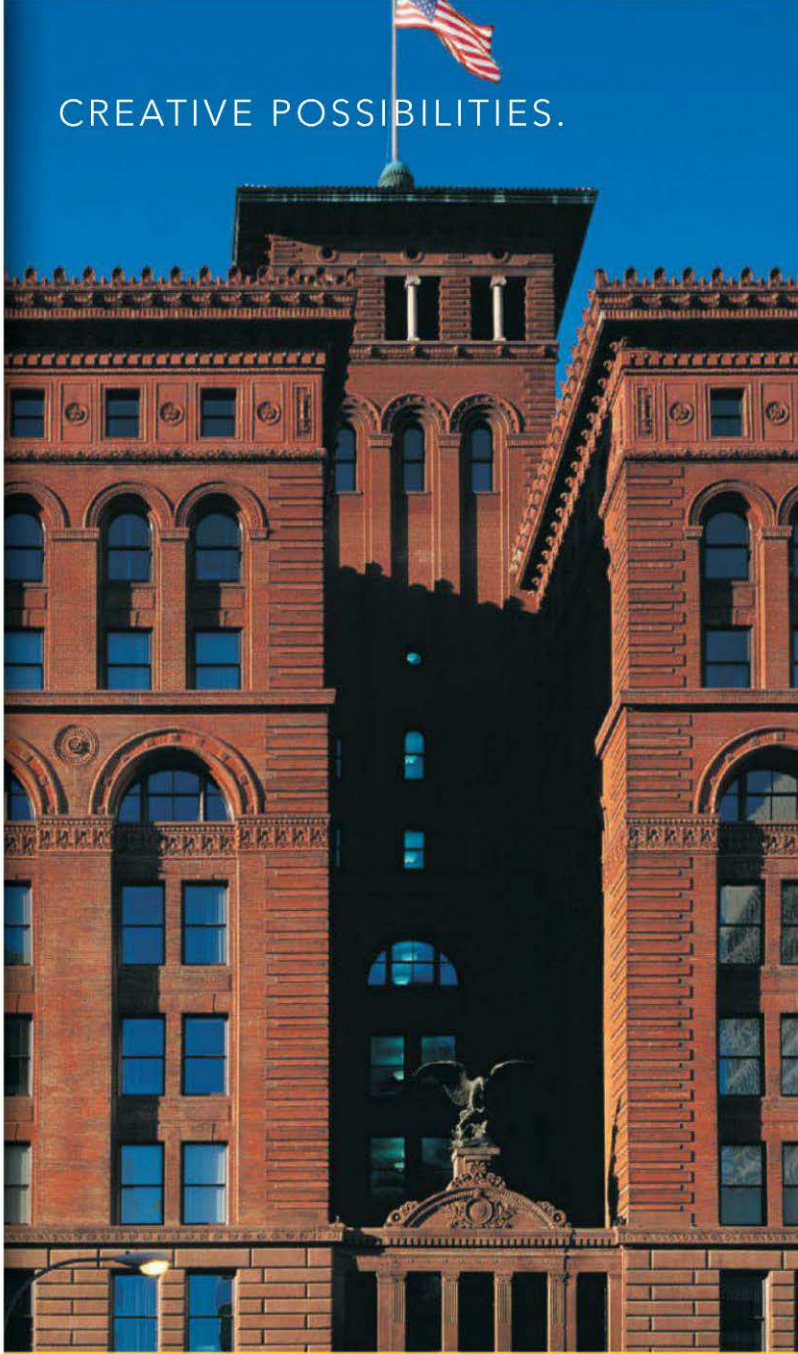


CHECKRAIL



SILL

CREATIVE POSSIBILITIES.



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perspective

"You have all the constraints of the client, of the site conditions, of the economy, of gravity—you name it. But a highly unpredictable boss is yet another constraint." — *Bjarke Ingels in the September 10 issue of the* New Yorker

Rebuilding Detroit Piece by Piece

BY LAURA MIRVISS

Detroit Works recommends expanding existing neighborhood initiatives, like the Spirit of Hope garden in Midtown.

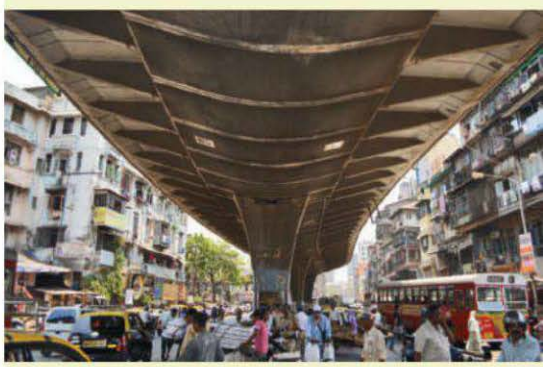
IN DETROIT, the statistics are jarring: The city has 26 jobs for every 100 people, 47 percent of residents are functionally illiterate, and, with 344 homicides in 2011, its violent-crime rate eclipses that of any other major U.S. city. Twenty-three percent of the housing stock is vacant, and though municipal tax rates in Detroit are 2.5 times the national average, services are spread thinly across the city's expansive 143-square-mile footprint. As industry left town in the second half of the 20th century, the population declined steeply, leaving a city of 700,000 people to foot the bill for infrastructure designed for 2 million. The shrinking tax base, intensified by the recession and rampant foreclosures, left Detroit broke and scrambling to fend off a state takeover earlier this year.

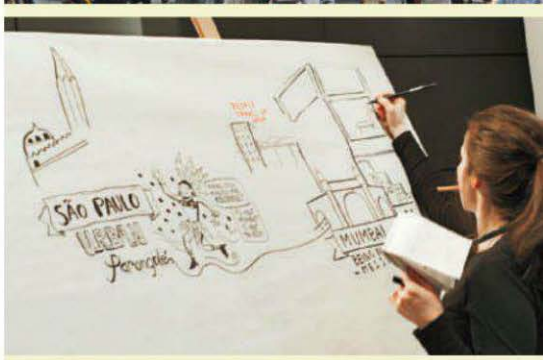
In 2010, Mayor Dave Bing, a basketball legend turned businessman, launched the latest effort to bring the city back from the brink. Branded the Detroit Works Project, the initiative was funded primarily by private organizations—including $2.7 million from the Kresge Foundation—to inventory the city's physical condition and economic, social, and infrastructural challenges. "Detroit is unique because of its scale and size. There really isn't a postindustrial American city with that level of vacancy and population loss," says Toni Griffin, an urban-planning professor at City College of New York who was tapped by Detroit Works to oversee a team of economists, designers, planners, and engineers. Detroit Works will unveil its final report in late October with a series of targeted recommendations for short- and long-term renewal.

The city has a troubled history with top-down planning projects that did more harm than good, and Bing and Detroit Works came under fire in the project's early stages for lack of community engagement. In response, the group created a full-time staff to lead community meetings, focus groups, and (*continued*)

Driving Urbanism

The car has long played the villain in urbanist narratives, but German automaker Audi wants to change that role in the next chapter of the story. On October 18 it will present the second Audi Urban Future Award, the result of a biennial competition to reimagine the city, beginning with transportation networks. Audi has asked five firms to develop speculative plans for their metropolitan areas: CRIT (Mumbai), NODE Architecture & Urbanism (China's Pearl River Delta), Superpool (Istanbul), Urban-Think Tank (São Paulo), and Höweler + Yoon Architecture (which is taking on "Boswash," the U.S. megalopolis from Boston to Washington, D.C.). The winner will receive 100,000 euros, while Audi will get inspiration for its next generation of products. *William Hanley*





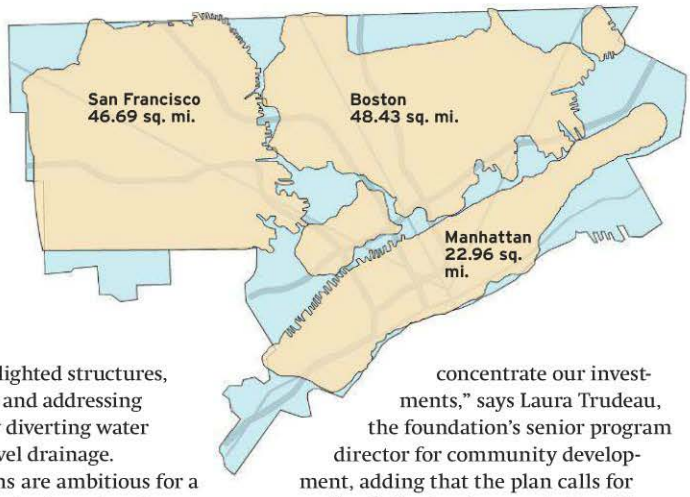
Finalists will display their proposals in Istanbul this month. CRIT will look beyond Mumbai's existing infrastructure (top); Urban-Think Tank will address social mobility in São Paulo (above).

PHOTOGRAPHY (CLOCKWISE FROM LEFT): © DAVE JORDANO; CRIT; AUDI AG

(Detroit continued)
other outreach efforts. They spent over 10 months floating ideas and soliciting feedback from philanthropies, businesses, city officials, and upwards of 75,000 residents.

When the Detroit Works report rolls out, it will propose immediate pilot projects generated through the public feedback. The plan hinges on leveraging and expanding the city's existing programs, according to Dan Kinkead, an architect at Detroit-based Hamilton Anderson who leads the technical team along with Griffin. Examples include the nonprofit Focus: HOPE in northwest Detroit, which provides job training for adults and academic support for students; the Warm Training Center, which offers classes in green infrastructure and technology; and Hatch Detroit, a group that offers start-up capital and micrograntsto small-scale entrepreneurs.

The planners hope that these will build momentum for larger initiatives like massive expansion of public transit and changing zoning codes to encourage denser neighborhoods, new business districts, and urban agriculture. Detroit Works will suggest coordinating the various agencies that now separately manage the city's vacant land, says Kinkead. It will also recommend expanding programs that advocate reuse of blighted structures, rather than demolition, and addressing water contamination by diverting water from pipes to surface-level drainage.



Three urban areas easily fit inside Detroit's vast footprint. The city's shrinking population has struggled to support high-vacancy neighborhoods.

The recommendations are ambitious for a city that has seen ineffectual master plans come and go, but Detroit Works has taken steps to have its recommendations carried out. In particular, it has gotten key players—city government, philanthropies, businesses, and corporate investors—to pledge financial or programmatic support. For its part, the Kresge Foundation says the recommendations will represent a significant slice of its grants for the next five to 10 years, and possibly beyond. "We're already starting to concentrate our investments," says Laura Trudeau, the foundation's senior program director for community development, adding that the plan calls for expanding infrastructure projects of the last decade, which included $35 million for a 3.4-mile light rail in 2009 and $50 million for the Detroit RiverWalk starting in 2002.

This integrated approach is key to the new initiative. "Detroit's assets are really there; they just have to be aligned and amplified," Griffin says. Having obtained the support of the city's financial, municipal, and community leaders, Griffin believes that Detroit Works will succeed where others failed. ■

Survey Predicts Architecture Shortage by 2014

BY WILLIAM HANLEY

THE RECESSION decimated the architecture profession, with firms closing or laying off large numbers of employees, architects left jobless for months or years, and many leaving the profession entirely. But a survey recently conducted by McGraw-Hill Construction (RECORD's parent company) came to the counterintuitive conclusion that some U.S. firms expect a shortage of qualified designers to meet their workloads by 2014.

The survey of 1,007 U.S. designers found that nearly one-quarter of respondents anticipated a shortage of architects resulting from a combination of designers exiting the profession, baby boomers retiring, a lack of skills among architects looking for work, and less talent in the pipeline as job prospects discourage students from entering the field. Firms both large (more than 50 employees) and small (less than 10) anticipated some kind of shortage of designers, but nearly half of respondents from larger firms expect it to be severe.

A parallel survey of 448 American Institute of Architects members found that of the 15 percent of respondents who reported being laid off during the recession and its immediate aftermath, 15 percent of that group have moved on to other industries. At the same time, 60 percent of professionals surveyed anticipated a loss of knowledge resulting from older architects retiring. Of particular concern was a lack of workers with skills related to sustainable design—a rapidly growing segment of the industry. Fifty-six percent of firms surveyed reported difficulty finding employees with adequate green skills, and that number jumps to 72 percent for small firms. "Firms must be able to attract talent over a wide range of experience, while appealing to younger workers who are strongly motivated by environmental issues," said Harvey M. Bernstein, vice president of industry insight and alliances for McGraw-Hill Construction, in a statement about the study.

But those young workers might not be the ones who are being hired. The survey of AIA members found that 94 percent thought that the economy would make it difficult for architecture students to find work, "a factor that surely influences whether to pursue a career in architecture," said Bernstein, adding that 76 percent of students included in the study expressed an interest in working abroad, where many believed there would be more opportunities. "Architecture firms need to think strategically," said Bernstein. "Not only about how to draw talented professionals to their firms, but also about how they will attract more architects to the profession." ■

Nearly one-quarter of respondents anticipated a shortage of architects resulting from designers exiting the profession, a lack of skills among architects looking for work, and baby boomers retiring.

IMAGE: © DAN PITERA

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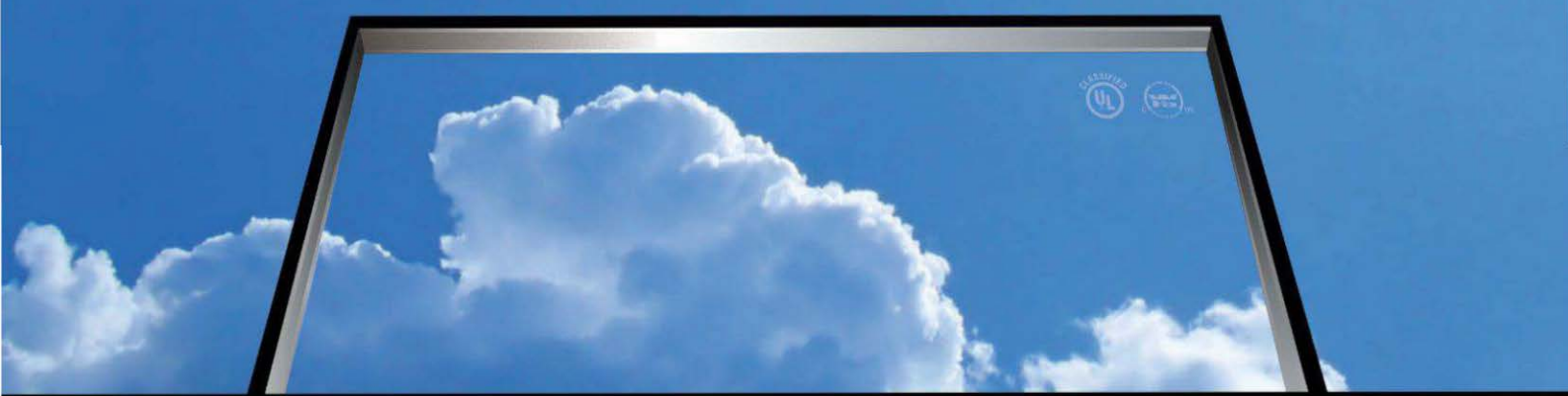

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CIRCLE 74

Infrastructure in the Election

BY BEN ADLER

WHEN IT comes to public infrastructure, Americans face a stark policy choice this November. More than any president since Franklin Delano Roosevelt, Barack Obama has made investing in infrastructure central to his presidency. Mitt Romney, on the other hand, says little about issues like transportation and housing. When he does, it is to suggest cuts to programs and agencies that provide them.

The current administration encourages cities and states to spend federal money on projects that enhance the public realm. The interstate-highway system often cut neighborhoods in half or separated cities from their waterfronts. Wary of repeating those mistakes, the Department of Transportation has launched a competitive grant program—Transportation Investment Generating Economic Recovery (TIGER)—that rewards integrating housing with new roads or mass transit so as to maximize benefits and minimize environmental degradation.

Romney's domestic agenda has essentially one goal: spend less money. He has pledged to balance the budget while cutting income-tax rates by one-fifth and increasing the defense budget. The only way to do so would be to drastically cut domestic discretionary spending. He refuses to divulge exactly which domestic programs he would cut, or by how much, on the grounds that Democratic criticism of such proposals could hurt his chances of winning. The few specifics he has offered—eliminating funding for National Public Radio and Amtrak—are far too small to cover his tax cuts, much less the existing budget deficit. It is safe to assume that most infrastructure programs would be reduced, and possibly abandoned entirely. At one April fundraiser in Palm Beach, Florida, reporters standing outside overheard Romney speculating that he might eliminate the Department of Housing and Urban Development (HUD).

That would be a dramatic shift from the Obama administration, which has used HUD, through its signature Office of Sustainable Communities, to promote smart growth. The Sustainable Communities program offers grants and technical assistance to assist cities and counties in developing transit-oriented housing and revitalizing their downtowns. HUD Secretary Shaun Donovan has also sought to improve the appeal and functionality of public housing through the Choice Neighborhoods program.

The biggest infrastructure investment in the Obama years is already in the past. The American Recovery and Reinvestment Act of 2009, known as the stimulus bill, contained $35.7 billion in spending for transportation, from highway improvements to constructing high-speed rail lines. An additional $29.2 billion went to other infrastructure investments, such as building water and sewer lines and expanding broadband. In 2011, the president proposed a follow-up called the American Jobs Act that would have created a national infrastructure bank, which would borrow some federal funds and leverage private investment to provide a steady revenue source to supplement the declining federal highway fund. (*continued*)

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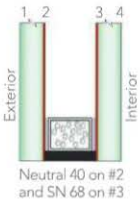

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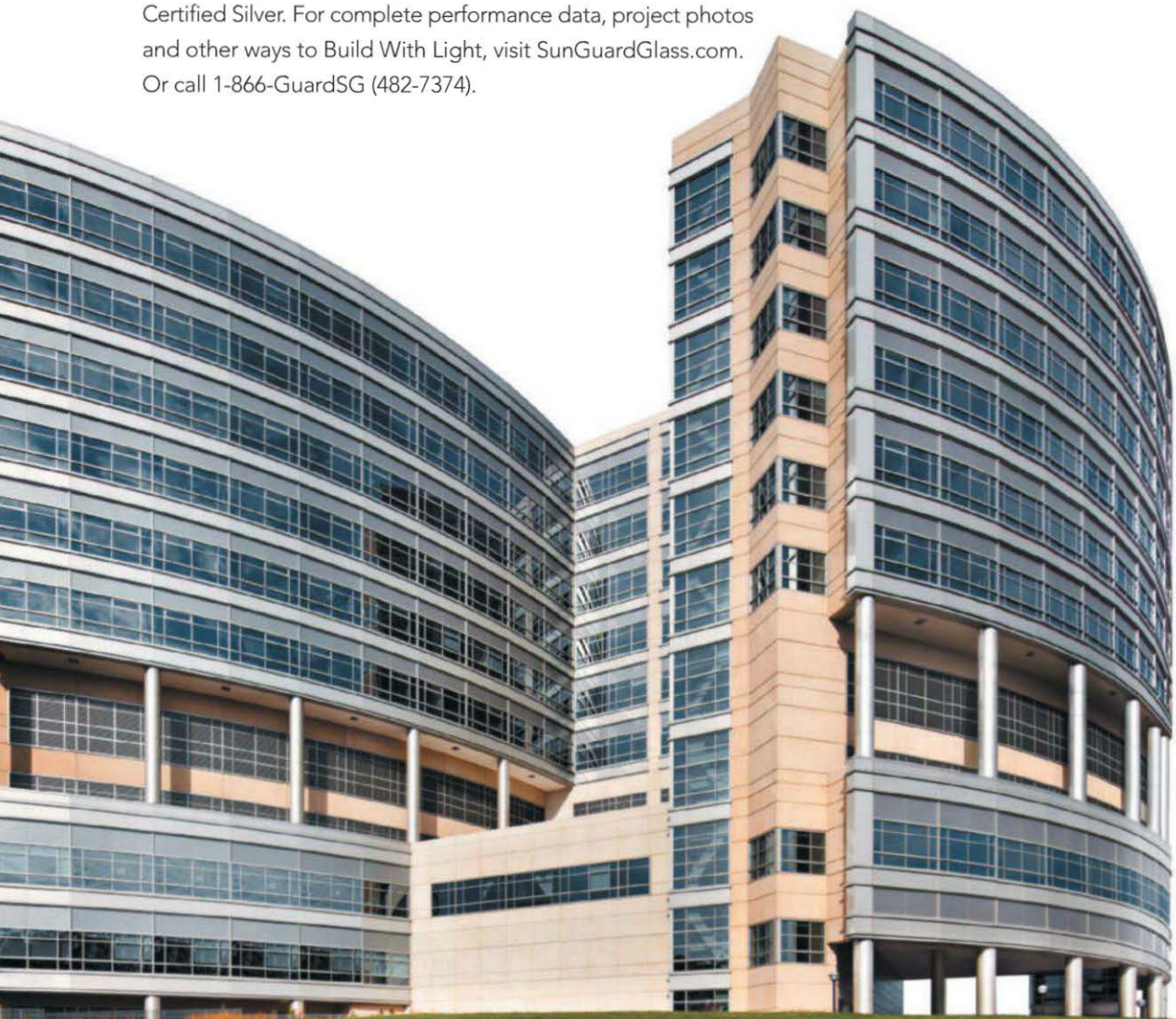

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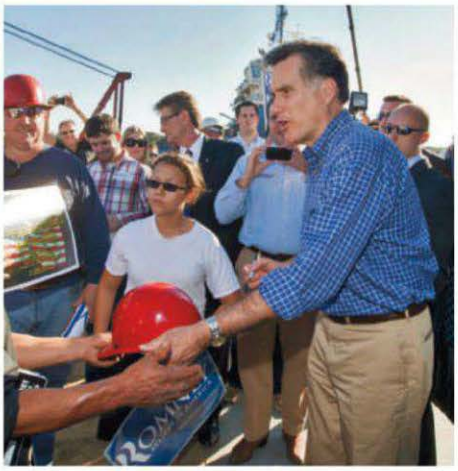
CIRCLE 48

President Obama in Michigan (above); Republican presidential candidate Mitt Romney in Florida (right).

(Infrastructure continued)

But with Republican control of the House of Representatives, it has no chance of passage. In the unlikely event that Democrats held the White House and Senate while retaking the House, the American Jobs Act and a six-year extension of the federal transportation law would be Obama's two most likely second-term infrastructure investments.

Ironically, Romney was once an advocate for smart-growth initiatives. When he was governor of Massachusetts, he created the Office of Commonwealth Development and put Douglas Foy, an environmentalist, in charge of it. Through the office, Massachusetts employed anti-sprawl policies such as issuing a pedestrian-friendly highway design manual and making it a priority to fix existing roads over building new ones. Romney also signed a law that offered incentives to towns that zoned to allow higher-density and mixed-use development. As with other progressive stances, Romney abandoned this agenda when he started running for president.



If you speak with advocates for cities, transportation spending, or smart growth, you will often hear a hopeful refrain: that if Romney wins he may govern as the moderate former governor, not the conservative who ran for president. But Romney's selection of Wisconsin Rep. Paul Ryan, author of a budget plan more extreme than his own, as his running mate is not an encouraging sign for urbanists. Until recently, support for infrastructure investment was a rare issue of bipartisan agreement in Washington. But those days are over, and the two parties are as polarized on these policies as on all the others. ■

PHOTOGRAPHY (FROM LEFT): © SAUL LOEB/AFP/GETTY IMAGES; MARK WALLHEISER/GETTY IMAGES NORTH AMERICA

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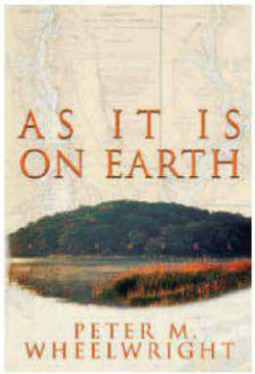
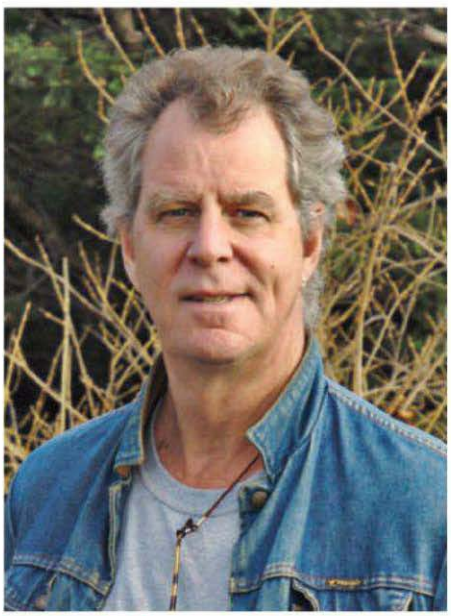
Peter M. Wheelwright

BY JAYNE MERKEL



WHAT DOES architecture have in common with writing a novel? If you ask Peter M. Wheelwright, the answer is a lot. The principal of PMW Architects in New York City, Wheelwright recently released his debut novel, *As It Is on Earth*, which was published in September by Fomite Press. Wheelwright is also a professor at New York's Parsons the New School for Design, where he teaches design studios mixed with heavy doses of theory, history, and philosophy—subjects that play a major role in his novel, about a young professor delving into his family's past.



Peter Wheelwright's novel was published in September.

How did your work as an architect affect your writing?

I'm often asked if *As It Is on Earth* is about architecture or an architect. It is not, but my training as an architect could not have better prepared me to write this book. The spatial and formal requirements were all there: How does one enter the story? How does one move through it? What is its structure? Working these things out, alone, at my new "drafting" board felt very familiar. Also, I think architects are natural storytellers. They tell stories about their buildings, about the world in which they are designing. They have to tell stories to persuade or inspire others to help them get things built.

Your descriptions of people and places are memorable. Has your work as an architect sharpened your powers of observation?

Architects are also visual; we almost compulsively notice our environment and aspire to a kind of spatial harmony of scale and detail in our work. This is true of the ways we regard both the built and natural environments, I think. That's why the landscapes, rivers, islands are as significant in *As It Is on Earth* as the people and the places that inhabit them.

The way you deal with time also seems architectural. We go to a building and walk around it, but we rarely take a straight path. Did that arise from your sensitivity to architecture?

In the book, time follows the kind of meander we make through architectural space in order to understand it fully. The narrator has lost his sense of self. He feels he is only the sum of other events, times, and places that were or are beyond his control. He feels he is only a product of history, and his quest is to meander back and forth through time in order to finally find himself.

To what extent do the characters and settings grow out of your personal history? You have taught for many years, and your narrator is a professor. How else has teaching influenced your book?

One writes what one knows. While *As It Is on Earth* is not in any sense autobiographical, my family goes back 13 generations in Maine. I know the setting well. Also, the decision to have the narrator be a young college professor helped to explain his obsession with history and the connectedness of things. I know that territory well also. In fact, you'd come across a number of the book's themes if you sat in my history and theory seminars at Parsons.

Why did you decide to write fiction?

The late American philosopher Richard Rorty made a wonderful literary distinction between instruction and inspiration. It helped me to see that the academic texts I'd written in the past were being received by students as a form of instruction about the way the world is, whereas fictional texts have the capacity to inspire us about the way the world is and how it could be made better. ■

noted

Frank Lloyd Wright Archives Move to New York City

The Museum of Modern Art and Columbia University have jointly acquired Wright's archives (including 23,000 architectural drawings and 44,000 historical photographs) from the Frank Lloyd Wright Foundation. The archives are currently housed in Taliesin and Taliesin West.

Dorothy Robyn to Be New GSA Commissioner

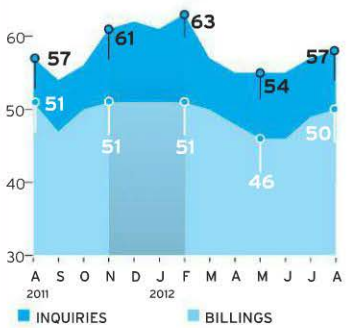
Dorothy Robyn, a Defense Department official, was named the new Public Buildings Service commissioner at the General Services Administration. Former commissioner Robert Peck left in the fallout from a scandal involving the cost of a conference. He is now a director of workplace consulting at Gensler.

Deborah Berke Named Winner of UC Berkeley Prize

New York City–based architect Deborah Berke has been named UC Berkeley's first Berkeley-Rupp Architecture Professorship and Prize winner. The $100,000 teaching prize goes to practitioners who have contributed to promoting the advancement of women in architecture.

Facebook Hires Frank Gehry to Expand Its Campus

The ubiquitous social network Facebook has hired Gehry Partners to design a new building to be located across a highway from its existing complex in Menlo Park, California; the former Sun Microsystems campus was recently converted into a code geek's paradise by Gensler's San Francisco office. Construction is to begin in the spring of 2013.



ABI Continues to Rise

The Architectural Billings Index rose to 50.2 in August, the first time it's landed in positive territory since March (a number below 50 denotes a decrease in billings). The inquiries score also continued to rise, up nearly a point in August (57.2). Sector indices were: residential, 53; commercial/industrial, 47.9; institutional, 50.2; mixed, 46.8.

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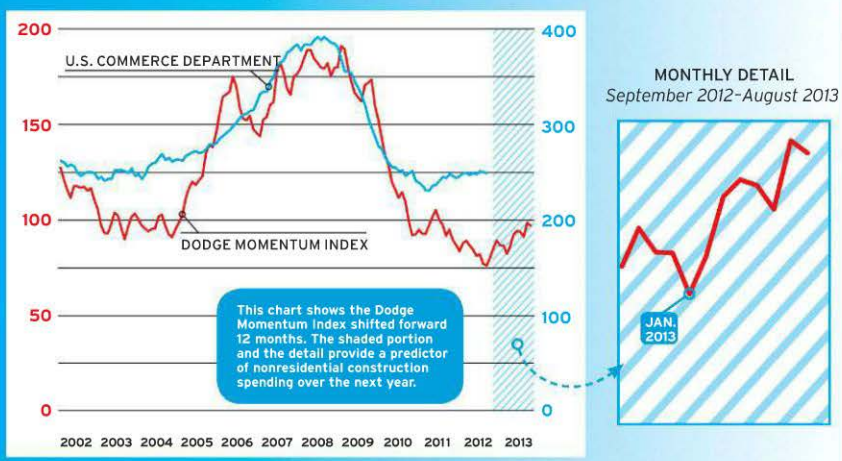
Data from McGraw-Hill Dodge Analytics

INDEX DIPS, BUT STILL TOPS 2011

The Dodge Momentum Index slipped 1.4% in August to 96.8, down from July's revised level of 98.1 (100 is the index baseline and is derived from the total value of projects in the Dodge database in 2000). The U.S. economy's recent softening may be to blame for the deceleration. The slowing was particularly evident in the commercial segment of the index, which dropped 3.5%. Despite the pullback, the index remains 21.4% ahead of its level a year earlier.



The Dodge Momentum Index is a 12-month leading indicator of construction spending. The information is derived from first-issued planning reports in the largest database of construction projects in the U.S., McGraw-Hill Construction's Dodge Reports. The data have been shown to lead the U.S. Commerce Department's nonresidential spending by a full year.

Top 2012 Government Building Projects

Ranked by construction-starts value through July 2012

Values exclude the construction cost associated with ancillary facilities such as parking garages.

$272M
PROJECT: *Justice Center*
ARCHITECT: ***Skidmore, Owings & Merrill***
LOCATION: *San Bernardino, CA*

$220M
PROJECT: *Wayne County Jail*
ARCHITECTS: ***AECOM*** *Ghafari Associates*
LOCATION: *Detroit*

$152M
PROJECT: *Public Safety Building*
ARCHITECTS: ***HOK*** *Mark Cavagnero Associates*
LOCATION: *San Francisco*

$136M
PROJECT: *Hall of Justice*
ARCHITECTS: ***AC Martin Partners*** *AECOM* ***Levin & Associates*** *Kupiec Architects*
LOCATION: *Los Angeles*

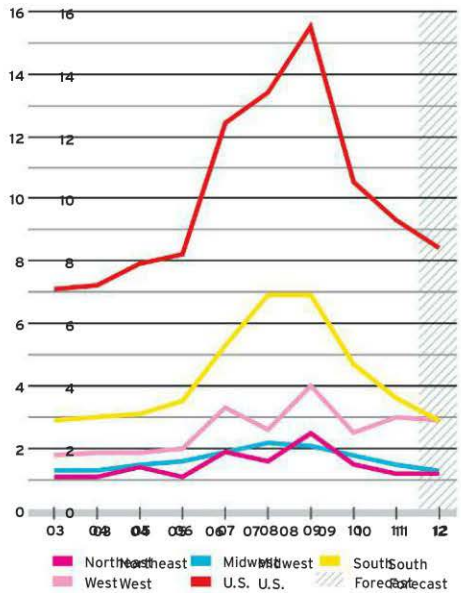
$91M
PROJECT: *Consolidated Courts Complex*
ARCHITECT: ***Fentress Architects***
LOCATION: *Norfolk, VA*

GOVERNMENT BUILDINGS

After a spike prompted by a 2009 federal stimulus package, construction of government buildings continues to drop. This year starts are expected to decline further, to $8.4 billion.

Government Building Starts by Region

Including U.S. total and 2012 forecast figures, by billions of dollars



Top Metro-Area Markets

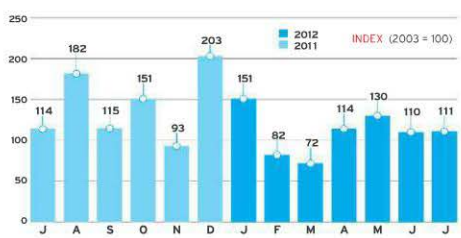
Total government building starts, 1/2011–7/2012

		$ millions
1	Stockton, CA	578
2	Los Angeles	496
3	Riverside, CA	468
4	Washington, DC	404
5	Philadelphia	396

THE DODGE INDEX FOR GOVERNMENT BUILDING CONSTRUCTION

7/2011–7/2012

This index is based on seasonally adjusted data for government building starts in the U.S. The average dollar value of projects in 2003 serves as the index baseline.



McGraw-Hill Dodge Analytics tracks projects from predesign through construction to capture hard construction costs, square footage, and other key statistical information.

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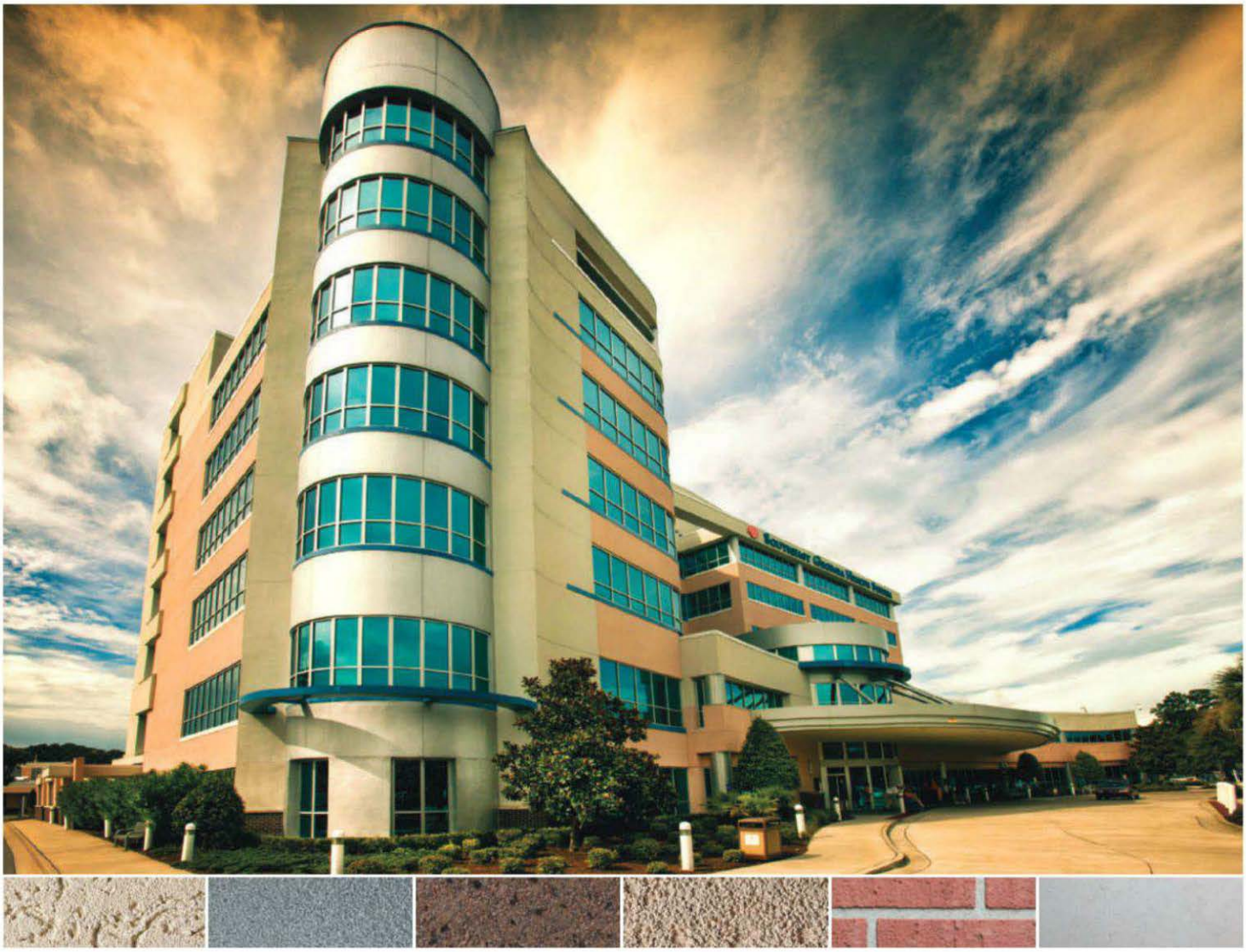

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Project Shown: Southeast Georgia Health System; Brunswick, Georgia; Architect: Gresham, Smith & Partners

CIRCLE 39

Firms in Focus

This month, New York's Architecture & Design Film Festival shows the people behind the projects.

BY DANTE A. CIAMPAGLIA

WHEN ARCHITECT Kyle Bergman organized a small festival of design films at Yestermorrow Design/Build School in 2008, he was surprised when more than 1,000 people made the trip to the tiny Vermont institution to attended screenings. Four years later, the Architecture & Design Film Festival is now held annually at Tribeca Cinemas in New York City and has expanded to include a program in Chicago, with another in Los Angeles debuting in 2013. But despite the event's growth, the goal, Bergman says, remains the same: to present films that show design in creative and challenging ways to as broad an audience as possible.

The 2012 New York edition runs October 18–21, with more than 25 films grouped into some 12 programs of features and shorts, as well as five related panel discussions. The selection includes the formally inventive *Architect: A Chamber Opera*, with a score that samples ambient sound recorded at Louis I. Kahn projects. Other films take on the political side of design. *Mission Statements: The Architecture of Dutch Diplomacy* examines how culture is exported through architecture by focusing on the construction of four Dutch embassies, while *16 Acres* documents the rebuilding of the World Trade Center site. (The 2012 festival is the latter film's U.S. premiere.) Other highlights on the festival schedule profile a single design practice.

The event opens with the world premiere of *Design Is One: Lella and Massimo Vignelli*, an intimate documentary about the legendary designers who have visualized everything from watches to iconic corporate branding (American Airlines, Bloomingdale's, Ford) to a New York City transit-system map lauded for its clarity but criticized for its abstraction when it was in use during the 1970s (the map has recently been reintroduced to show weekend service changes). "Every time we take the subway in New York, we're in Vignelli land," Paola Antonelli, senior curator of architecture and design at New York's Museum of Modern Art, says in the film.

CLOSE-UPS Kathy Brew and Roberto Guerra's *Design Is One: Lella and Massimo Vignelli* (above) profiles the prolific duo; Muffie Dunn and Tom Piper's *Diller Scofidio + Renfro: Reimagining Lincoln Center and the High Line* (right) looks at the firm through the lens of its public projects.

Another standout on the schedule is *Diller Scofidio + Renfro: Reimagining Lincoln Center and the High Line*. At a lean 54 minutes, it's more straightforward than intimate. But its biographical sketch of, primarily, Elizabeth Diller and Ricardo Scofidio has a surprising amount of depth as it charts their evolution from a firm known for imaginative art installations to in-demand architects.

The film also probes what Scofidio calls the blurring of "boundaries between what is public and what is private" by focusing specifically (but not exclusively) on the work that went into New York's High Line park and the redevelopment of the city's Lincoln Center. Both projects—and the greater issue of public versus private spaces—promise to provoke discussion at a panel organized around the film.

"The conversations that happen between the films are really one of the most important parts of the festival," Bergman says. "We're trying to raise the level of design dialogue, not just among pros, but among engineers and lawyers and pediatricians and people who make pizza. As an architect, that's something that I think is really good for the profession." ■

Dante A. Ciampaglia is a writer, editor, and photographer based in New York.

> VIEW A COMPLETE LIST OF FILMS, AS WELL AS A SCHEDULE OF SCREENING AND DISCUSSION TIMES, AT ARCHITECTURALRECORD.COM.

PHOTOGRAPHY (FROM TOP): © JOHN MADERE; CHECKERBOARD FILM FOUNDATION

Taking the Pulse of Architecture

David Chipperfield looks for common ground at the 13th Venice Architecture Biennale.

BY CHRISTOPHER HAWTHORNE

ALMOST BY definition, the Venice Architecture Biennale is a wildly uneven affair. It combines a main exhibition overseen by a major architect, critic, or curator with a scattered collection of separately organized national pavilions. And it seems to get bigger and flashier with every edition, as ancillary exhibitions, press conferences, and Bellini-soaked parties in rented palazzi sprawl across most of the city of Venice. The odds that these diverse elements will come together to offer a compelling message about architecture, architects, buildings, or cities would seem close to zero.

And yet somehow the Biennale, for my money, is the most reliable barometer of the architecture profession ever invented. Taken together, its attractions suggest in surprisingly clear terms what the world's top architects are working on and at what scale; where they're drawing inspiration from and what they're anxious about; and, most useful of all, how their various theoretical factions and geographical camps are getting along (or failing to).

The 2012 version, running until November 25 and anchored by a thoughtful, beautifully crafted, and rather cautious main show by the 58-year-old British architect David Chipperfield, is no exception. It reveals in almost painfully honest terms the clashing ways that architects are reacting to the two most disruptive forces to hit the profession in decades: the digital revolution on one hand and the global economic crisis on the other.

Those reactions vary tremendously depending on the age of the architects involved. In fact, the deep contradictions that slice through the central exhibition—it is optimistic and fearful, judgmental and carefree, generally handsome but occasionally rough around the edges—can mostly be explained by its generational mix. Chipperfield reserved many slots for older architects, both well-known names like Rafael Moneo, Álvaro Siza, and Zaha Hadid and more obscure figures like Hans Kollhoff and Luigi Snozzi.

In the spirit of Chipperfield's rather open-ended theme for the Biennale, "Common Ground," these contributors offer work exploring two subjects in particular: the city and architectural history. Their presentations are heavy on hand-drawn sketches and architectural models, a way for Chipperfield to challenge the ubiquity and influence of the computer rendering—and "the image" more broadly. In his introduction to the exhibition catalogue, he writes that he chose "Common Ground" as the theme "in order to question the priorities that seem to dominate our time, priorities that focus on the individual, on privilege, on the spectacular and the special. These priorities seem to overlook the normal, the social, the common."

Many of the installations he commissioned, with their insistence on safeguarding architectural "quality" (to use a word emphasized in a display by the historian Kenneth Frampton), suggest a circling of the wagons in the face of economic uncertainty and technological upheaval. And there is an inescapable irony in some, if not many, of Chipperfield's choices: To forge links between architecture and the larger society—to explore politics, populism, and the commons of the contemporary city—he recruited many of the very architects and critics who were responsible, in the 1980s and 1990s, for aggressively walling off architecture and architectural theory from those very topics. Thus Peter Eisenman, Jeffrey Kipnis, Bernard Tschumi, and several others are quietly absolved for their earlier sins, which include arguing year after year, in defiantly unreadable prose, that meaningful architectural discourse is something only a handful of privileged initiates deserve access to.

To his credit, Chipperfield sought out collaborators of his own in planning the exhibition, including the London-based critic Kieran Long. The emerging architects they recommended lend the show some much-needed energy and unpredictability. The British firm FAT, for Fashion Architecture Taste, offers a witty study of architectural copying centered around a large model of part of Palladio's Villa Rotonda. The installation suggests how freely architects in their twenties and thirties, so fully at home in a digital world, sample the architectural past. For them, reusing a Palladian detail is not so different from streaming a Truffaut movie on Netflix.

The younger contributors address many of the same themes that the more established ones do. But they do so with an entirely different spirit—and a different agenda. For them, the return to history doesn't represent an attempt to recover architectural standards, as it does for many of the older participants. Instead it's a way to bring variety, irony, and humor back to architecture. If Léon Krier was the invisible figure looking over the shoulders of many of Chipperfield's crew, it was Robert Venturi, Denise Scott Brown, and Charles Moore who inspired the younger participants.

View additional images at architecturalrecord.com.

SHOWING OFF
As part of the main exhibition, an installation by Álvaro Siza (opposite) displays the architect's skill at manipulating simple elements to create evocative spaces. The British firm FAT uses a model of the Villa Rotonda to explore architectural copying (right). At the U.S. pavilion, an exhibit called "Spontaneous Interventions" looks at small urban projects (below).

PHOTOGRAPHY: © MICHAEL MORAN

The show is at its best when these two generational camps come together in a single installation. For one room, the 62-year-old Spanish architect and critic Luis Fernández-Galiano hired 200 recent graduates of Spanish architecture schools—giving them perhaps the only paid work in their field many will receive this year as the eurozone crisis grinds on—and asked them to hold models of recent work by older Spanish architects and explain them as visitors walk through. Chipperfield calls the combination of the unemployed architects and the often stunning architectural models "tragic and beautiful," and he is right.

In the end, the common ground that Chipperfield most noticeably charts is with previous Biennales. In its focus on history and enthusiasm for classical references, this show recalls Paolo Portoghesi's famous 1980 Biennale, "The Presence of the Past," which helped introduce Postmodern architecture. Chipperfield also explores many of the same ideas that filled the superb 2010 Biennale, organized by Kazuyo Sejima, including the vernacular, the well worn, and the handmade.

The best of the national pavilions offers a crisp, energetic antidote to the sometimes ponderous rooms of the main show. Israel's contribution, organized by Erez Ella, Milana Gitzin-Adiram, and Dan Handel, examines the relationship between the U.S. and Israel since 1973, and in particular the ways in which Israel's shift to American-style capitalism has remade its architecture. The pavilion features the kind of political nuance and sardonic humor lacking elsewhere, with models of settlement architecture in the Occupied Territories and bobble-head dolls of Jimmy Carter, Menachem Begin, and Anwar Sadat.

In a pavilion overseen by Toyo Ito, Japan presents a collaboration by three of its most talented younger architects—Sou Fujimoto, Akihisa Hirata, and Kumiko Inui—on a community center for victims of the 2011 earthquake and tsunami. Delicately beautiful models on rough wooden pedestals chart the evolution of the project, which is now under construction in the flood-ruined town of Rikuzentakata.

The American pavilion—organized by the Institute for Urban Design and curated by Cathy Lang Ho, David van der Leer, and Ned Cramer—celebrates 124 small-scale, ad hoc, or temporary improvements to U.S. cities. The range of examples is vast and includes Occupy Wall Street (celebrated as an example of instant city-making) and Alice Waters's Edible Schoolyard. The installation itself is saved from feeling hopelessly overcrowded by the smart exhibition design of the firms Freecell and M-A-D Studio.

The national pavilions are often produced by curators in their twenties and thirties, in contrast to the éminences grises typically recruited to direct the main exhibition. The vitality that marks the best of them suggests how much might be gained by handing over curatorial duties for the main Biennale—the whole enchilada—to a younger figure. Alas, the rumor on my last day in Venice—still unconfirmed as this review goes to press—was that the 2014 show will be directed by Rem Koolhaas. As curious as I am to see how he might shake up and reinvent the Biennale, he is hardly an up-and-comer. ■

Christopher Hawthorne is the architecture critic of the Los Angeles Times.

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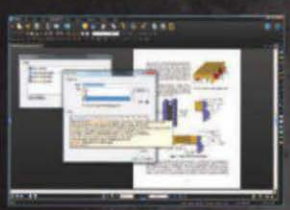

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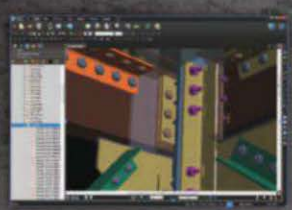

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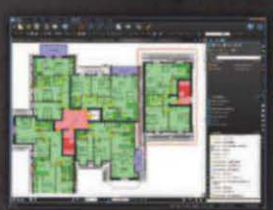

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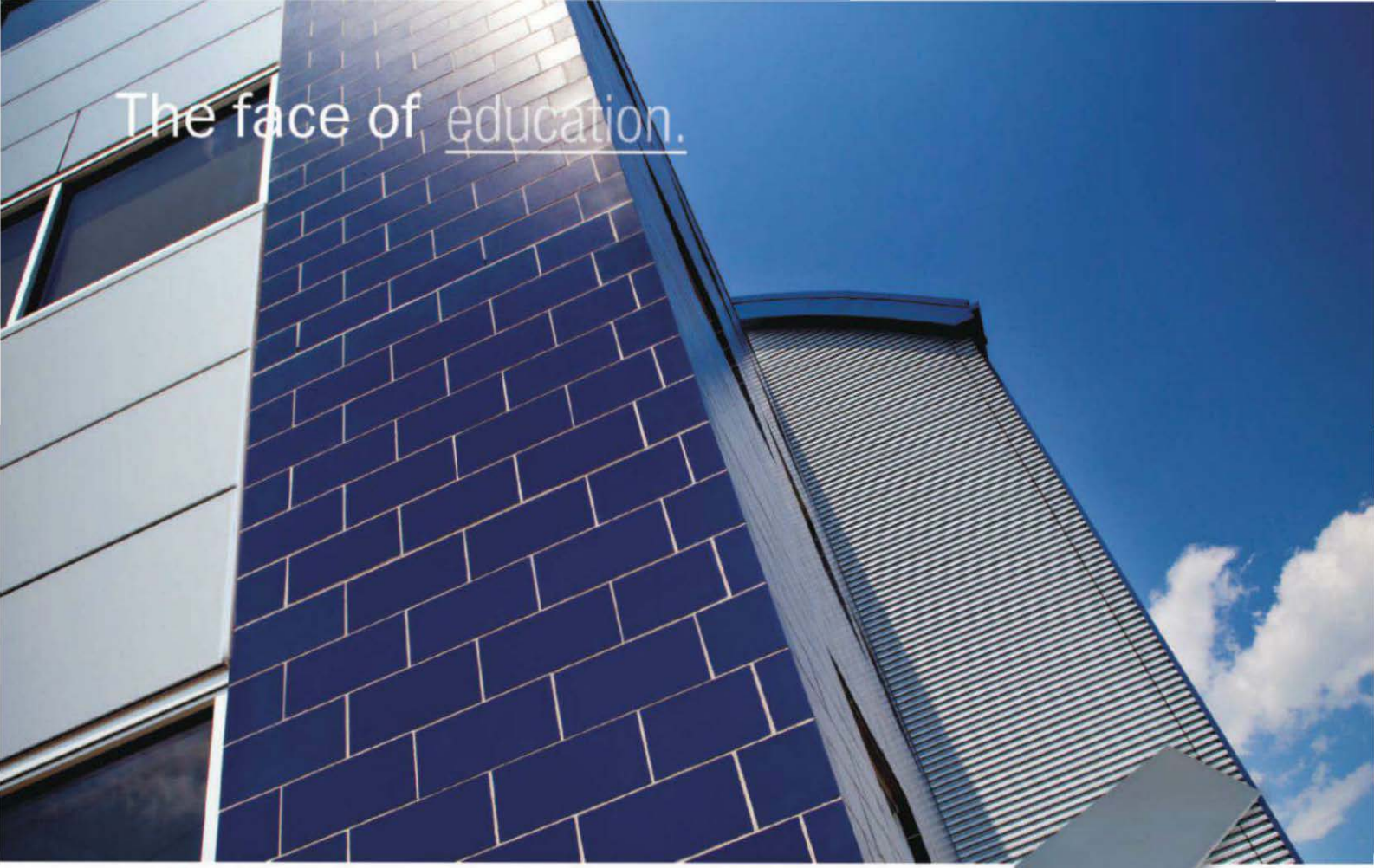

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Masters of the Neighborhood

Goldman Sachs shapes the spaces around its NYC headquarters.

BY FRED A. BERNSTEIN

ANYONE LOOKING for a dream career in architecture—without having to practice—could do worse than to emulate Timur Galen, who, after receiving his M.Arch. at the University of Pennsylvania, noticed, he says, "a real deficit in the world of clients." (Who hasn't?) In his current job as global head of corporate services and real estate for Goldman Sachs, Galen has worked to close that deficit, first hiring Pei Cobb Freed grandee Harry Cobb to design the firm's 42-story headquarters in New York, then bringing in architects like Office dA for the building's cafeteria, SHoP for its auditorium, and Architecture Research Office for its fitness center. For years, he presided over weekly meetings with Cobb and the young turks chosen to design stylish amenities for the building. Cobb, who had recommended several of the firms, served as a kind of curator and occasional conciliator.

But Goldman's ambitions didn't stop with its own offices; it was determined to remake its surroundings, a relatively quiet section of Battery Park City, kitty-corner from the World Trade Center site. The first target was a red-brick building, immediately west of Cobb's, containing an Embassy Suites hotel, the Regal multiplex theater, and several restaurants, including an Applebee's, that, Galen notes, could have been anywhere. Goldman asked Preston Scott Cohen, known for his Tel Aviv Museum of Art addition, to design a glass canopy over the alley between the two buildings.

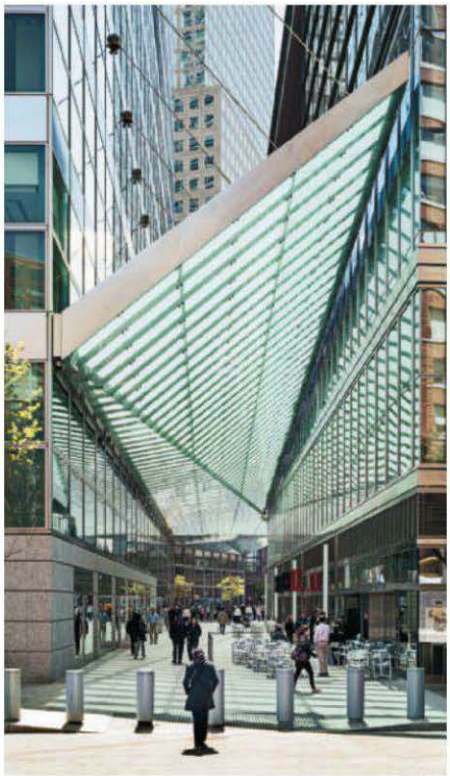
With the angled canopy giving the 30-foot-wide alley an architectural presence, Goldman commissioned an A-list design team including Kohn Pedersen Fox and Monica Ponce de Leon, the University of Michigan architecture dean (and former principal of Office dA), to renovate and upgrade the hotel building (which it owns), turning the property into the Conrad New York. A grand stairway ties the hotel to the alley. The addition of benches by landscape architect Ken Smith, and a group of stores and restaurants by architects like Rogers Marvel and Bentel & Bentel, complete the makeover.

For Goldman's employees, there's nothing but upside—the sleek Modernist style of its own building now extends into the public sphere (which is why the building's back door, opening onto the alley, is busier during the day than its larger front entrance).

There appear to be benefits for the rest of the neighborhood as well. April Koral, publisher of the *Tribeca Trib,* says that TriBeCa residents are now beginning to cross West Street to shop and dine in what is becoming known as Goldman Alley (officially it's North End Way). If the passageway is not exactly abuzz, it's at least ahum. And a $250 million upgrade to the public spaces of the nearby World Financial Center, designed for owner Brookfield Properties by Pelli Clarke Pelli, should further the process.

But Galen concedes that creating a $2 billion bank headquarters is necessarily a conservative undertaking, and there isn't much here to contradict him. The architectural flourishes are beautiful but rarely innovative. And making room for Cohen's glass canopy required the removal of a large movie-theater marquee, a bit of complexity and contradiction that Robert Venturi—for whom Galen worked during and after architecture school—might relish. But how can there be signs for the Regal now that Goldman reigns? The most moving part of this section of Battery Park City is still the Irish Hunger Memorial, completed in 2002, with its quarter acre of Irish countryside by the artist Brian Tolle—a monument to poverty and economy of means in a neighborhood of sleek affluence. ■

Contributing editor Fred A. Bernstein studied architecture and law and writes about both subjects.



BANKING ON DESIGN A glass-and-steel canopy by Preston Scott Cohen covers an alley (left and above) between the Goldman Sachs headquarters by Pei Cobb Freed and the Conrad New York, a collaborative design effort.

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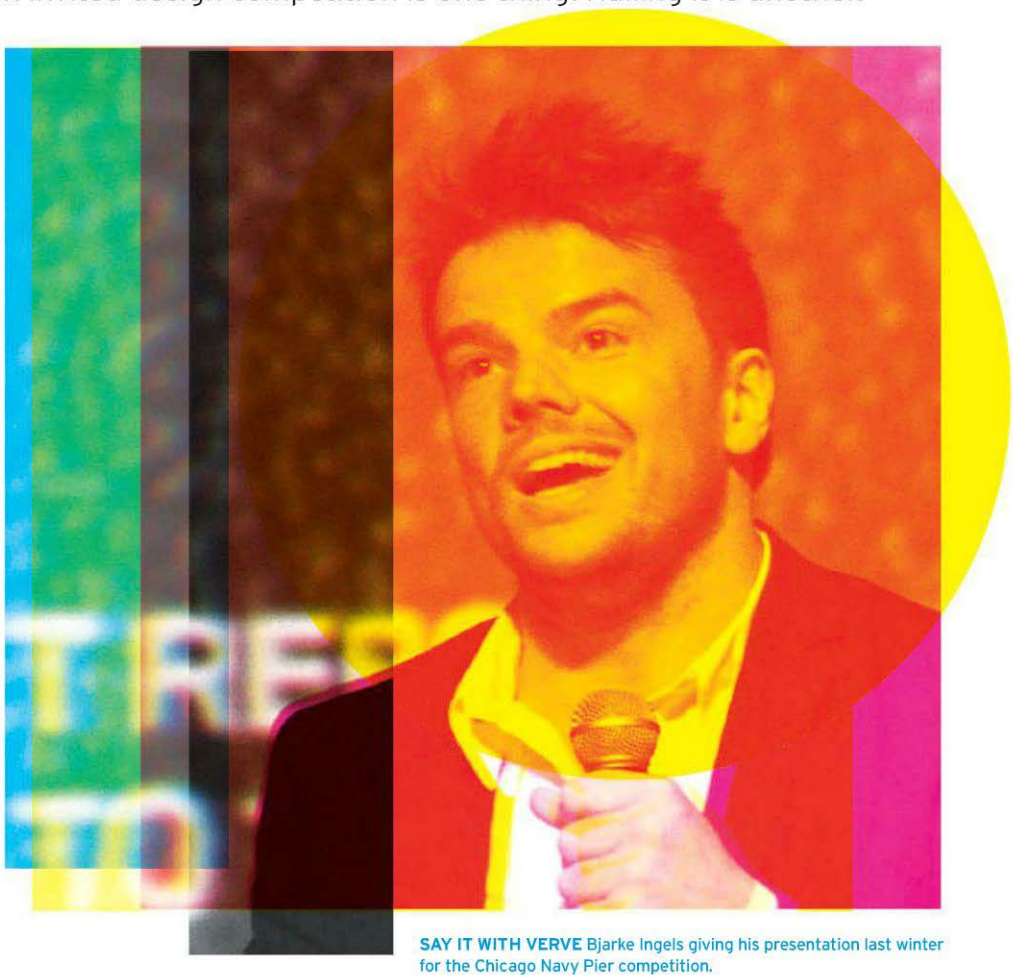
CIRCLE 64

The Art of Presentation

Getting on the short list of an invited design competition is one thing. Nailing it is another.

BY SUZANNE STEPHENS



SAY IT WITH VERVE Bjarke Ingels giving his presentation last winter for the Chicago Navy Pier competition.

DOES THE best design always win a competition? Not necessarily. Vying for a commission is a tricky process, especially when you're up against a short list of your peers. Who can forget the impression that Daniel Libeskind made in the public presentation a decade ago for plans to rebuild Ground Zero? With less experience than the other six contending teams, he came out on top. Was it just the strength of his scheme? Or did it help that his presentation, with his coming-to-America immigrant saga, captured the imagination of public officials and much of the audience?

"Few architects realize the presentation is key," says Bill Lacy, the dean of design-jury advisers, who has helped guide the selection of the architect for the California Academy of Sciences (Renzo Piano), the Nelson-Atkins Museum of Art addition (Steven Holl), and many others. Ed Feiner, a principal with Perkins+Will, who ran the Design Excellence program at the General Services Administration from 1996 to 2005, agrees. After the short list is formed, he notes, "the due diligence is over," and the client expects that each architect on the list could do the job. The deciding factor? "Probably the most important element is the interview," says Feiner. Eugene Kohn, partner at Kohn Pedersen Fox and a master presenter known for his smooth style—sincere, serious, yet laced with humor—says: "You don't win without a good scheme and a good team, but you can blow it on the presentation." There is no winning formula, but you can learn from architects with a convincing style and advisers who witness such performances.

If you are really confident—and have the personal charisma to match it—less can be more. Philip Johnson was famous for arriving without notes and not showing any slides, in those pre-digital days. And he'd get the job. Edward Larrabee Barnes would pull out a piece of paper with a doodle on it from a jacket pocket, then another sketch from another pocket, and so on. And he'd get the job. I.M. Pei has walked into interviews without models or drawings, just ideas and quiet charm. Piano—who usually declines to even participate in competitions—may arrive at client meetings with nothing more than his beguiling Italian accent and green felt-tip pen to make a few seemingly impromptu sketches.

That technique won him a prestigious museum commission after he'd followed a famous rival who gave "one of the most extravagant presentations ever," according to one observer. Piano simply sat at the same conference-room table, but without any models or drawings—just a sketch pad and his charming, lilting voice. "He was relaxed and persuasive," says our source. "But you have to be good at this."

And those back-to-back interviews can be daunting. "Presenting is like speed dating," says developer David Levinson, whose company, L&L, is planning a tower at 425 Park Avenue in New York. With architect and planner Vishaan Chakrabarti as adviser, Levinson winnowed a list of 11 firms to four architects: Norman Foster of Foster + Partners, Richard Rogers of Rogers Stirk Harbour, Zaha Hadid, and Rem Koolhaas of OMA. They made the first round of presentations in July, with a final decision to be made this month. Levinson admits, "Seductive presentations bring you into their vision."

Preparation, of course, matters, though winning architects have varying techniques. "Take public speaking and keep practicing," advises Kohn. T.J. Gottesdiener, the seemingly modest

PHOTOGRAPHY: © JENNIFER GIRARD

managing partner of Skidmore, Owings & Merrill, says: "We rehearse for hours, so we feel comfortable." But Liz Diller, another artful presenter—an intellectual who is articulate yet down to earth—doesn't agree. "I feel when I practice, I lose my edge," says the principal of Diller Scofidio + Renfro. The charismatic Bjarke Ingels of Bjarke Ingels Group (BIG) comes on with an upbeat ebullience and straight talk. "Juries are often dominated by non-architects," he says. "Using introverted architectural lingo doesn't help."

Longtime architectural partners develop their own modes of presentation—a kind of duet that depends on each one's strengths. When Tod Williams and Billie Tsien interviewed for the commission to design the new Barnes Foundation in Philadelphia, they struck a balance of clarity and enthusiasm, recalls Martha Thorne, the executive director of the Pritzker Architecture Prize and adviser for the Barnes selection committee: "Tod had an optimistic, nervous energy. Billie was calm. It was like watching smoothly flowing water." That style extended to the content of their presentation. "The abstract ideas in their explanation were countered with a real understanding of the program," says Thorne.

WOW FACTOR
MVRDV's animation for the China Comic and Animation Museum in Hangzhou helped get the commission in 2011.

How to convey the essence of your scheme—with a little or a lot?

What hurt the losers on the short list of the Barnes competition? Diller presented three schemes, giving a detailed analysis of each. "You can overthink a solution," she now admits. "My instinct is to show that decisions are complex and layered. But that is not necessarily the way to get the job." Some clients like to see flexibility but, says Thorne, it can hurt if it appears the architect doesn't have a strong conviction or is not comfortable with the program. Yet too much conviction can be even more damaging. One of the other short-listed architects presented a scheme that veered far from the prescribed program. When asked if he would consider altering his design, he said, politely, no.

It seems obvious to point out that you should learn as much as you can about a project before you meet the jury. Feiner recalls a famous architect who didn't have time—or didn't bother—to check out the site for a National Institutes of Health facility in Bethesda, Maryland. Another short-listed architect, Robert Frasca of Zimmer Gunsul Frasca, won the job by his knowledgeable discussion of the hospital's impact on the neighborhood. Last year, when Ingels successfully went after a new building for the Kimball Art Center in Park City, Utah, the Danish designer points out, "we were competing against American firms. So we really familiarized ourselves with the historic neighborhood and the city, looking for that thing that would make the design idea have relevance to the community. We even went skiing."

Of course, despite those rare architects who walk into interviews alone and unadorned, bringing along stunning visuals—drawings, models, computer renderings, and digital presentations—is more important than ever. Architect Russell Crader of Adjaye Associates says that the wow factor goes to firms like MVRDV, OMA, and Herzog & de Meuron, whose sophisticated animations, with music and subtitles, seem essential to nabbing commissions in the global marketplace, especially if there's a language barrier. Just check out MVRDV's presentation for the China Comic and Animation Museum in Hangzhou, with an animated video that showed their proposed design was based on clusters of speech balloons from cartoons. Besides the fact they got the commission, their animation has had 43,000 hits and counting on YouTube.

As projects have become increasingly complex, choreographing your presentation by bringing along the right consultants matters more than ever, too. "It often seems you can't get on a short list for a hot-dog stand without having four or five consultants," says Ingels. But beware of allowing too many team members to talk. "It can be distracting," says Kohn, who suggests that clients usually want to see the whole team but hear only from one or two presenters.

Still, even a veteran like Kohn can miscalculate. Recently, KPF lost out on a mixed-use project in London, which included a hotel, because the developers wanted to hear more from the team's specialists—such as those with expertise in hotel design. "And we had the most beautiful presentation," Kohn says somewhat ruefully.

No one wins them all. Ingels (who was on a team with AECOM) lost a major commission to redesign the Chicago Navy Pier, which went to James Corner Field Operations last winter. But his memo-to-self: "Make sure you are doing something that satisfies your curiosity and desire for experimentation. The losing scheme could be a breakthrough that will inform the next project." Diller agrees. "It's another opportunity to think through certain problems," she says. And like Ingels and other colleagues such as Gottesdiener, she takes one more step when she gets the bad news—she calls the client to find out why her firm lost. "While it may be hard to muster emotional energy," Diller says, "it does give you a sense of closure." And there will always be a next time. ■

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perspective **house of the month**

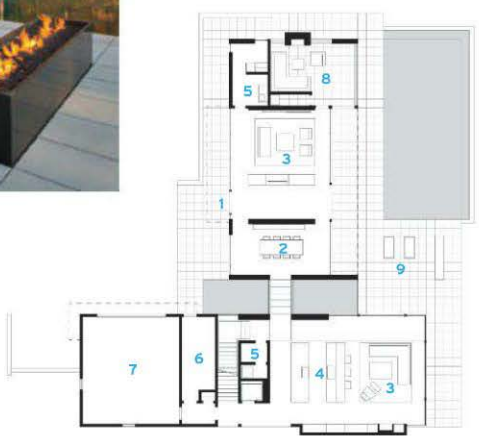
ROBERT GURNEY'S WISSIOMING2 IS A SUBURBAN REFUGE OUTSIDE BUSTLING WASHINGTON, D.C., WITH MONDRIAN-INSPIRED WINDOWS AND CUBIC VOLUMES NESTLED IN THE MARYLAND WOODS. **BY LAURA RASKIN**

MATERIAL GOODS Architect Robert Gurney preserved trees by siting the house around an existing driveway. A glass bridge crosses a reflecting pool and connects the two volumes (left). A formal living room and the master bedroom look out onto the infinity pool and woods from glass window walls (below left). Inside, the architect kept the palette muted to reflect light: white-oak floors on the second story (below right) and terrazzo-covered concrete slabs on the first.

WHILE WASHINGTONIANS haven't exactly led the pack in their desire for modern residences, Robert Gurney, a D.C.-based architect, says that has dramatically changed since he began his practice in 1990. "Now there's no shortage of people who want to do modern projects," he says, including his client who commissioned two neighboring houses in Glen Echo, Maryland, just outside the city. (Incidentally, Glen Echo is home to an enclave of about 20 mid-century houses by Keyes, Lethbridge, and Condon.)

The client, a developer, lives in one of the two, an 8,255-square-foot concrete-and-wood structure clad in mahogany, cement-board panels, and corrugated metal. The architect divided formal and informal spaces between two main rectilinear volumes, which connect via a glass bridge to form a T-shaped plan. Formal living and dining rooms are housed in the southern volume, while a kitchen, more relaxed living space, and garage define the northern one. Gurney further articulated the cubic forms by cantilevering some of the bedrooms.

Mondrian-inspired steel-framed windows lead to the woods and an infinity pool. With views of the Potomac as well, "this is so much about the outdoors," says Gurney. ■



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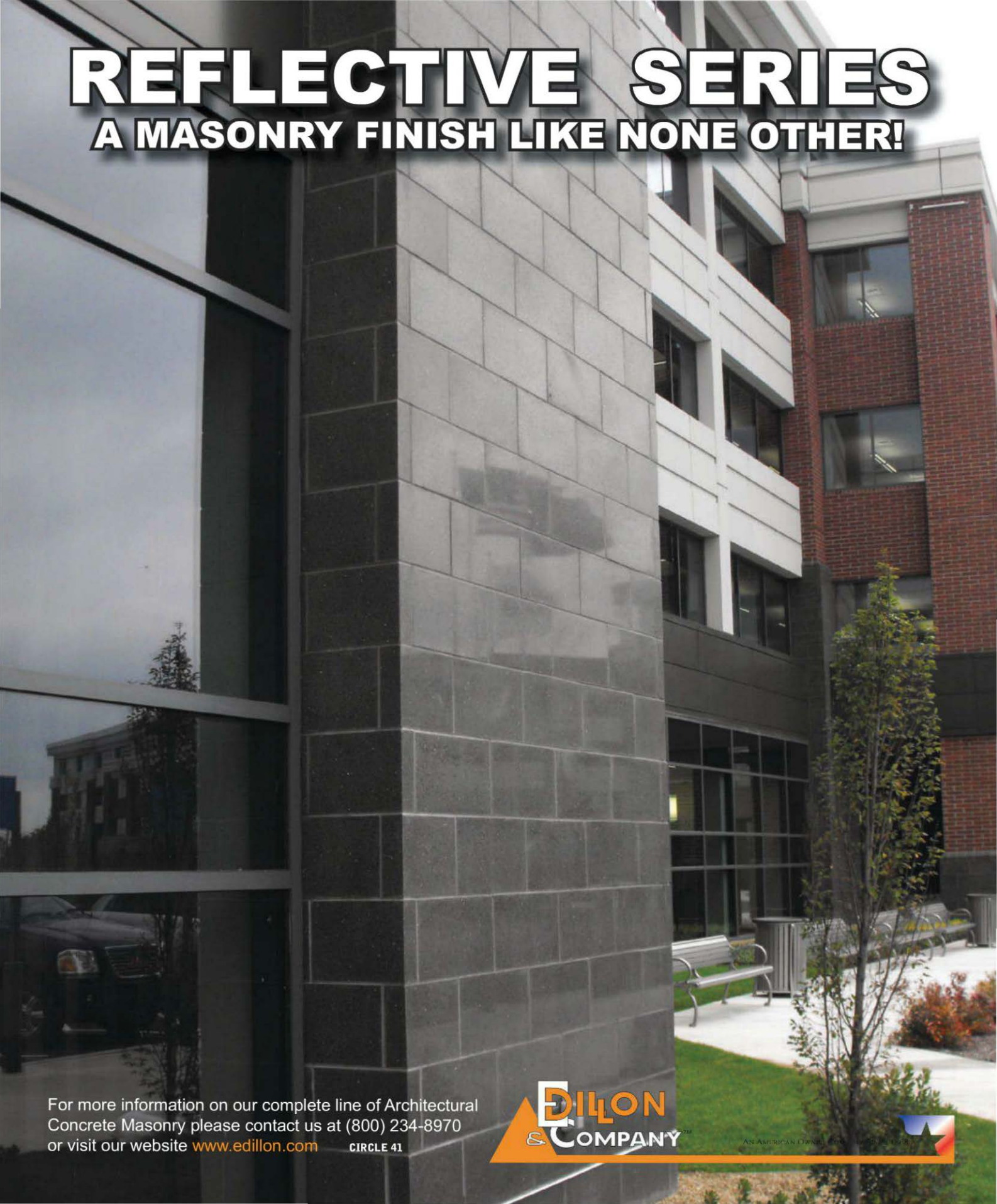
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Cladding Bridges New Pavilion to Bay Area Landmark

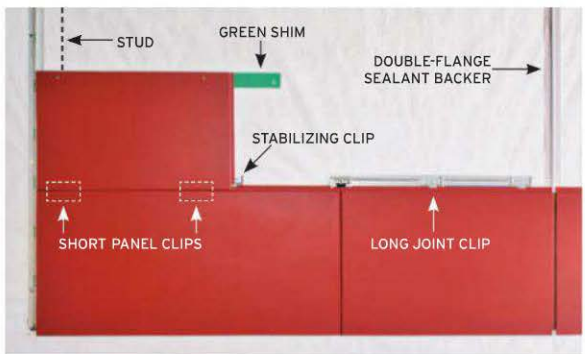
NOT MANY bridges are well known enough to merit their own visitors' center, but San Francisco's Golden Gate is an exception. In May, as part of the bridge's 75th-anniversary celebration, the Golden Gate National Parks Conservancy opened the Bridge Pavilion to welcome an estimated 10 million annual visitors to the site. Located next to the toll plaza on the San Francisco side of the bridge, the 3,500-square-foot pavilion is linked to the world-famous landmark by color, employing an International Orange fiber-cement cladding from Nichiha USA.

According to John Jackson, director of architecture at San Francisco–based Project Frog, the lead architect, the team used a prefabricated kit of parts to design and build the structure. "In a matter of weeks we had a high-quality, energy-efficient building envelope, ready for the interior tenant improvement work to begin," says Jackson. The firm chose Nichiha's Illumination Series panels to help the building become "a modern interpretation of other masonry structures" on the historic site, including administrative buildings and the Art Deco Round House, says Jackson. He also cites the moisture-control benefits of the rainscreen system, the durability of the fiber-cement material, and the straightforward custom-color system that allowed the team to relate the building to the bridge. Containing 40% recycled content, the cladding works in tandem with other sustainable features, including Serious Energy suspended film glazing and interior and exterior LED lighting.

Nichiha uses a hidden-clip system that holds the panel ¼" from the vapor barrier, creating an air space for moisture to drain away from the building. Michael Cobb, vice president of sales and marketing for Nichiha USA, says the fire-resistant panels were produced by the Japanese building industry—which has had its fair share of experience with earthquakes—making them a good option for San Francisco. The ⅝"-thick fiber-cement composition includes portland cement, wood fibers, and fly ash. A built-in gasket system and V-groove panel joints help prevent moisture penetration.

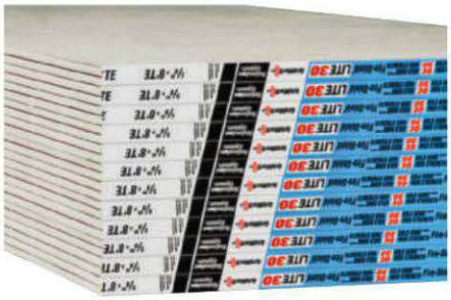
The 18"-x-6' panel dimension allowed Project Frog to use the panels straight from the box, eliminating extra cutting and waste and saving time. In the end, the material felt right to Jackson: "All the other boards had a flat finish to them, which is great in some applications. In this one we really liked the actual texture on the panel itself."

nichiha.com CIRCLE 200



ICONIC MATCH
For the Golden Gate Bridge's new welcome center, San Francisco–based Project Frog selected a fiber-cement cladding that was easily finished with the landmark's signature color, while also offering the moisture-control benefits of a rainscreen system.

PHOTOGRAPHY: MARIKO REED (TOP)



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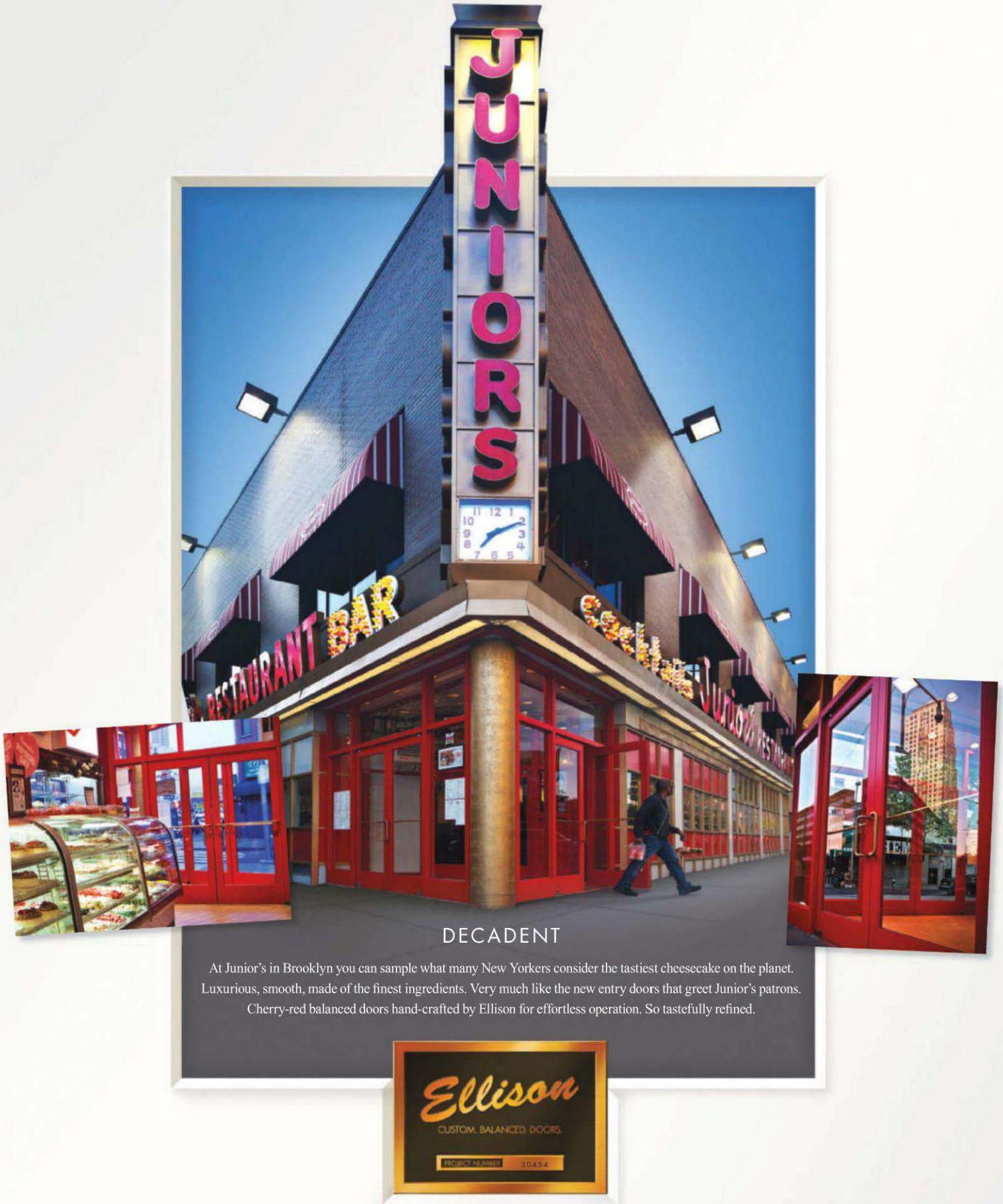
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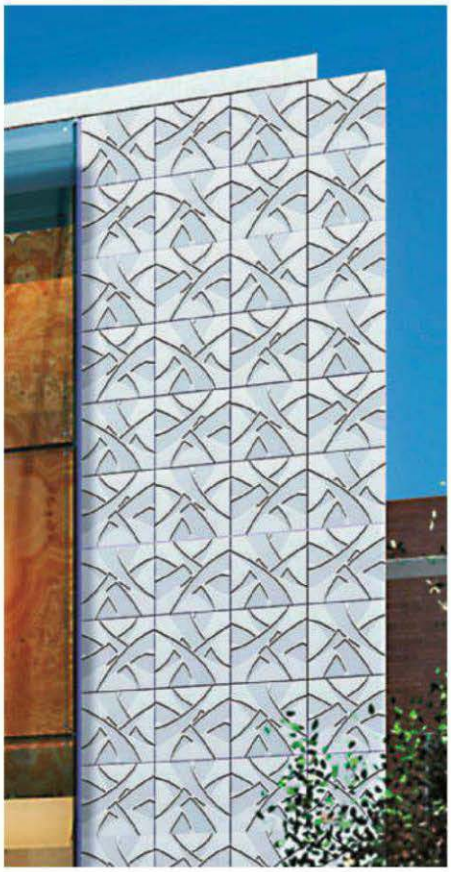

Dri-Design/DuPont Corian Cladding

Dri-Design dri-design.com/CorianEC

Dri-Design and DuPont Corian have collaborated on the first exterior-wall system that will include Corian surfacing as a standard offering. In the new system, Corian EC panels are fastened to Dri-Design's pressure-equalized, rainscreen metal wall-panel system for use as cladding on buildings four stories and less in the United States and three stories and less in Canada. The solid-surfacing panels come in a palette of 29 colors, two standard sizes, and eight textured patterns (custom colors, sizes, and patterns are also available). The manufacturers claim the panels offer excellent colorfast qualities and resistance to humidity, pollutants, detergents, water absorption, and freeze-thaw cycles. The panels' sustainable features include 100 percent recyclable aluminum, 20 percent recycled content in some of the Corian colors, and zero-landfill status for the Corian EC (none of the manufacturing waste is sent to a landfill). CIRCLE 207

SureFlo Automatic Soap Dispenser

Bobrick bobrick.com

The SureFlo automatic dispenser fills easily from the top, and one jug of the dispenser's bulk soap replaces the waste of five under-counter cartridges. Precise electronic optics inside the dispenser help eliminate the need for hand-waving and prevent false activations that waste soap. The chrome finish coordinates with other restroom fixtures, and battery or hard-wired operation is available. CIRCLE 208

Translucents Canopies

USG usg.com

Translucents Canopies offers three curvy configurations that can be suspended individually or connected with hardware for larger ribbonlike arrays. Ideal for gaming, hospitality, health-care, retail, and office spaces, the panels can be suspended under the standard troffer light fixtures located in a suspended ceiling or lit from above with point-source lighting. The acrylic version offers up to 50% recycled content. CIRCLE 209

Mogens Koch Bookcase System

Carl Hansen & Son carlhansen.com

This "new" bookcase from Carl Hansen & Son was designed in 1928 by Danish architect and designer Mogens Koch (1898–1993) for his own storage use. It was put into production in 1932 by Rud. Rasmussen, a renowned Danish furniture manufacturer that Carl Hansen & Son bought last December. Crafted by hand with carefully selected thin wood panels, the bookcase has been produced continuously for more than 75 years but is only now available in the United States. Skilled cabinetmakers use traditional dovetail joints and rabbet joints to provide high strength and stability to each bookcase system. The original design spawned many variations including a wardrobe, a display unit, and a cabinet for drawings, but only the bookcase is being sold currently through Carl Hansen & Son. The solid-oak system comes in several dimensions and finishes and can be placed on bases or wall-hung. CIRCLE 210

For more information, circle item numbers on Reader Service Card or go to architecturalrecord.com/products.

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Franklin D. Roosevelt Four Freedoms Park
Design Architect: Louis I. Kahn, FAIA
Architect of Record: Mitchell Giurgola Architects

Columbia University Medical Center -
Physicians & Surgeons Medical and Graduate Education Building
Design Architect: Diller Scofidio+Renfro
Executive Architect: Gensler

Princeton University –
Andlinger Center for Energy and Environment
Architect: Tod Williams Billie Tsien Architects

51 Astor Place, Commercial Office Building
Design Architect: Maki and Associates
Executive Architect: AAI Architects, P.C.

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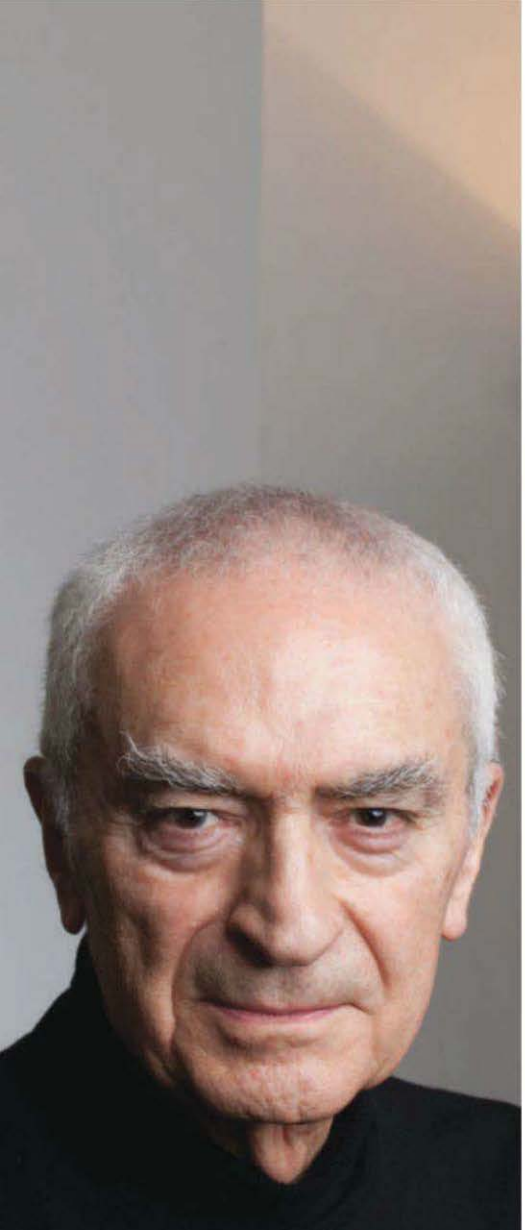

Congratulations, Massimo and Lella Vignelli, on the premiere of the film about your groundbreaking work, "*Design is One*"

Over a decade (1982-89 and 1991-96), Massimo Vignelli was the design consultant who created *Architectural Record*'s elegantly modern look.

ARCHITECTURAL RECORD

Photo © John Madere

OPENING NIGHT FILMS

ADFF's opening night film on October 18th at Tribeca Cinemas will be the world premiere of ***Design is One: Lella & Massimo Vignelli,*** a fascinating retrospective on the work and relationship of these two seminal figures, directed by Robert Guerra and Kathy Brew.

Another opening night film for ADFF, the U.S. premiere of ***16 Acres,*** will be presented in partnership with the Municipal Arts Society, and take place at the Time Warner Building. ***16 Acres,*** a film by Richard Hankin, is the dramatic story of the rebuilding of the World Trade Center site as told by the key players who have shaped its redevelopment.

architecture & design film festival

SELECTED FILMS

A partial listing of other films offered during the four-day festival includes:

ARCHITECT: A Chamber Opera in Six Scenes – based on the work of Louis Kahn

Mendelsohn's Incessant Visions – a look at the life and work of Erich Mendelsohn as told through letters between the architect and his wife

Diller Scofidio + Renfro: Reimagining Lincoln Center and the High Line

Modern Tide: Midcentury Architecture on Long Island

Coast Modern – a celebration of west coast modernism

Bauhaus: Model & Myth – first-hand accounts told by people who attended the school

Life Architecturally – about the Australian husband and wife team, architect Robert McBride and interior designer Debbie Ryan

From Nothing, Something – a thoughtful, intimate, often funny look at the creative process – straight from the minds of some of our culture's most accomplished and inspiring talents

Jeanne Gang: The Sky's the Limit

Mission Statements: The Architecture of Dutch Diplomacy

Most films are eligible for CEU credits

SELECTED SPEAKERS

In addition to a wide-ranging variety of films, the festival will include panel discussions and Q&A's with some of today's design leaders, critics and filmmakers, including:

Massimo Vignelli – Designer
Charles Renfro – Architect and Principal of Diller Scofidio + Renfro
Rick Bell – Director of the Center for Architecture in New York
Suzanne Stephens – Deputy Editor of *Architecture Record*
Jane Loeffler – Author
Jord den Hollender – Architect and Filmmaker
Tomas Rossent – Architect and Principal of Ennead Architects

For the complete schedule of festival offerings, and to purchase tickets, please go to our website

CIRCLE 96 **adfilmfest.com**

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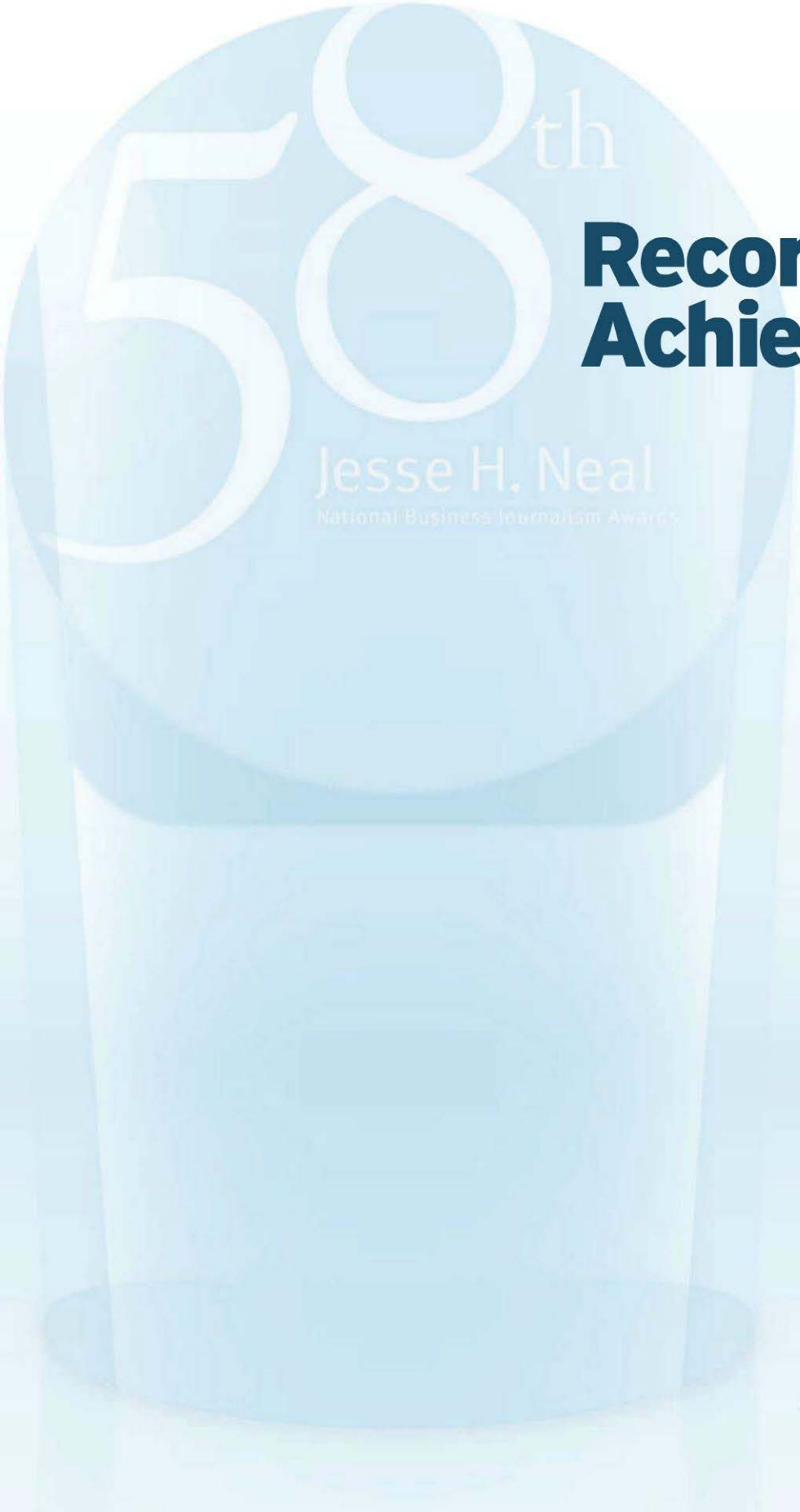
*Based on brightness comparison to the sun and 5,500 K burning temperature. †LED lights are more efficient than standard xenon lights based on light-emitting diodes for all light functions. Full LED headlights are an optional upgrade. "Audi," "A8," "Audi connect," "quattro," "Truth in Engineering," the Audi Singleframe grille design, and the four rings and Audi emblems are trademarks or registered trademarks of AUDI AG. ©2012 Audi of America, Inc.

SKY LOBBY AT THE JAMES NEW YORK



Record Achievements

BIG WINS THIS YEAR FOR ARCHITECTURAL RECORD

The 58th Annual Jesse H. Neal Awards

2012 GRAND NEAL

Judged on service to the industry, editorial craftsmanship, journalistic enterprise and innovation.

Architectural Record also won Best Use of Social Media; Best Integrated Package; and Best Single Issue of a Magazine (Sept. 2011).

2012 BtoB Magazine

MEDIA POWER 50

Selected on the basis of ad revenue, audience, and something even more valuable: influence, as evaluated by the nation's top media buyers, advertisers and industry analysts.

2012 BtoB Magazine

GREAT MEDIA WEBSITE

The industry barometer of best practices in driving web traffic and connecting with professional audiences. Judges analyzed key metrics and measured the amount of user-generated content for Architectural Record's new Continuing Education app.

2012 MIN Sales Executive of the Year Awards

TEAM LEADER OF THE YEAR

Architectural Record Publisher Laura Viscusi was recognized for more than just her team's success, but for her innovation in helping customers achieve their own marketing goals.

ARCHITECTURAL RECORD

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CIRCLE 82

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CIRCLE 46

NEW LIFE FOR THE AMERICAN CITY

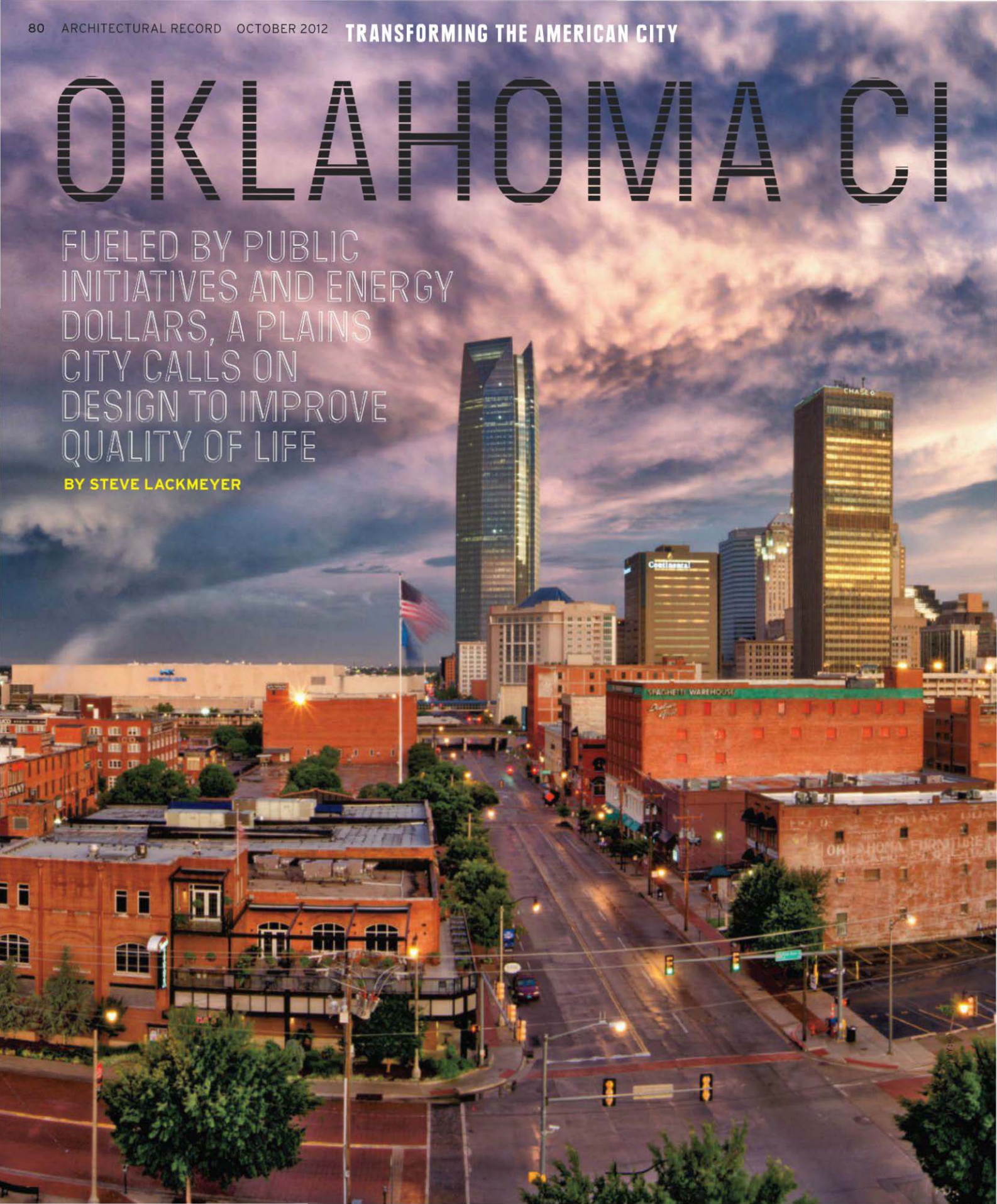
PHOTOGRAPHY: © JAMES EWING

TODAY ONE-THIRD of the U.S. population lives in central cities, the highest proportion since 1950. How are urban centers responding to growth, and how do they find imaginative ways for creating vital places to live and work? In this issue we investigate three metropolitan areas in the process of reinventing themselves—Oklahoma City, Pittsburgh (Forbes Avenue is shown here), and Cleveland—and examine how they are changing, through public initiatives, architecture, and urban design. In these cities, long-term investment, rather than opportunistic development, is the key to building a promising future. ■

OKLAHOMA CI

FUELED BY PUBLIC INITIATIVES AND ENERGY DOLLARS, A PLAINS CITY CALLS ON DESIGN TO IMPROVE QUALITY OF LIFE

BY STEVE LACKMEYER



TY, OK

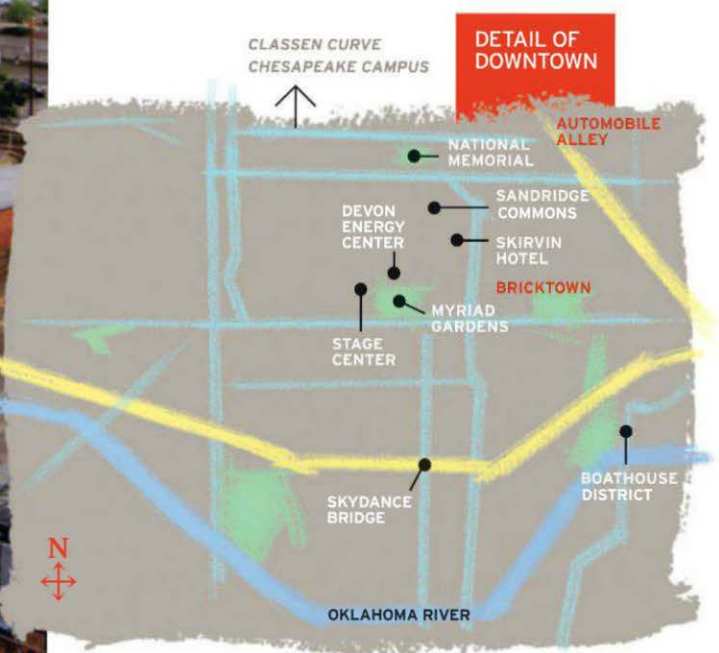
Even with temperatures in the low 100s, Oklahoma City residents gathered in droves this summer to enjoy weekly outdoor movies on a grand lawn just beyond the glimmering new 50-story Devon Energy Center and marvel at the ongoing transformation of their downtown.

Oklahoma City, a sprawling, vehicle-addicted community long known for big-box architecture and chain stores rather than boutique shopping and style, is celebrating a renewed emphasis on architecture and design. A downtown declared dead in 1989 by city-council members is now home to a growing population that routinely gathers for independent-film screenings, live musical performances, and other cultural events. It has not just survived but thrived through the "great recession" of 2009. It ranked seventh in the nation for private-job growth between 2010 and 2011, with a 2.75 percent jump of 12,000 new jobs (and placed third, at 3.68 percent, for new retail jobs). Population growth last year ranked 34th nationally, while a 4.9 percent unemployment rate is the lowest in the country among metropolitan areas with more than 1 million residents. OKC once briefly lost its orchestra, yet recently ranked in the top 10 percent of all U.S. cities in arts and entertainment employment. A mix of energy companies, aviation, and biosciences firms are credited with placing the metropolis of 1.2 million atop this year's Gallup Job Creation Index.

At the heart of it all, the new Devon Energy Center (page 86) punctuates a skyline undergoing dramatic change, and another $100 million redevelopment is under way nearby at SandRidge Energy. To the south, sleek, sharp-edged boathouses now line the once-derided Oklahoma River, home to a growing mix of amateur, collegiate, and Olympic rowing enthusiasts.

Jeff Speck, author of *Suburban Nation* and the forthcoming *Walkable City*, applauds how quickly Oklahoma City is making over its downtown streets and sidewalks with Project 180.

PHOTOGRAPHY: © THOMAS TUCKER; MAP BY NORMAN HATHAWAY



The $115 million initiative is funded through a tax-increment-financing district created with the construction of Devon Energy Center. In just four years, all one-way streets are being converted to two-way, and curbside parking spots, bicycle lanes, landscaping, lighting, and other amenities are being added. "Of the automobile-oriented cities in which I've been working, none has made such a dramatic commitment to reorganizing its street structure around welcoming pedestrians and bicycles in the way Oklahoma City has," Speck says.

Energy dollars are driving part of this renaissance, but architects argue that the transformation is more nuanced—and rooted in public initiatives pursued 20 years ago. Hans Butzer, who recently followed up his award-winning design of the Oklahoma City National Memorial (in honor of the victims of the 1995 bombing of the Murrah Federal Building) with a pedestrian highway crossing dubbed SkyDance Bridge, sees a once-drab Plains city aspiring to increasingly ambitious design. He credits planning advocates,

OKLAHOMA CITY HAS NOT JUST SURVIVED BUT THRIVED THROUGH THE RECESSION

young and veteran architects, civic leaders, and grassroots groups with collaborating to shape the city's growth. "There are a lot of forces at play here coming together for a perfect storm on the Plains, putting us on the cusp of a great age in design for Oklahoma City," Butzer says. "We just happen to be fortunate enough to have some energy companies that share the understanding of how encouraging better architecture and better planning creates a healthy community socially, economically, and culturally." Some of the country's top designers are being drawn to Oklahoma City to work on the headquarters for its energy employers. Devon employed Connecticut firm Pickard Chilton and San Francisco–based Gensler, while New York–based Rogers Marvel was commissioned to make over the Pietro Belluschi–designed Kerr-McGee Tower as well as the historic former Braniff Airlines building and combine them with new construction and park space into one cohesive campus for SandRidge Energy.

Perhaps no local architect has benefited more from the influx of energy dollars than Rand Elliott, who was commissioned by Chesapeake Energy chief executive officer Aubrey McClendon to oversee master planning and architecture for the company's 50-acre neo-Georgian campus (and its subsequent modern interventions) and the design of OKC's first contemporary shopping center, Classen Curve (page 90). With backing from Chesapeake and Devon, Elliott has also recently designed three boathouses along the riverfront that kicked off development on this previously neglected waterway.

Interestingly, Elliott famously criticized the architectural legacy of energy companies during the 1980s boom. "The early '80s brought to Oklahoma City those seeking fame and fortune," he said back then. "They saw us as a Class C city, and they gave us what they felt we should have. We were an easy mark. Oil-boom boxes sprang up everywhere. It happened so quickly we hardly stopped to question the long-term impact." Now, notes Elliott, the city has matured, and design along with it. "I've never imagined Oklahoma City playing as a team like it is right now," he says. "In the 1980s, a small group of influential people were in charge. Now leadership is much broader. The '80s was about personal gain. Today is more about collective benefit."

The change in Oklahoma City's approach toward its built environment is widely credited to voters' 1993 passage of Metropolitan Area Projects (MAPS),

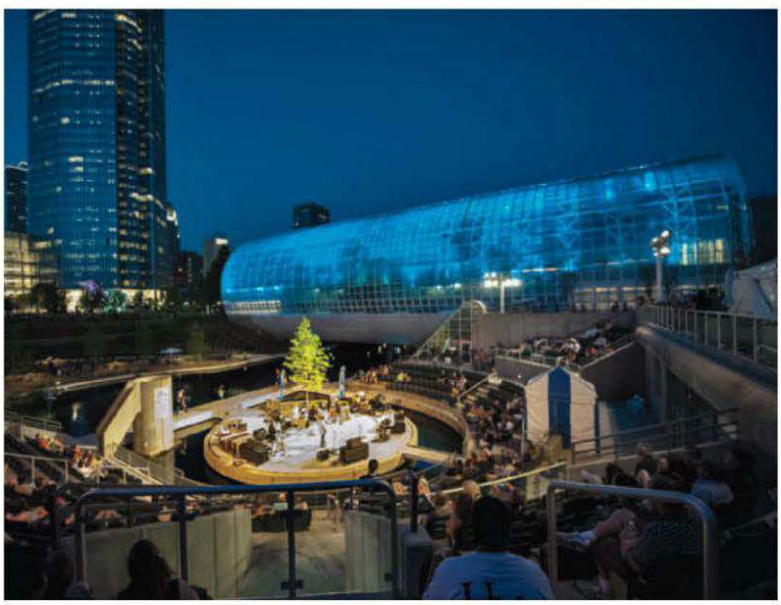
SKYDANCE BRIDGE The newly finished SkyDance pedestrian bridge, by OKC-based design group S-X-L, takes its form from the colorful state bird, the scissor-tailed flycatcher. The team won a competition to create the 197-foot-tall, locally-fabricated-steel structure. Architect Hans Butzer, a member of the S-X-L team, hopes the bridge will become a symbol of an enlivened Oklahoma City.

STAGE CENTER Designed by "Harvard Five" architect John Johansen in 1970, Stage Center—previously known as Mummer's Theater—is mired in preservation controversy: The prime downtown parcel on which it sits is the envy of developers, while the seminal (though deteriorating) building is the darling of preservationists. Unoccupied since a 2010 flood and now up for sale, the theater's fate hangs in the balance.

PHOTOGRAPHY (CLOCKWISE FROM BOTTOM LEFT): © ROBERT SHIMER/HEDRICH BLESSING/COURTESY ELLIOTT + ASSOCIATES ARCHITECTS; ROB FERGUSON; COURTESY ROGERS MARVEL ARCHITECTS; PRAKESH PATEL/GENSLER; ROB FERGUSON

SANDRIDGE COMMONS When New York's Rogers Marvel Architects (RMA) finishes work on SandRidge Commons (left) in 2014, the site—which is anchored by a soon-to-be-renovated 30-story office tower designed by Pietro Belluschi in 1967—will include a series of connected public greens and two administrative-office buildings for oil and natural-gas company SandRidge Energy. The project, a collaboration with Chicago-based landscape designers Hoerr Schaudt and Arup's environmental group, aims to bring restaurants, shops, and other amenities downtown, says RMA principal Rob Rogers. It will incorporate nearby Kerr and Couch parks and, with the renovation of the Belluschi building, create SandRidge's new downtown headquarters.

MYRIAD GARDENS Just across the street from the towering Devon Energy Center, the newly revived Myriad Botanical Gardens (below) teems with activity. The 17-acre park's centerpiece, the 224-foot-long tubular Crystal Bridge Tropical Conservatory, was designed by I.M. Pei in 1964, and is surrounded by playgrounds, green space, and an outdoor amphitheater (below left). A major, city-commissioned 2010 renovation of the greenhouse (by Gensler) and park (by the Office of James Burnett), and the erection of Devon's neighboring headquarters, has led to greater use of the gardens, Burnett notes. Concerts, trick-or-treating, and other seasonal events "have really activated this area," says the architect.



BOATHOUSE DISTRICT Three pavilions for rowing (two of which are visible above), designed by OKC-based Elliott + Associates Architects, breathe new life into once-disused land along the Oklahoma River's northern bank. The newest and tallest, the five-story, steel-frame Chesapeake Finish Line Tower (above center), cantilevers over its concrete base, marking the official end point for races, while the Devon Boathouse (above right) is home to the Oklahoma City University rowing and kayaking teams. The boathouses have garnered national attention and elevated Oklahoma City's status as a world-class city for training and competition, says principal Rand Elliott.

a penny sales tax for high-profile capital improvements. Oklahoma City has a history of big dreams, starting with the arrival of 10,000 people on April 23, 1889, when the community sprang up overnight with the Oklahoma Land Run. The skyline rose in great spurts, first in 1910, then in the early 1930s (the first OKC boom sparked by oil). But with MAPS, for the first time since the city's brief embrace of the City Beautiful movement in the 1930s, civic leaders worked to improve quality of life, not just by building new public amenities but by focusing on projects to add architectural flair with an eye on urban design and planning.

The 2001 renovation by local architect Richard Brown and New York–based Polshek Partnership Architects (now Ennead) of the Art Deco Civic Center Music Hall, itself a legacy of the City Beautiful movement, stands out as one of the MAPS improvements that led this latest transformation. Bricktown Canal, a San Antonio River Walk–style passage, and streetscape improvements connect the various MAPS projects, which pumped life into the city's wan design community. Developers followed the city's lead and renovated many historic buildings in the Bricktown warehouse district and Automobile Alley, once home to dozens of car dealerships. The emergence of these areas, which are now filled with restaurants, shops, offices, and entertainment venues, further proved that residents craved a community in which they could congregate, shop, and enjoy the city's new urban vibe.

These changes, in turn, attracted the return of some of the design community's prodigal sons. They include Wade Scaramucci, who came back after years abroad, and whose latest project, Level Urban Apartments, has introduced modern, cost-efficient design not previously seen downtown. Architect Anthony McDermid is at work on the similarly modernistic Aloft Hotel, across the street from Level. McDermid's OKC firm, TAP Architecture, is also designing a new downtown elementary school and a mixed-use parking garage. The architect sees opportunities to recast the feel and look of the city with both projects—and has received unprecedented support for looking forward instead of maintaining the status quo. "The general public has a lot of confidence they've never had before," he says. "They had confidence in voting themselves a tax, and projects were delivered."

Based on the success of MAPS, voters passed two sequels: the MAPS for Kids overhaul of city schools, in 2001, and MAPS 3, in 2009, to fund a new streetcar system, park, convention center, and further improvements along the Oklahoma River. Such rising self-esteem was evident with the completion of the first MAPS projects—but it was not yet enough to convince talented young design professionals to stay in their hometown. By the time Butzer's work on the memorial was recognized by *Time* magazine as one of the top 10 best designs in 2000, he noticed a troubling trend among first- and second-year students he taught at the University of Oklahoma. When he polled them about their postgraduate future, 90 percent responded they planned to leave the state. Butzer switched to teaching fifth-year design studios and sought out real-life projects being contemplated in the urban core. In these studios, students have had their work reviewed by chief executives of some of the city's largest corporations, and Butzer believes the talent drain is now a trickle.

Chesapeake's McClendon and Devon Energy executive chairman Larry Nichols both have their say in the city's transformation through their contributions toward the development of the boathouse district as well as their headquarters and other local investments. They've also supported the creation of amenities designed to appeal to a younger generation focused on sustainability. An underground garage with a green roof is Elliott's latest addition to the Chesapeake campus, while Nichols has supported Project 180's addition of bike lanes, electric-vehicle charging stations, and a makeover of the downtown Myriad Gardens—a project guided by the Office of James Burnett, landscape architect Scott Murase, and Gensler. A public discussion on this evolution continues, with hundreds of residents showing up for town-hall meetings about the design of a new downtown boulevard. "There's a recognition now," says Butzer, "that having more voices at the table for these decisions is a win-win situation." ■

Steve Lackmeyer is a columnist with the Oklahoman *who has covered architecture and planning since 1995.*

BRICKTOWN AND AUTOMOBILE ALLEY

Urban revitalization isn't just about OKC's downtown core. A stone's throw from the burgeoning city center are two Oklahoma City neighborhoods with histories that stretch back to the early 1920s: Bricktown (above) and Automobile Alley (right). Both are getting new leases on their previous lives (as centers for freight operations and the auto industry, respectively). Today Bricktown—and its water-taxi-navigable canals—is home to restaurants, nightclubs, and the corporate headquarters of fast-food giant Sonic. Automobile Alley is similarly dotted with shops and restaurants, and, like Bricktown, has seen many of its concrete-and-brick buildings become rental apartments and condominiums. *—Caption texts by Asad Syrkett*

PHOTOGRAPHY (CLOCKWISE FROM LEFT): © RUSSELL CHRONISTER; STEVEN WILSON; BEAU WADE

Devon Energy Center | Pickard Chilton

SCRAPING THE BIG SKY

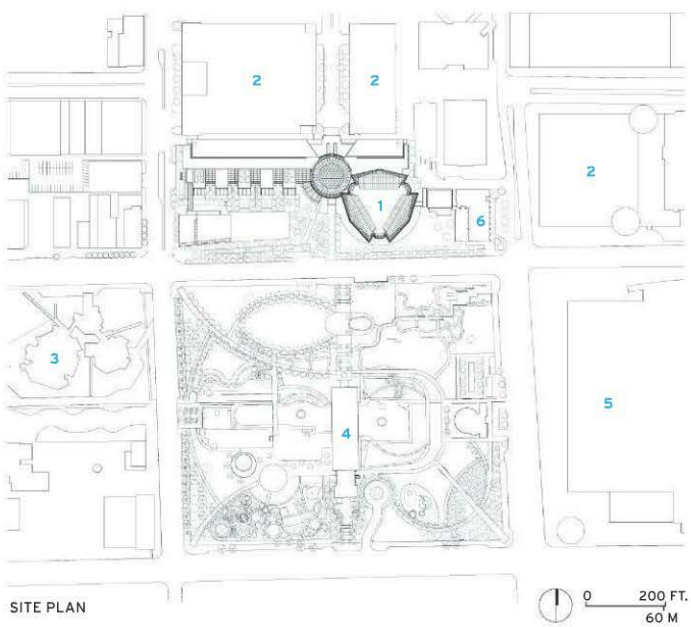
A 50-STORY CORPORATE HEADQUARTERS RISES OVER THE PRAIRIE

BY BETH BROOME

IF THERE is one single building that is emblematic of what might be called the renaissance of Oklahoma City, it is the gleaming new Devon Energy Center by New Haven–based architects Pickard Chilton. Soaring 50 stories over the low-rise downtown, the glass-and-steel tower has quickly become a reference point and a thing of wonder in this emerging, though still rough-at-the-edges, prairie town.

Devon Energy, an independent oil and natural-gas exploration and production company, was founded in Oklahoma City in 1971. Following numerous acquisitions, it grew rapidly to about 2,000 employees who were spread out across five different aging buildings downtown. Recognizing the need to unite the offices, the company in 2006 relaunched "Operation Scissortail," a 2002 plan (named after the state bird) to develop a new corporate headquarters. Houston regularly wooed Devon, as it did other local energy interests. But management insisted on staying in Oklahoma City, refusing even to consider relocating to the suburbs, says Klaholt Kimker, the company's vice president of administration. "We could see in future years the city was going to be great," he says. Kimker credits, among other things, a shift in the local bureaucracy and the introduction of the MAPS program (a penny sales tax for metropolitan capital improvements) with spurring the city's transformation. "Young leadership created an environment where Devon could stay and prosper," he says.

INSIDE OUT An airy, six-story-high cylindrical atrium (left) serves as the front door to the complex. A canopy (below) creates a transition between the café and seating area inside and a lush green space, which is used by Devon employees as well as the public.

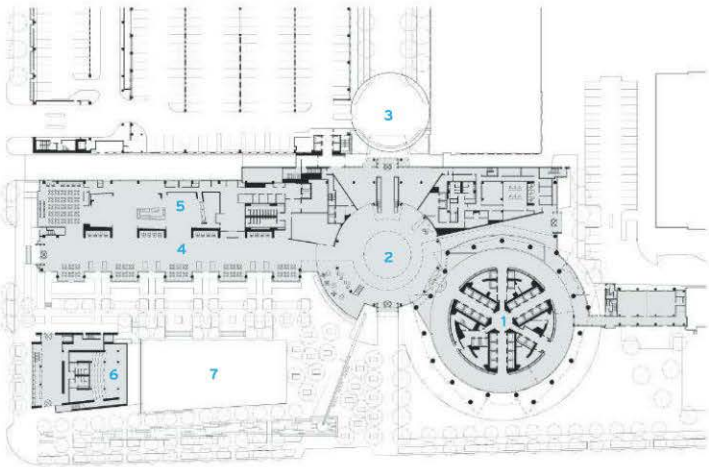


SITE PLAN

1 DEVON ENERGY CENTER
2 PARKING
3 STAGE CENTER
4 MYRIAD BOTANICAL GARDENS
5 COX CONVENTION CENTER
6 COLCORD HOTEL

PHOTOGRAPHY: © ALAN KARCHMER (OPPOSITE); BETH BROOME/ARCHITECTURAL RECORD (TOP); SIMON HURST (RIGHT)

1 TOWER
2 MAIN ROTUNDA
3 NORTH ROTUNDA
4 GARDEN/DINING WING
5 NEBU CAFÉ
6 AUDITORIUM
7 LAWN



LEVEL 1

0 100 FT. 30 M.

In 2008, after reviewing the credentials of prominent core-and-shell architecture firms, Devon selected Pickard Chilton, which at the time had a staggering 17 high-rise buildings in the works worldwide (12 of them in North America). Though the resulting complex has several low-rise components that include public amenities, it is unquestionably defined by the tower. But erecting the city's tallest building was not the ultimate goal of Devon executive chairman Larry Nichols, notes principal Jon Pickard. "By following the logic of meeting Devon's business needs, we were able to create something that was compelling and special and could in fact become a key symbol for Oklahoma City—and it turned out to be a 50-story tower," he says.

In its early analyses, the design team looked at the benefits and efficiencies of an upended, boxlike structure. Then they tweaked the form into a building that has a more interesting geometry with faceted and chamfered facades, but one that would still deliver the planning efficiencies characterized by a more prosaic shape. The geometry responds to the building's context, says Pickard. To the northeast is the center of downtown, to the northwest is the civic and arts district, and to the south is the newly revived Myriad Botanical Gardens. "There are so many vectors that are important," he notes. "We wanted the building to radiate that attention and energy, and this translated into a geometry based on an equilateral triangle."

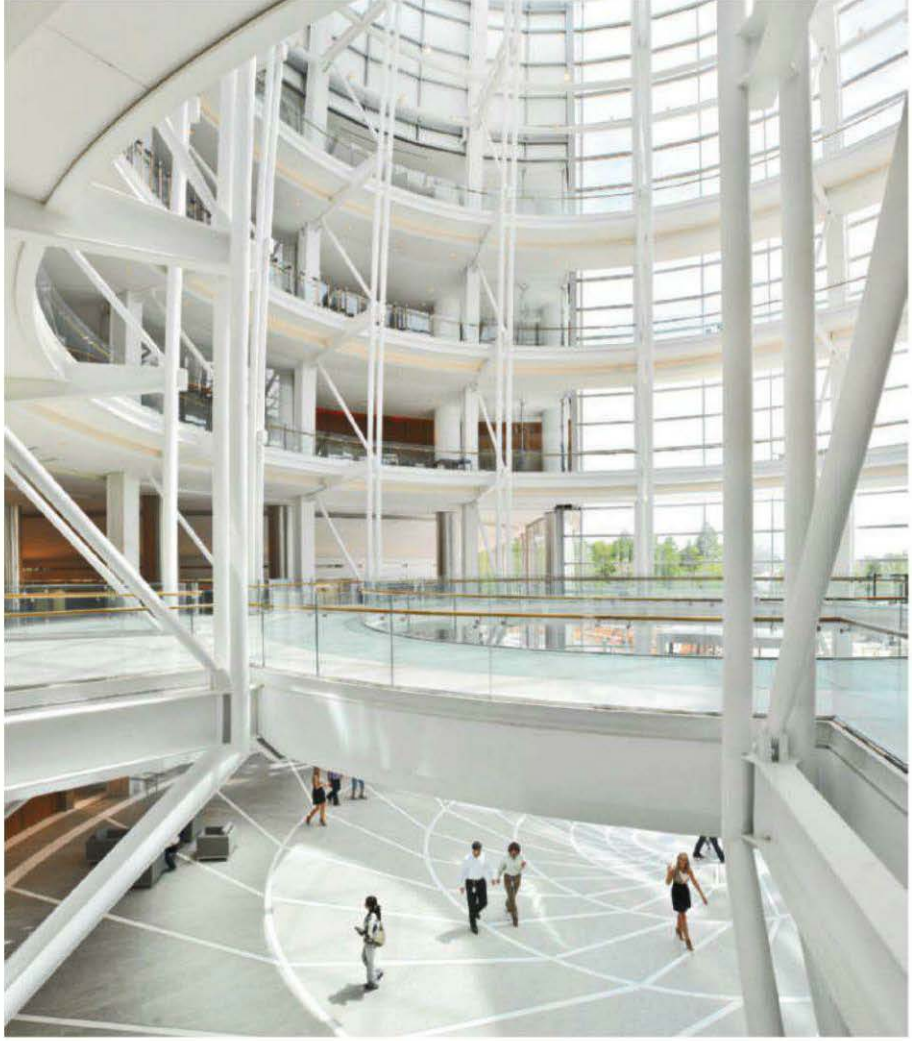
To create a curtain wall that was energy-efficient yet still conveyed a dignified, civic quality, the team conducted dozens of enclosure studies to develop a strategy for mitigating solar-heat gain while not obscuring the awe-inspiring views out to the endless landscape. The architects ultimately arrived at a vertical glass blade with a ceramic frit, which is attached, on five-foot modules, to a stainless-steel-and-aluminum cladding system on the tower as well as a low garden wing to the west. Inside, the three inset corners that punctuate the floor plates shorten the perceived distances of the hallways, highlighting connections to the outside. Gensler (which did the interiors) designed the glass office partitions that—along with floor-to-ceiling, low-E glass panes and the inset corners—carry abundant daylight deep into the building.

Integrating into the city's fabric to create a meaningful civic space was another of Devon's main goals. "What Nichols charged us with was creating a center in downtown Oklahoma City," says Pickard. To this end, Nichols insisted that the complex's ground level be open to the public. So the architects created a cylindrical volume for the main entry with a six-story-high, light-flooded rotunda that buzzes with the activity of employees during their workday, but also that of tourists and locals passing through. To the east, the atrium connects to the main tower and its elegant circular elevator bank (which will transport passengers to a top-floor restaurant once interiors are completed in November) clad with sapele-wood screens. To the west, it connects to a five-story barlike volume that houses a conference and training center on its upper floors (topped by a green roof) and Nebu, a corporate café, on the ground level. The café, which is open to the public, abuts a seating area that leads to a public green space, visually linking the complex to the Myriad Gardens across the street.

Devon also required a corporate auditorium, so the design team created a freestanding building with a 300-seat theater clad in embossed stainless steel. It not only anchors the western edge of the property and renders the garden a protected space, but it declares its role as a community resource that is available for public use. The last component of the program is the Colcord Hotel, a 12-story 1910 office building that was converted to a boutique hotel in 2006. Acquiring the property relieved Devon of the potential headache of an unhappy neighbor as construction progressed, but also resulted in a useful amenity and (by linking the building to the tower) the creation of another entry point for the new complex. Devon's interest in engaging its surroundings did not stop there. As the project developed, the company asked the city to form a tax-increment-financing (TIF) district to improve the Myriad Gardens, as well as upgrade the downtown streetscapes. A deal was struck, and Devon lent $95 million to speed up the improvements, with more money added by the city.

The architects say that pragmatism was a key driver of this project, which is targeted for LEED-NC Gold. "We wanted to create a beautiful building, but at the same time, we respect silly things like efficiency and practicality," says Pickard. "I don't think Devon was interested in having an artist come in and say, 'This is my sculpture, and I hope you like it.'" But, given the undeniable force of this towering object—on the skyline, on the surrounding landscape, and on the people who marvel from below—it is clear that it has already assumed an iconic status, symbolizing a renewed urbanism in Oklahoma City. ■

PUBLIC INTEREST A five-story barlike volume to the west of the tower houses the Nebu café and a lively seating area that are open to both employees and visitors.



credits

ARCHITECT: Pickard Chilton – Jon Pickard, William D. Chilton, Anthony Markese, partners in charge; John Lanczycki, project manager

ARCHITECT OF RECORD: Kendall/Heaton Associates

ENGINEERS: Thornton Tomasetti (structural); Cosentini (m/e/p); Smith Roberts Baldischwiler (civil); Morrison Hershfield (curtain wall, roofing, waterproofing)

GENERAL CONTRACTOR: Holder, Flintco (a joint venture)

PROGRAMMING & INTERIOR DESIGN: Gensler

CONSULTANTS: Office of James Burnett; Murase Associates (landscape)

CLIENT: Devon Energy Corporation

SIZE: 1.9 million square feet (gross)

COST: withheld

COMPLETION DATE: November 2012

SOURCES

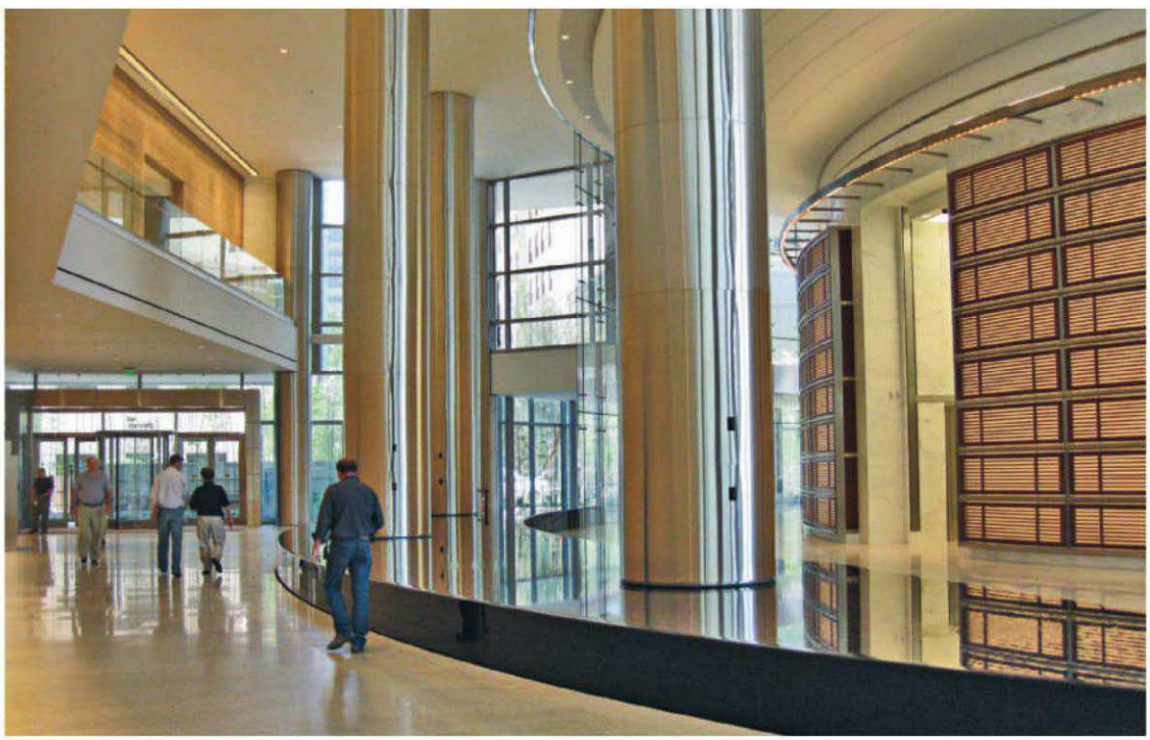
CURTAIN WALL: Permasteelisa (metal, glass, metal panels, rainscreen); Viracon (metal, glass); MG McGrath, Firestone (rainscreen)

WINDOWSHADES: MechoSystems

ROOFING: Carlisle SynTec (built-up roofing), Firestone (metal)

INTERIOR FINISHES: Armstrong (acoustical ceilings, resilient flooring); Johnsonite (resilient flooring)

SKY WALK
A light-drenched public rotunda faces the Myriad Gardens across the street (above). The elevator banks at the base of the tower (right) employ lush finishes, such as sapele-wood screening and Calacatta Caldia white marble on the walls and Kashmir White granite on the floor.



PHOTOGRAPHY: COURTESY PICKARD CHILTON (OPPOSITE AND TOP); BETH BROOME/ARCHITECTURAL RECORD (RIGHT)

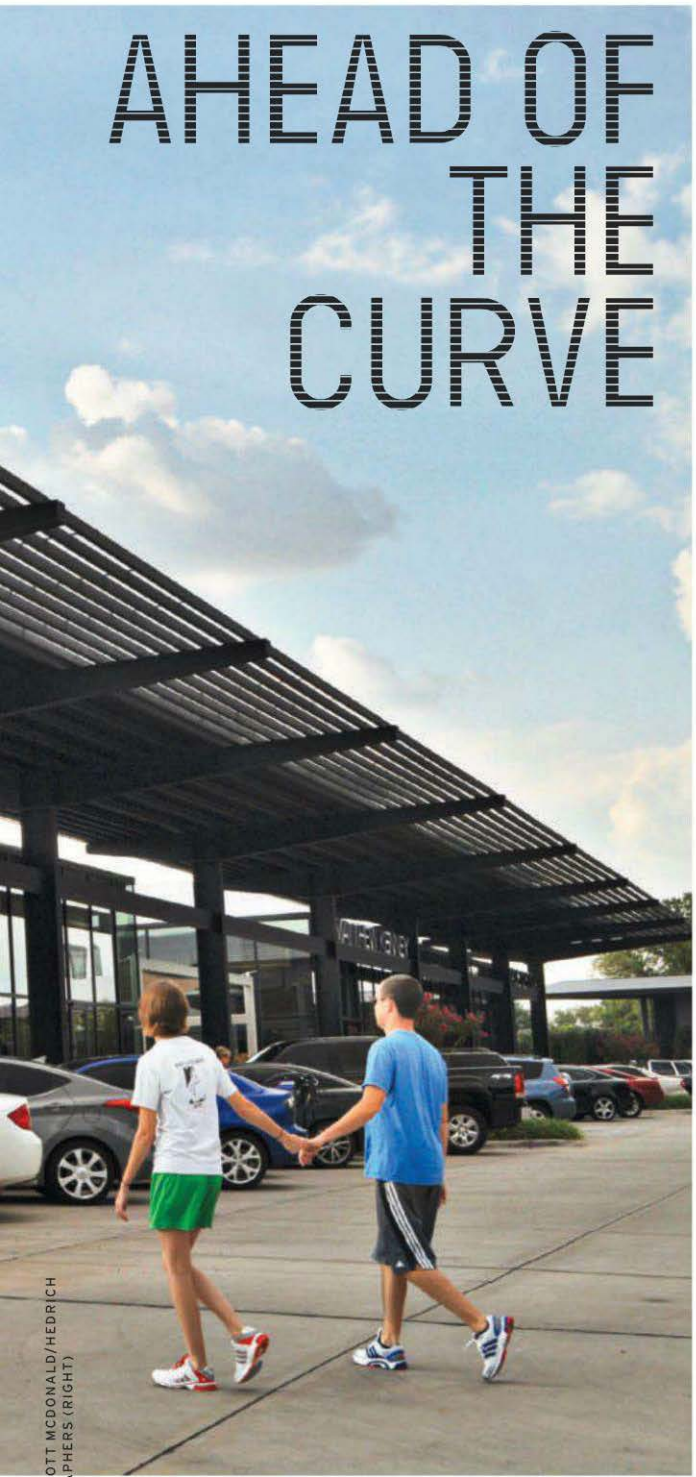
REINVENTING THE STRIP MALL FOR THE 21ST CENTURY

BY BETH BROOME

PHOTOGRAPHY: © LYNNE ROSTOCHIL, EXCEPT AS NOTED

Classen Curve | Elliott + Associates Architects

AHEAD OF THE CURVE



PHOTOGRAPHY: © SCOTT MCDONALD/HEDRICH BLESSING PHOTOGRAPHERS (RIGHT)

MALL CRAWL Special events draw crowds to the shopping center, like beginning runners (above) who assemble for a lesson at Red Coyote Running and Fitness. A rainwater-retention pond turned decorative lake (right) is one of many landscaping features.

DESPITE ITS racy-sounding name, there is probably no less sexy building type than the strip mall. This car-friendly retail model proliferated in the United States through the middle and end of the last century, in response to the flight from urban centers. But just as suburban living has found itself under the microscope in recent years, there has been a reexamination of the culture of shopping. With an eye toward high design, Elliott + Associates Architects has recently created Classen Curve, a smart new retail center in a mixed commercial-residential district to the north of Oklahoma City's downtown.

The project, which to date has consisted of three phases, was developed by Chesapeake Land Development Company, whose parent company, Chesapeake Energy Corporation, is one of Oklahoma City's largest employers. An important amenity for the workers at the corporation's sprawling 111-acre campus just across the road, it exemplifies the sort of high-end development that has become one of the calling cards of Chesapeake chief executive Aubrey McClendon, who has worked with Oklahoma City–based Rand Elliott on numerous projects (including the campus) and has left his imprint across the city.

Elliott has a way with turning nothing-sounding commissions into something. Cases in point: taking a program for a combination gas station, restaurant, and convenience store on Route 66 and creating Pops, a flamboyant roadside attraction (RECORD, March 2009, page 72), and rendering a field office in Hennessey, Oklahoma, for Kirkpatrick Oil (RECORD, May 2012, page 132) as a sleek, defining element for the town's Main Street. With a charge to design a shopping center, the architect again saw an opportunity to raise the bar. "Big boxes have invaded the world," he says. "They are not architecture; they're just buildings. This was a chance to fix everything that is wrong with this type of retail center today."

For inspiration, Elliott called upon his personal history when, as a child, he and his family would head into downtown Oklahoma City on Sundays for lunch and an afternoon of window-shopping. His handsome, minimalist scheme here aims to recapture the tradition of leisurely destination shopping and bring a renewed dignity to the environment in which it is done.

Classen Curve—named for the bend in North Classen Boulevard, the busy road whose contour it follows—looks inward, rather than out to the main thoroughfare, blocking the aural and visual static on the other side, and offering a protected environment that slows down time. Landscaping and covered courtyards tucked between buildings provide breathing space and invite shoppers to linger. Even the less glamorous elements are handled deftly, such as a water-retention pond, which the design team transformed into a lushly landscaped water feature. Dumpsters are enclosed in clean-lined steel

1 ANCHOR STORE
2 RETAIL
3 RESTAURANT
4 WATER FEATURE
5 RESIDENTIAL NEIGHBORHOOD

SITE PLAN: PHASE I AND II

OPEN MARKET Courtyards tucked between buildings (right in photo above) and protected by tensile awnings provide a place for shoppers to catch their breath.

Steel canopies shade customers as they walk between the stores (below). Landscaping extends to these interstitial spaces.

structures with black anodized-aluminum extrusions that rise to become landmark towers for supporting signage. To break up the scale of the development, which contains a total of 94,000 square feet of interior space, Elliott designed a complex comprising 13 separate low-slung buildings. The steel-frame structures support horizontal boxes clad in manganese iron-spot brick, with 18-foot-high glass storefronts that admit ample daylight and put wares on full display. Freestanding canopies run the length of the buildings and lend a defining dynamism to the project. Supported by massive steel members and topped with steel purlins and corrugated decking, the canopies protect both the cars and pedestrians on walkways from the elements—in particular the blazing-hot sun of the summer months.

The center, which is anchored by the luxury clothing boutique Balliets, consists of locally owned retailers and restaurants, rather than national chains, building on its mission to create a "modern Main Street for 21st-century shopping." With a combination of upscale retail, restaurants, and "lifestyle" outlets, the management hopes to foster a lively atmosphere—one that encourages shopping as the pleasurable family experience that Elliott recalls from his past. Though the buildings were completed in September 2010 (with more parking added in the final phase in mid-2011), to date many retail spaces remain vacant. Combine this with the fact that Oklahomans are understandably loath to get out of their vehicles on blistering summer days, and it is not surprising that there was not exactly a shopping frenzy in the air on a Thursday afternoon in late July—though restaurants buzzed with activity within their air-conditioned confines, and special events organized by tenants draw crowds.

"You do have to accept the notion of the car," says the architect. And despite everything, shopping centers are not going away anytime soon. With Classen Curve, Elliott has again found a way to come to terms with the messy realities of the American landscape and, with smart architectural solutions, turn a potential suburban blight into an urbane new destination. ■

AL FRESCO Patrons enjoy a meal at the outdoor dining area of Matthew Kenney (top), a raw whole-foods restaurant.

Classen Curve looks inward, away from the main thoroughfare (above). The popular Cafe 501 is linked to the anchor tenant, Balliets clothing boutique (in background).

credits

ARCHITECT: Elliott + Associates Architects – Rand Elliott, David Buser, David Ketch, project team

ENGINEERS: Johnson & Associates (civil); Engineering Solutions (structural)

GENERAL CONTRACTOR: Smith & Pickel Construction

CLIENT: Chesapeake Land Development Company

SIZE: 94,000 square feet

COST: withheld

COMPLETION DATE: September 2010

SOURCES

CURTAIN WALL: YKK (metal and glass)

GLAZING: PPG

RAINSCREEN: Trespa

MOISTURE BARRIER: Dow Corning

ROOFING: MBCI (metal); Trespa

DOORS: YKK (entrances); Curries

HARDWARE: Schlage, Adams Rite (locksets); Hager, YKK (hinges); LCN (closers); CHMI (pulls)

INTERIOR FINISHES: Sherwin-Williams (paints and stains)

PITTSBURGH,

THE FORMER STEEL TOWN EMBRACES ITS RIVERS AND GREEN DESIGN

BY CHRISTINE H. O'TOOLE

PA

PHOTOGRAPHY: © JASON VARNEY; MAP BY NORMAN HATHAWAY

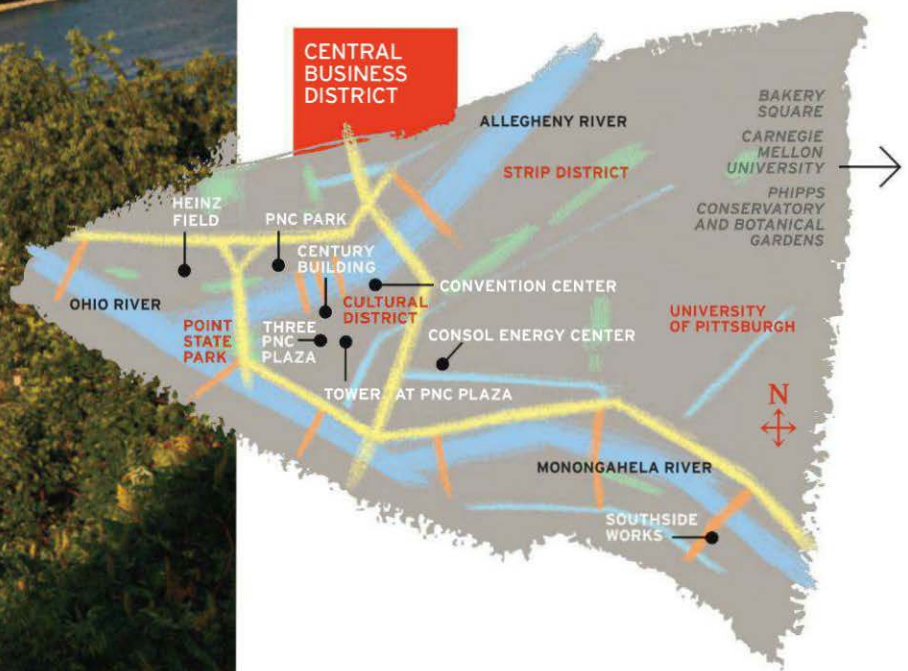
Pittsburgh's identity has always been its work. Thirty years ago, when it lost the steel mills that had forged its 20th-century reputation, it became part of the Rust Belt, with a fractured economy and three polluted rivers: the Ohio, Monongahela, and Allegheny.

Today, locals use the rivers for play as well as work. On sunny summer weekends, the water buzzes with kayaks and pleasure boats, thousands flock to outdoor festivals at refurbished Point State Park at the confluence of the rivers, and cyclists zip past golden bridges and black-and-gold-clad sports fans. The region is reclaiming its riverfront, embracing a new name suggested by architect and Carnegie Mellon University faculty member Don Carter: the Water Belt.

Emphasizing urban design and environmental protection, the southwestern Pennsylvania city has leveraged a $124 million investment in publicly accessible riverfront into $4 billion in corporate, public, nonprofit, and entertainment activity downtown, according to Riverlife, the city's nonprofit think tank for waterfront design. With a quarter-century of renewal behind it, Pittsburgh is now doubling down on sustainable investment with a deeper commitment to public spaces: softening the edges of the waterfront, finding long-term solutions for stormwater management and water quality, strengthening the central core, and extending its eds-and-meds-based growth into old neighborhoods.

Heavy industry's demise had one salutary effect: It forced Pittsburgh to clean and repurpose the brownfields that claimed prime riverfront acreage. By the 1990s, Mayor Tom Murphy was championing public access to the rivers with the first recreation trails. Riverlife then created and implemented a comprehensive plan for Three Rivers Park, 13 miles of public green space and trails along downtown's shorelines. "We've shown the power of urban design and scale to open up riverfronts to everyone and rebrand Pittsburgh as a river city," says Lisa Schroeder, Riverlife CEO.

Pittsburgh has revived its economy as well as its riverfront. While other regions struggle, southwestern



Pennsylvania posted a job-growth rate of 3.9 percent between the first quarter of 2010 and the beginning of 2012. The region now boasts more jobs than it had at the start of the national recession in 2008. In the past six years, Pittsburgh has added $5 billion in capital investment in its central business district, most notably in new construction by PNC Financial Services Group. And while the city population of 305,000 is down from the mid-20th-century peak of 680,000, it is growing—and growing smarter. Pittsburgh, along with Washington, D.C., has the nation's highest percentage of young adults with graduate degrees. Meanwhile, the Marcellus Shale discovery has turned Pittsburgh into the largest city atop the world's second-largest natural-gas field.

A decade's worth of public-private projects are now complete. In addition to the recreational trails, the city completed Rivers Casino and two new sports stadiums, PNC Park and Heinz Field, along the north shore of the Allegheny. Nearby, the city's cultural district reclaimed 14 historic blocks from a red-light eyesore. The Pittsburgh Cultural Trust now

GOVERNMENT, DEVELOPERS, AND PHILANTHROPIES HAVE JOINED FORCES ON SEVERAL RECENT PROJECTS

manages over 1 million square feet of property there, adjacent to the city's 2003 convention center, designed by Rafael Viñoly. It is the only convention center with dual LEED certification: Gold for new construction and Platinum for operations. On the southern bank of the Monongahela, SouthSide Works, named for the 44-acre steel mill that occupied the site until 1985, is a successful mixed-use neighborhood developed by the Soffer Organization that extends the city's traditional street grid and bridges.

On the opposite bank, the city's two major research institutions, the University of Pittsburgh and Carnegie Mellon University, are outgrowing space in Pittsburgh Technology Center, less than a mile from their campuses. They are expanding medical and high-tech lab space in another East End neighborhood, East Liberty, following successful transit-oriented developments near an express-bus station. Two-year-old Bakery Square, created in a former Nabisco factory there, includes a health club, a hotel, and retail space, and is home to Google's Pittsburgh office. Pittsburgh-based Astorino designed the red-brick complex's LEED Platinum renovation, while another local firm, Strada, designed Google's space, retaining original details like the plant's industrial mixers. In August, developer Walnut Capital announced Bakery Square 2.0, a $120 million expansion with a master plan by Strada.

A number of recent projects join government and developers with local philanthropies, including those founded by 19th-century fortunes like Mellon and Heinz. "Foundations made a collective decision to invest not only in downtown, but also in the neighborhoods," says Carnegie Mellon University's Carter, director of the school's Remaking Cities Institute. With consistent support from the city's Green Building Alliance, foundations have set high standards for development with ambitious projects like the recently completed Center for Sustainable Landscapes by The Design Alliance Architects at the Phipps Conservatory and Botanical Gardens (page 102). The $12 million education and research facility received a $2.6 million grant for design from the Heinz Endowments.

Despite budget deficits that have kept the city under state oversight since 2004, Pittsburgh and surrounding Allegheny County have provided direction, if not dollars, through policies and incentives, particularly those

THREE PNC PLAZA Pittsburgh-based PNC Financial Services Group claims more green buildings than any other company in the world. Nationwide it has about 160 LEED projects, with several major ones on its home turf, including Three PNC Plaza (background), a glass-clad, 23-story mixed-use building by Gensler. When it opened in 2009, it was the first tower completed in the downtown core in more than two decades. The building has three programmatic elements—a hotel, condominiums, and office space—with separate but interconnected lobbies. It overlooks Market Square (foreground), a recently renovated public space surrounded by restaurants and retail that was the home of some of the city's early civic buildings, including the first Allegheny County Courthouse and the first jail.

BAKERY SQUARE In 2007, a Pittsburgh-based real-estate developer purchased a vacant Nabisco factory in the city's predominantly residential East End. The repurposed 495,000-square-foot building, dating to 1918, reopened in 2010 following a $110 million renovation by Pittsburgh-based Astorino. The complex now includes a hotel, retail space, and offices and serves as Google's new Pittsburgh headquarters. The tech giant occupies a two-story penthouse designed by another local firm, Strada. The office features an open floor plan and whimsical elements, including a giant suspended hammock. Plans are in the works for Bakery Square 2.0, a $120 million office, retail, and residential complex across the street.

CENTURY BUILDING In 2009, Koning Eizenberg Architecture completed the transformation of the 104-year-old Century Building in Pittsburgh's downtown cultural district, converting the 12-story commercial office building into 60 residential units with retail and office space on the lower floors. The LEED Gold–certified building offers some of the first mixed-income housing in the city's downtown; the affordable and market-rate units are indistinguishable, and residents have access to a fitness room, lounge areas, and a roof deck with views of the Allegheny River. The exterior of the building is embellished with a loud, lime-green billboard stamped with a bike icon that advertises storage units attached to the building that are available to tenants and cycling commuters.

PHOTOGRAPHY (CLOCKWISE FROM LEFT): © BRUCE DAMONTE; JOSEPH HOFFHEIMER; ERIC STAUDENMAIER

to encourage LEED-certified development. The Tower at PNC Plaza, the bank's under-construction 33-story headquarters (page 100), is its third major LEED project in the core. Designed by Gensler, the tower is planned to exceed Platinum standards. The new building at Phipps is targeting certification through several green-building programs, including the ultra-stringent Living Building Challenge. Downtown property owners also recently created a 2030 District, making Pittsburgh the third U.S. city (behind Seattle and Cleveland) to commit to carbon neutrality by that year. Over 23 million square feet and 61 properties are included in the program.

A pressing priority for the Three Rivers watershed is managing stormwater and combined-sewer overflow. Alcosan, the sewer authority, has signaled a willingness to consider green projects as a means of improving river-water quality and as an alternative to costly infrastructure replacement. The Allegheny Riverfront Green Boulevard plan, approved by the city in 2010 and designed with $1.5 million in federal funds, incorporates water capture on public and private land in a corridor along the northern edge of downtown. The scheme by Sasaki Associates and Perkins Eastman envisions habitat restoration along a 6.45-mile rail-with-trail that would accommodate an existing rail freight line and add passenger use.

Along the Ohio, another plan envisions the use of a riverfront parcel between the Carnegie Science Center and the Rivers Casino. NBBJ's Headwaters Lagoon master plan calls for a hotel and public space adjoining Three Rivers Park and a completed multimodal transit station. The design relies on existing stormwater holding tanks and has naturally filtered fountains cascading into the river, creating what Riverlife's Schroeder calls "a national model" for watershed management. Local foundations including the Heinz Endowments and the Buhl Foundation have made $1 million in grants for project planning and design.

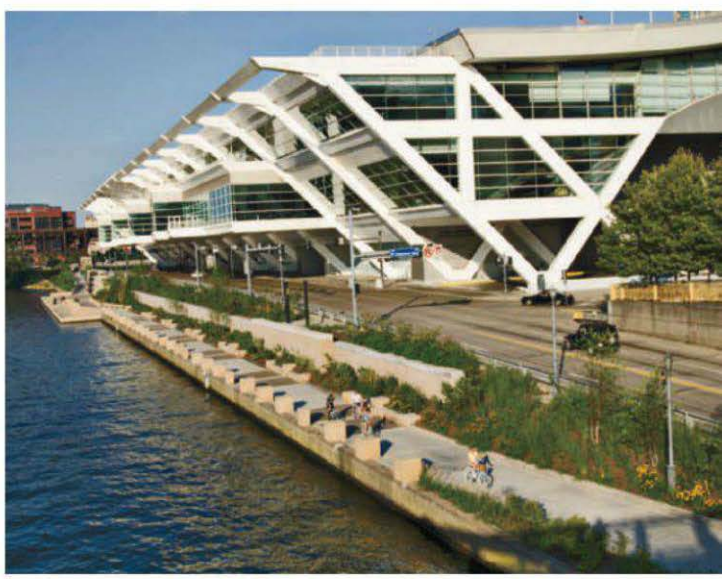
On the Monongahela, Pittsburgh's foundations and sustainable-design advocates are collaborating on a 180-acre capstone to riverfront redevelopment. Four local foundations, including Heinz, put up $10 million to adapt the former Jones & Laughlin steel mill in Hazelwood, about 3.5 miles east of downtown. A sustainable master plan developed by Rothschild Doyno Collaborative focuses on office space for high-tech research and development, plus industrial and residential use, on the last large riverfront site in the city. Foundations have committed another $10 million for infrastructure improvements. The project will incorporate industrial remnants, such as a railyard roundhouse and a 1,300-foot-long steel mill, and will extend an existing riverfront trail. "Facing the river is something we should be celebrating," says Dan Rothschild, a principal of the firm.

Closer to the central business district, a field of rubble in the shadow of the city's tallest building, the former U.S. Steel headquarters, could soon extend the city's core. Here the National Hockey League's Pittsburgh Penguins will develop the 28-acre site of their former arena, demolished last year. A conceptual redevelopment plan by Urban Design Associates targets LEED for Neighborhood Development certification and calls for 1,200 units of housing, office and retail space, and parks. The Penguins, now playing next door at the LEED Gold–certified Consol Energy Center, have hired Jones Lang LaSalle to engage the community and later market the project to investors. Unlike large development sites in other Rust Belt cities, the old arena's empty plot sits next to the central business district, points out Craig Dunham, president of Dunham reGroup, the owner's representative. "This isn't fringe," he says. The location, "coupled with Pittsburgh's overall strength and the activity going on downtown, make it unique."

The new neighborhood will draw more residents to live in the core, where recreation and cultural amenities continue to expand. In 30 years the city's steel heritage will be a distant memory. Its new identity, in sustainable and smart growth, will be its work. ■

Based in Pittsburgh, Christine H. O'Toole has reported on the city for the New York Times, Washington Post, National Geographic Traveler, *and other national media.*

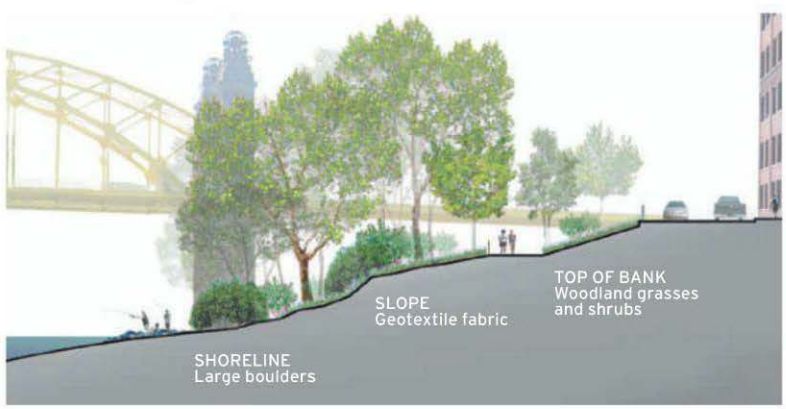
DAVID L. LAWRENCE CONVENTION CENTER The sweeping roof of Rafael Viñoly's David L. Lawrence Convention Center (below) echoes Pittsburgh's "Three Sisters" bridges. When it opened in 2003, the LEED Gold, 1.5 million-square-foot facility was the world's largest green building. Earlier this year, the convention center earned a Platinum rating for its operations and maintenance practices as part of the LEED-EBOM program, making it the first convention center with certification for both new construction and existing buildings. In 2011, a waterfront plaza in front of the building (bottom) was completed, extending an existing shoreline trail for pedestrians and cyclists. The park, designed by LaQuatra Bonci Associates, also provides recreational boat access.



GATES AND HILLMAN CENTERS The angled zinc-clad walls of Carnegie Mellon University's Gates Center for Computer Science and Hillman Center for Future-Generation Technologies were completed in 2009 and rise from a ravine on the western side of the urban campus. The LEED Gold–certified complex, designed by Mack Scogin Merrill Elam Architects, is made up of a six-story structure and a smaller, trapezoidal, four-story one, connected by a glass-enclosed lobby with pedestrian bridges. Michael Van Valkenburgh designed a naturalistic landscape for the buildings that features five green roofs and a winter garden. CMU's School of Architecture has been an influential advocate for sustainable design in the city and worldwide through its Center for Building Performance and Diagnostics, Computational Design Laboratory, Intelligent Workplace Laboratory, and Remaking Cities Institute.

–Caption texts by Laura Mirviss, Christine H. O'Toole, and Joann Gonchar, AIA

ALLEGHENY RIVERFRONT GREEN BOULEVARD The steep banks and industrial history of the Allegheny River pose challenges to ecological restoration. Railroad tracks, the site of an 1877 strike, run along the river to the Strip District, a landmark marketplace on the river's southern shore. An early plan by Andropogon for the Allegheny Riverfront Green Boulevard proposes strategies for stabilizing the failing riverbank and slowing stormwater runoff. The scheme calls for a continuous 95-foot setback for public use. A proposal by the Buncher Company for a mixed-use development on a 55-acre site that is part of the area covered by the boulevard plan has sparked controversy by limiting setbacks to 50 to 70 feet between the water's edge and new buildings.



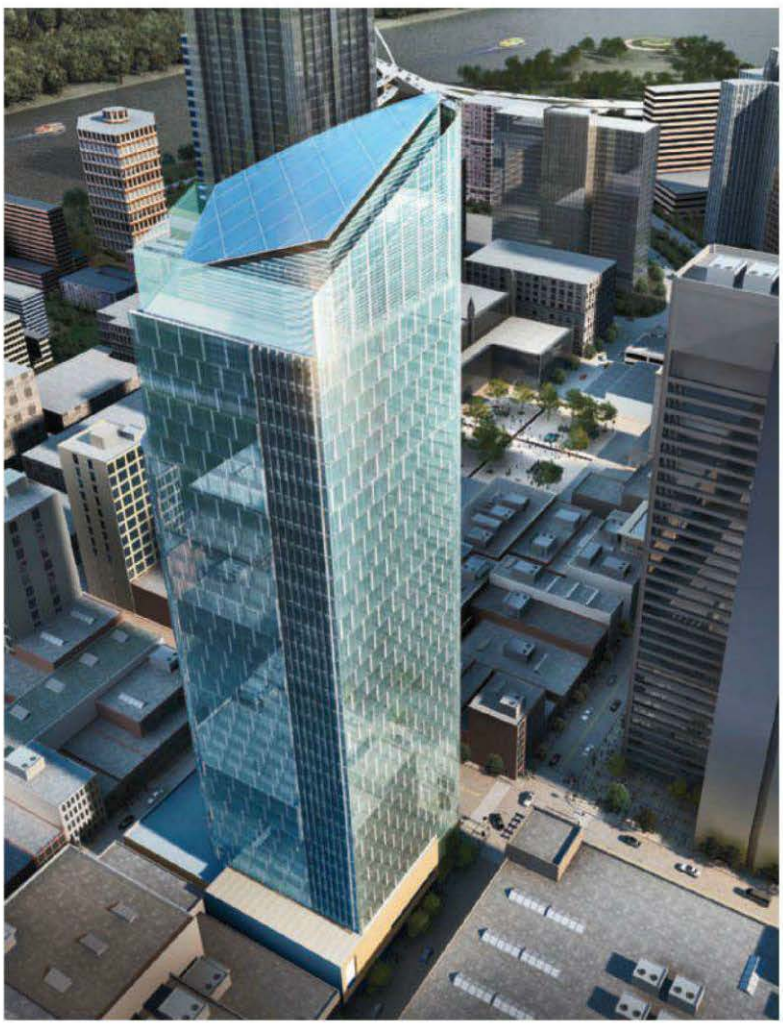
IMAGES (CLOCKWISE FROM BOTTOM LEFT): © MICHAEL HARITAN; BRAD FEINKNOPF; BRAD TEMKIN; COURTESY ANDROPOGON/RIVERLIFE

Tower at PNC Plaza | Gensler

LET THE FRESH AIR IN

A TOWER OFFERS AN ALTERNATIVE TO THE HERMETICALLY SEALED GLASS BOX

BY JOANN GONCHAR, AIA



AT 33 STORIES and about 550 feet, PNC Financial Services Group's new headquarters in Pittsburgh will not break any records for its height. But when the under-construction, $400 million building designed by Gensler is completed in the summer of 2015, it will be among a handful of naturally ventilated office towers in the U.S. And it is expected to be the country's tallest tower relying on such a passive strategy for environmental control.

The goal for the Tower at PNC Plaza was to design "a building that would breathe," says Hao Ko, design director for Gensler. The high-rise's steel structure is wrapped in a glazed double curtain wall that includes automated windows on the exterior and flaps on the interior to bring in fresh air. Designers estimate that the tower will operate in this natural-ventilation mode, without the need for fan power, for more than 40 percent of working hours.

The scheme's key feature is a solar chimney comprising two shafts at the core of the building's trapezoidal floor plate. It will create a "controlled" stack effect to draw hot air out of the building, according to Denzil Gallagher, principal at Buro Happold, the skyscraper's structural and mechanical engineer. At the top is a 5,000-square-foot chamber with a glass roof and a concrete slab, sloped and angled toward the south in order to trap solar radiation. During much of the spring and fall, when temperatures are mild and humidity is low, this configuration will create a pressure differential that should pull outdoor air through the operable facade and the 30-inch cavity it defines; the air will be drawn across the floor plates, and then vented through the solar chimney. In the winter, the chamber will help preheat fresh outdoor air before its distribution throughout the tower.

To make sure the air would keep moving through the building, but flow slowly and gently, the project-team members built an approximately 5-by-5-foot mockup of the glass-topped chamber on the roof of another PNC-owned building near the site. With the mockup, they recorded factors like air and surface temperatures inside the chamber in order to calibrate their computational fluid dynamics (CFD) studies and energy models. The ultimate goal of this process was optimization of the solar chimney's size and shape.

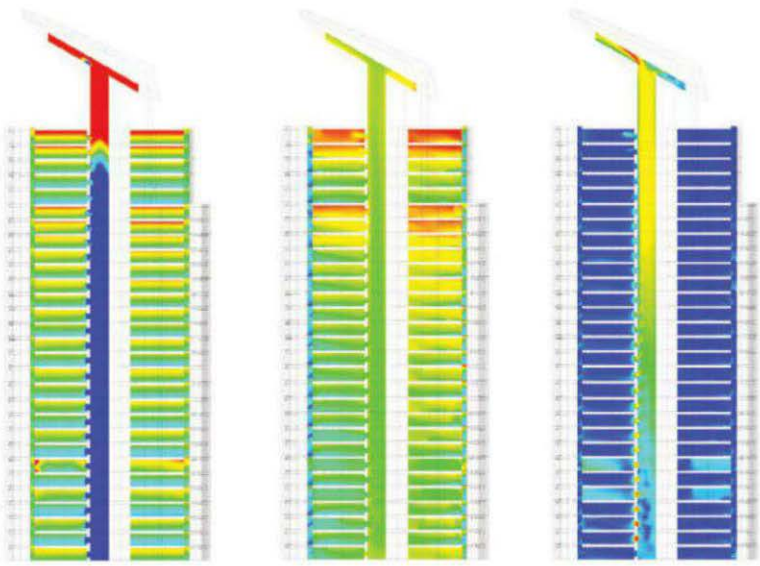
Consultants predict that the natural ventilation, along with features like active chilled beams, efficient lighting, and automated shades, will produce a skyscraper that exceeds LEED Platinum requirements. And they estimate that the tower will consume only about half the energy of a building that complies with the 2007 version of the ASHRAE 90.1 standard.

But conserving energy is not the only objective. PNC, which has about 160 LEED-certified facilities nationwide, hopes the tower will provide a comfortable working environment. For example, its employees will be able to enjoy views over the city from the multistory atriums, or "sky gardens," that make up the tower's west facade and provide space for informal meetings. They will also be able to open sliding windows on the building's interior skin to let the air circulating within the curtain-wall cavity into the office spaces. Even though the tower will rely on passive ventilation for much of the time, points out Ko, the occupants' relationship with the structure will be an active one. ■

View additional images at architecturalrecord.com.

SECTION–AXONOMETRIC

CLIMATE RESPONSIVE The keys to the tower's natural-ventilation strategy are automated windows and flaps in its double-skin curtain wall and a solar chimney. Comprising two shafts at the building core (left), the chimney is topped by a sloped, glass-roofed chamber (opposite) that traps solar radiation. Engineers relied on several tools to determine the tower's optimal configuration, including CFD analyses (bottom, left to right) of the pressure, temperature, and velocity of the air inside the chimney and throughout the occupied areas. The building's floors are primarily devoted to open offices but also include collaborative spaces like the multistory atriums clearly visible on the west facade (far left).



CFD STUDIES

credits

ARCHITECT: Gensler – Douglas Gensler (project director); Lisa Adkins (project manager); Hao Ko (design director); Benedict Tranel, Richard Peake (technical directors)

ENGINEERS: Buro Happold (structural, m/e/p); Civil and Environmental Consultants (civil)

CONSULTANTS: Paladino (sustainability); Heintges & Associates (facade); Fisher Marantz Stone, Studio I Architectural Lighting (lighting); LaQuatra Bonci Associates (landscape); Boundary Layer Wind Tunnel Laboratory (wind)

CLIENT: PNC Financial Services Group

GENERAL CONTRACTOR: P.J. Dick

SIZE: 800,000 square feet

COST: $400 million

COMPLETION DATE: Summer 2015

SOURCES

CURTAIN WALL: Permasteelisa

GLAZING: PPG Industries

VERTICAL TRANSPORTATION: Schindler

BUILDING-AUTOMATION SYSTEM: Automated Logic

IMAGES: COURTESY GENSLER, EXCEPT AS NOTED; BURO HAPPOLD (BOTTOM RIGHT)

Center for Sustainable Landscapes | The Design Alliance

HOW GREEN A GARDEN GROWS

A CONSERVATORY TARGETS A CERTIFICATION TRIFECTA

BY JOANN GONCHAR, AIA

PITTSBURGH IS home to what is arguably one of the greenest buildings in the country: the Center for Sustainable Landscapes, a recently completed facility for research and educational programs on the campus of the 119-year-old Phipps Conservatory and Botanical Gardens. The center, known as the CSL, is aiming for a trio of certifications. In addition to LEED Platinum, the project is one of 150 taking part in the Sustainable Sites Initiative—a pilot program intended to encourage ecologically sensitive landscape-design practices. Phipps and the CSL team hope to achieve four stars, the highest rating possible. But they have even bigger aspirations. They are targeting Living Building status, a designation with tough-to-satisfy requirements such as net-zero-energy and net-zero-water performance.

The $12 million CSL is just the latest piece of a multiphase green expansion program that began after the nonprofit Phipps Conservatory Inc. signed a 100-year lease, taking over management of the city-owned garden in 1993. "Phipps had the potential to be more successful and become a national tourist attraction," explains Richard Piacentini, the conservatory's executive director.

The new management's first capital project was a LEED Silver–certified visitors' reception wing that opened in 2005. The next year it completed two more: a 36,000-square-foot production greenhouse, with a computer-controlled roof venting system, and the Tropical Forest Conservatory, cooled passively with underground earth tubes.

For the CSL, the garden's most ambitious project to date, designers developed a "synthetic solution" in which the 24,000-square-foot structure and its 2.65-acre site work as one, explains Chris Minnerly, principal at The Design Alliance, the building's architect. The building steps down with the steeply sloping terrain and has its long axis oriented east-west to minimize solar gain. Its thermally robust envelope includes a skin of wood reclaimed from dismantled Pennsylvania barns. Photovoltaic panels, a vertical-axis wind turbine, and geothermal wells will satisfy energy needs.

The landscape, which was still under construction at press time, will include water features, native plant materials, and rain gardens. The scheme will do more than merely look good, says José Almiñana, a principal at Andropogon, which did the project's landscape architecture. "It will perform."

One of the roles the landscape will play is helping the project meet Living Building water requirements. The CSL and its environs will manage stormwater and treat wastewater. It will put these sources to use for toilet flushing and to offset the significant irrigation demands of the conservatory's greenhouses.

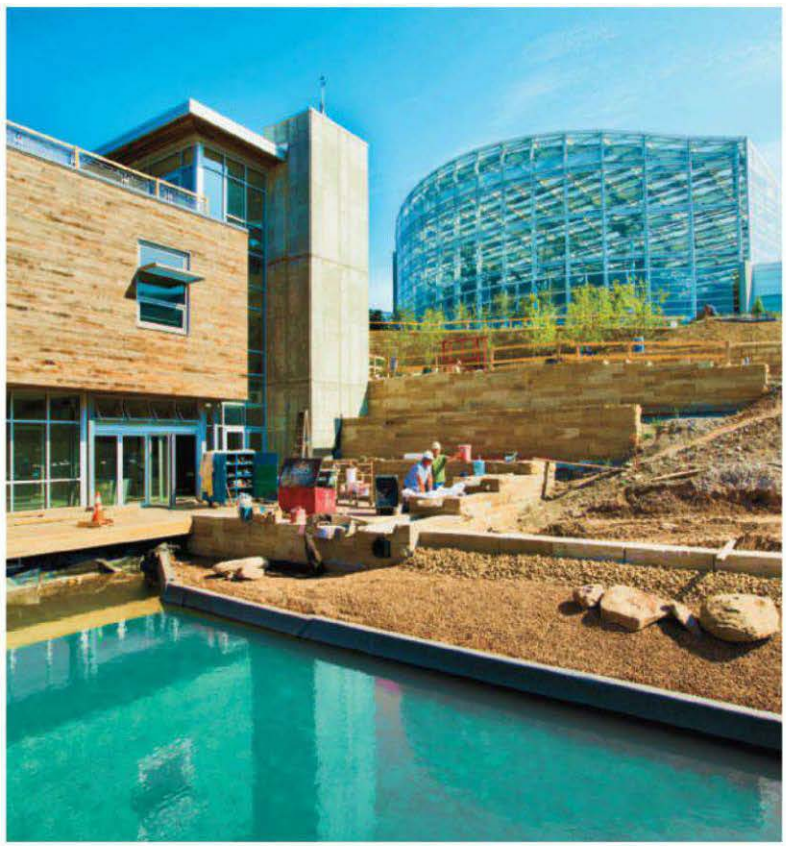
A collection of orchids, for example, will be watered with the outflow from sinks and toilets, but only after the effluent is cleansed in a multistep treatment process that includes a traditional septic system and a constructed wetland containing plants such as cattails and rushes.

1 CENTER FOR SUSTAINABLE LANDSCAPES
2 FUTURE MAINTENANCE FACILITIES
3 EVENT SPACE
4 TROPICAL FOREST CONSERVATORY
5 PRODUCTION GREENHOUSE
6 HISTORIC CONSERVATORY

A solar-distillation system will provide final purification.

A separate system will collect rainwater from the CSL's green roof and the roofs of neighboring buildings, directing it to a lagoon where hydrophytes (plants that thrive when submerged in water) will help remove the small amount of impurities found in roof runoff. After UV treatment, the water will be allowed to slowly filter into the ground or will be stored in cisterns for various nonpotable uses.

The lagoon will provide a habitat for fish and insects and, along with the constructed wetland, will transform the normally hidden, workaday processes of stormwater and wastewater management into landscape amenities. These water features are also an example of the "systems thinking" that inspired the project, says Piacentini. At the CSL, "the waste of one process benefits another." ■



SYNTHETIC SOLUTION The roof of the CSL (above) contains an edible permaculture garden that includes flowering plants and shrubs. Rainwater will be collected from this roof and from the roofs of neighboring buildings and directed to a lagoon (right) that was still under construction at press time. Here, plants will remove the small amounts of impurities typically found in roof runoff before a final UV-treatment step. Ultimately, the water will be stored in cisterns for nonpotable uses, such as irrigation, or allowed to slowly filter into the ground.

credits

ARCHITECT: The Design Alliance – L. Christian Minnerly, principal in charge; John Palmer, technical coordinator; Shannon Beisel, interior designer; Brandon Dorsey, systems-modeling technician; Paul Kane, Dave Parker, architects; Ryan Cole, architectural intern

CLIENT: Phipps Conservatory and Botanical Gardens

ENGINEERS: Civil & Environmental Consultants (civil); CJL Engineering (m/e/p); Atlantic Engineering Services (structural)

CONSULTANTS: Andropogon (landscape); evolveEA (sustainability, LEED and Living Building consulting); 7group (LEED and performance modeling)

GENERAL CONTRACTOR: Turner Construction

SIZE: 24,000 square feet

COST: $12 million

COMPLETION DATE: September 2012

SOURCES

RECLAIMED-WOOD SIDING: Quaker Barn Company

WINDOWS: Kawneer

GLAZING: PPG Industries

SKYLIGHTS: Oldcastle BuildingEnvelope

PHOTOVOLTAIC SYSTEM: Solar World

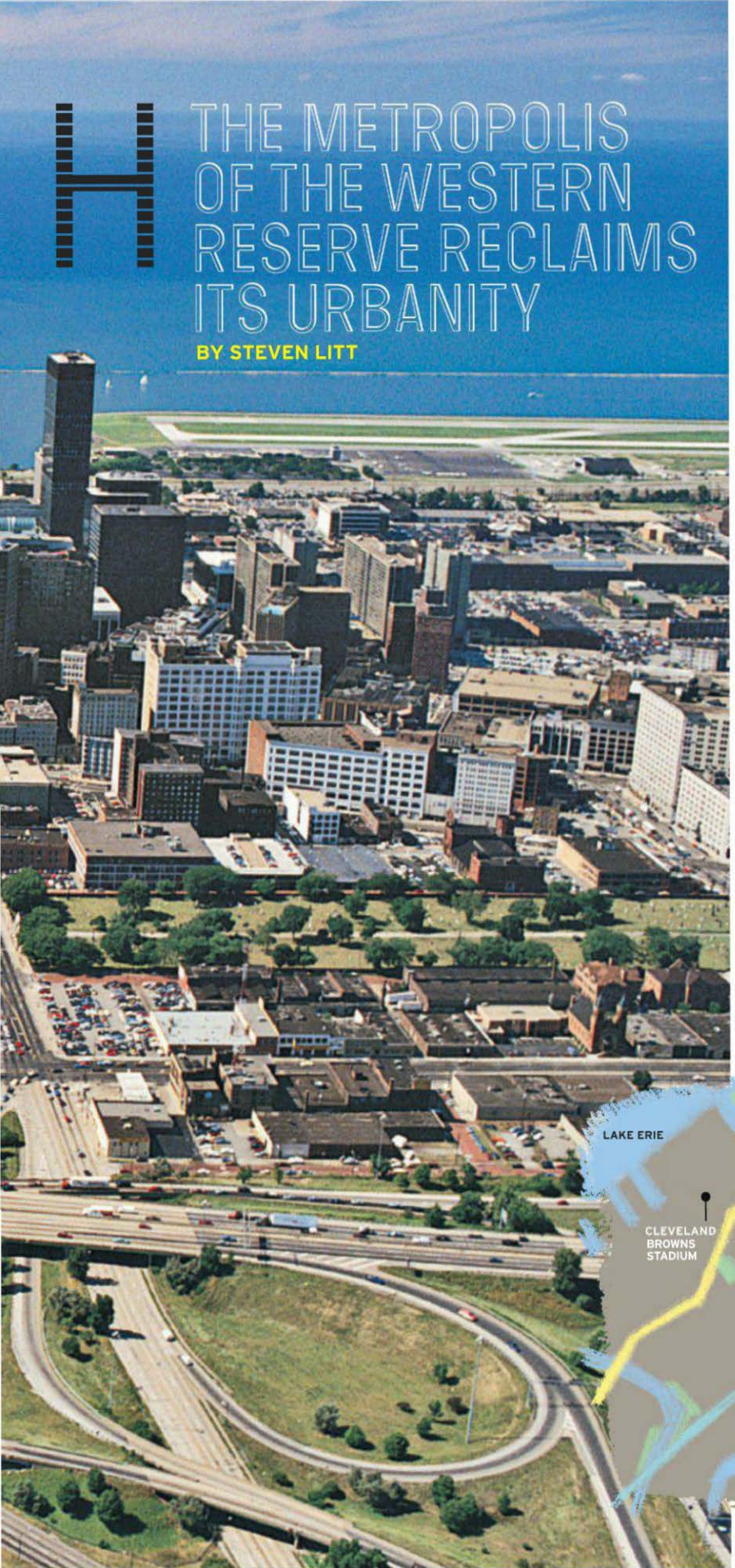
ENERGY-AUTOMATION SYSTEM: Automated Logic

IMAGES: COURTESY ANDROPOGON (OPPOSITE); © ALEXANDER DENMARSH

CLEVELAND, O

THE METROPOLIS OF THE WESTERN RESERVE RECLAIMS ITS URBANITY

BY STEVEN LITT

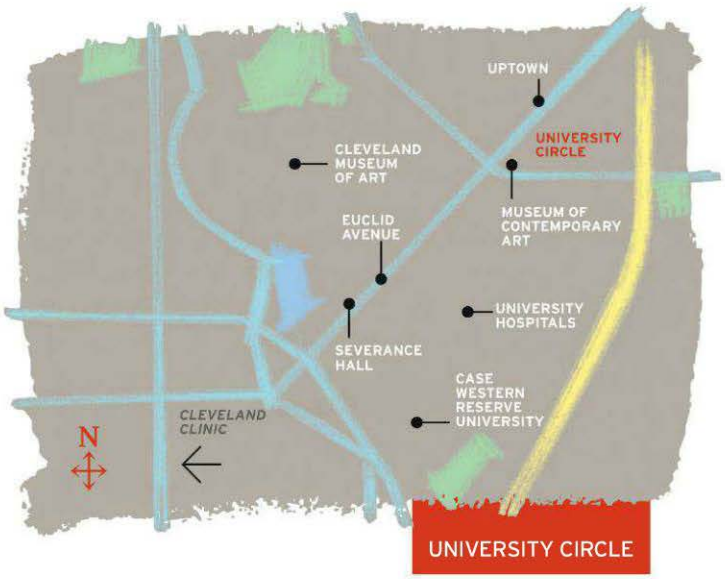


Cleveland has long been ridiculed as a dysfunctional city bisected by the once-infamous Cuyahoga River, where oil-soaked debris caught fire in 1969. Yet today more than 40 species of fish live in the far cleaner Cuyahoga, crew teams ply its curves, and the $250 million Flats East Bank development, with an 18-story office tower, hotel, nightclubs, and apartments, is rising amid the numerous bridges that link the city's halves. Burning River, meanwhile, is the name of a pale ale made by the local Great Lakes Brewing Company—a signal of counterintuitive pride in the city's big moment of shame, and a measure of how far it's come since then.

Though its population has shrunk to just below 400,000 from nearly 1 million in the 1950s, Cleveland is experiencing a $6 billion burst of development that includes everything from big downtown projects to the fine-grained revival of a half-dozen neighborhoods. An influx of young professionals, drawn by jobs in tech, digital media, marketing, and biomedical companies, has led to a tight downtown rental market with a residential population of about 10,000 and growing, and an occupancy rate of nearly 96 percent.

Michael Christoff, a 30-year-old architectural designer who grew up in rural Canfield, Ohio, says he decided to stick around Cleveland after graduating from Kent State University in 2004 with a bachelor's degree in architecture because he saw new opportunities in a city young people once fled. "If you've got ideas and you're passionate enough to put the work into doing them, people in Cleveland will support you," he says. "You can engage and get traction."

The change in Cleveland is readily visible four miles east of downtown in the University Circle neighborhood, the fast-growing cultural and educational hub, which is also home to University Hospitals and the world-famous Cleveland Clinic, the city's largest employers, with a combined staff of nearly 30,000. To stand there on Euclid Avenue, once notable for its Millionaires' Row mansions, is to catch a glimpse of a city capitalizing on one square mile of legacy institutions set among greenways designed a century ago by Frederick Law Olmsted, Jr. Fresh investments in the district include a $350



EAST FOURTH STREET Fifteen years ago, wig shops dominated East Fourth Street; the wigs in the windows were color-coded to correspond to the drugs for sale inside. In 2000, local developer MRN Ltd. used historic tax credits and abatements to begin to buy out 250 owners and create 224 apartments, for which there's now a 400-person waiting list. More than a dozen restaurants, a House of Blues, and a bowling alley keep the lantern-strewn strip buzzing. Downtown needs retail and more residents, but East Fourth Street helped jump-start the revitalization.

million expansion of the Cleveland Museum of Art, designed by Rafael Viñoly (page 114), and the new home of the Museum of Contemporary Art Cleveland (MOCA), a shiny gemstone in black, reflective stainless steel by Farshid Moussavi. MOCA anchors the eight-acre Uptown development, on the flank of Case Western Reserve University, which includes apartments, a bookstore, a supermarket, nightclubs, and restaurants wrapped in crisply geometric, aluminum-clad buildings designed by Stanley Saitowitz/Natoma Architects of San Francisco (page 110).

Such projects raise the possibility that other shrinking cities across the industrial Great Lakes could build a brighter future on similarly rich assets such as medical and cultural institutions, universities, specialized manufacturing, and handsome early-20th-century neighborhoods. Also key is a relatively low cost of living and a vast supply of Great Lakes water, now much improved in quality after decades of environmental regulation originally inspired by a certain burning river.

State and federal historic-preservation tax credits and other forms of public-sector leverage, including large-scale mass-transit improvements, have triggered many of the new projects. The Regional Transit Authority's new $200 million rapid bus line on Euclid Avenue, modeled on an award-winning fast-boarding system in Curitiba, Brazil, has boosted ridership with faster headways and shiny silver buses. It also provided the impetus to rebuild crumbling Euclid Avenue. That investment–80 percent of it in federal funds–has reinforced or leveraged more than $1 billion in development in University Circle alone, says Chris Ronayne, director of University Circle Inc., the area's nonprofit community-development corporation. "This was an intentional effort to bring back our historic Main Street," he says.

To be sure, Cleveland still struggles with poverty, racial tension, and poor public schools. Its shrinking population means the city is losing political clout in Congress and in the politically fragmented northeast Ohio region, where most of the 3.8 million residents live in sprawl suburbs and rarely go downtown. Yet several decades of patient stewardship by its cultural institutions, universities, foundations, and developers is paying off in selected parts of the city.

Efforts to improve social equity are part of the package. The Cleveland Foundation, the nation's oldest community foundation, with assets of over $1 billion, persuaded University Hospitals and the Cleveland Clinic to spread their wealth into the surrounding poor, predominantly African-

27 COLTMAN TOWNHOUSES Cleveland-based Dimit Architects' 27 townhouses in Little Italy, near University Circle, hit the market in early 2009—not the most auspicious time for real estate. Perhaps because of their flexible floor plans, industrial aesthetic (the property was a former brownfield), and proximity to the city's largest employers, all of them sold in two and a half years. The three-story houses, clad in cement board and phenolic panels, contain 1,600- to 3,400-square-foot loftlike units with roof terraces. The architects are working on another townhouse project for the same developer in Cleveland's Rocky River suburb.

UNIVERSITY HOSPITALS SEIDMAN CANCER CENTER Cannon Design's 375,000-square-foot cancer center (left) opened in spring 2011, combining all of University Hospitals' cancer departments under one roof (the health-care system is an affiliate of Case Western Reserve University). Located on the edge of the Case Medical Center campus next to a linear park and connected to the existing hospital, the center is another head-turning structure in University Circle. The architects stacked 10 floors of services between swerving glass curtain walls that bring daylight and distant views of Lake Erie to patient and treatment rooms.

RTA HEALTHLINE The nine-mile, $200 million bus rapid-transit line launched in October 2008, transporting passengers adjacent to and along Euclid Avenue, a grand corridor once known as Millionaires' Row, which went into a spiral of deterioration and neglect after the Great Depression. Decades in the imagining, the transit line is now credited with helping to attract $5.8 billion in investments for new construction and rehabilitation on Euclid. Hybrid rapid-transit vehicles stop at 40 stations and connect two growing areas, University Circle and downtown Cleveland.

PHOTOGRAPHY: (PREVIOUS SPREAD) © OCEAN PHOTOGRAPHY/VEER; (THIS SPREAD, CLOCKWISE FROM LEFT) MR. T IN DC, BRAD FEINKNOPF, JASON MEYER/FEINKNOPF, BRAD FEINKNOPF; MAPS BY NORMAN HATHAWAY

American neighborhoods by patronizing local employee-owned cooperatives such as laundries and urban greenhouses.

The Cleveland Foundation also cajoled the Northeast Ohio Regional Sewer District to work with Kent State University's Cleveland Urban Design Collaborative and others on a $3 billion project to cut pollution from the aging combined storm and sewer systems. The collaboration is part of KSU's "Reimagining Cleveland," an influential study of how the city could reuse neighborhoods hollowed out by population loss and foreclosures for parks, agriculture, constructed wetlands, and trails. "It's about nothing less than creating a sustainable framework for reviving the city," says Terry Schwarz, who heads the KSU program. "Rather than let the voids dilute the city, we have to think about putting vacant land back into productive but nontraditional uses."

The new projects across Cleveland are adding a fresh layer of architecture and landscape to the handsome civic armature established during the late 19th and early 20th centuries by industrial barons who built immense fortunes in oil, steel, mining, and banking, including John D. Rockefeller, industrial magnate John Long Severance, and Jeptha H. Wade, a founder of the Western Union Telegraph Company. "We inherited incredible bones, then we figured out how to take these wonderful old buildings and give them new uses," says the developer Ari Maron of MRN Ltd. Outside the historic core, prior attempts at revitalization include the less-than-successful Erieview urban-renewal district, conceived in 1961 by a young I.M. Pei. The project erased 200 acres of downtown density and filled the ensuing voids with bland Modernist towers now struggling to keep tenants.

Though considered the Midwest, Cleveland clings to its New England roots as part of a territory once termed the Western Reserve of Connecticut, first surveyed by Moses Cleaveland in 1796. He laid the plans for a 10-acre public square and downtown grid atop a 70-foot-high bluff that rises above Lake Erie and the Cuyahoga River. Downtown is still dominated by landmarks, such as the Neoclassical 1931 Terminal Tower, and by one of the largest intact City Beautiful districts in the country, designed in 1903 by Daniel Burnham. Part of the district will be relandscaped by Gustafson Guthrie Nichol of Seattle atop a new, below-grade convention center, designed by LMN Architects, also of Seattle. The $465 million project includes the nation's first Medical Mart, a showroom for advanced medical devices, set to open next year. Almost 20 years ago, Cleveland pegged its hopes for rebirth on such big, taxpayer-bankrolled projects as the Browns stadium and the Rock and Roll Hall of Fame, a mediocre building designed by an older I.M. Pei, plopped on the drab lakefront. The projects ensured that the city retained its major-league teams and attracted tourists, but did nothing to improve streetscapes or the poorly planned Lake Erie shoreline, cut off from downtown by a railroad and an interstate highway.

That once-elegant downtown, its broad streets nearly empty of shops, is still quiet these days, but there are pockets of vibrancy. Along East Fourth Street, in the shadow of the Gateway ballpark and basketball arena, also built in the 1990s, MRN Ltd. gentrified a dingy block of wig shops and greasy spoons, turning it into a regional hotspot for nightlife. Anchors on the street include Lola Bistro, one piece of a growing restaurant empire conceived by Iron Chef Michael Symon—part of the city's booming locavore gourmet movement—and the House of Blues, where you might catch one of the regular Pecha Kucha nights. In those alcohol-fueled networking events, young creatives strut their ideas in successive six-minute-and-40-second presentations on everything from art and fashion design to comedy, ceramics, and community redevelopment. "The energy is pretty awesome," says designer Christoff, an organizer of the events. If at least some of those twenty- or thirtysomethings stick around to grow new companies and raise families, Cleveland just might achieve its dream: a self-sustaining wave of reinvestment that leads the way to an even bigger rejuvenation. ■

Steven Litt is the architecture critic of the Plain Dealer *in Cleveland.*

MEDICAL MART, CONVENTION CENTER, AND BURNHAM MALL

Slated for completion in July 2013, LMN Architects' Medical Mart and the Cleveland Convention Center underground are rising in tandem with the revival by Gustafson Guthrie Nichol (GGN) of Daniel Burnham's 1903 downtown Mall (below). Together, the projects aim to bring the public back to the city center and reconnect a greener, unified Mall with the lakefront. The five-level Medical Mart (bottom), with a pixelated window pattern, is a permanent showroom for medical manufacturers. GGN's long-term plan for the Mall includes "outdoor rooms" to accommodate flexible programming and lighting to showcase beautiful historic buildings.

GREEN CITY GROWERS HYDROPONIC GREENHOUSE The newest addition to a group of local, worker-owned cooperatives, this four-acre greenhouse on a 10-acre site (above) in the Central neighborhood will be complete by mid-November; the first crop of leafy greens and herbs will be harvested in January. The greenhouse will supply 3 million heads of lettuce and 300,000 pounds of herbs per year, to be sold to the area's largest employers (Case Western Reserve University, University Hospitals, and the Cleveland Clinic) and retail groceries. Initially, the greenhouse will employ 20 to 25 people from the surrounding neighborhoods, where the median income is less than $18,500. A percentage of the profits will be distributed back to the employees.

MUSEUM OF CONTEMPORARY ART CLEVELAND Farshid Moussavi's first building in the U.S., on the corner of Euclid Avenue and Mayfield Road, adds another jewel to University Circle's crown when it opens this month. It is also a powerful urban accent in relationship to its neighbor, Stanley Saitowitz's mixed-use Uptown project. The four-story, 34,000-square-foot hexagon is clad in mirrored, black stainless-steel panels. A glass atrium will contain a small café and lounge, doubling as an event space. MOCA's new $27.2 million home includes three galleries, an education room, and offices. Exposed fluted metal decking painted a deep blue dominates the interior, which is punctuated by a sculptural steel staircase. *–Caption texts by Laura Raskin*

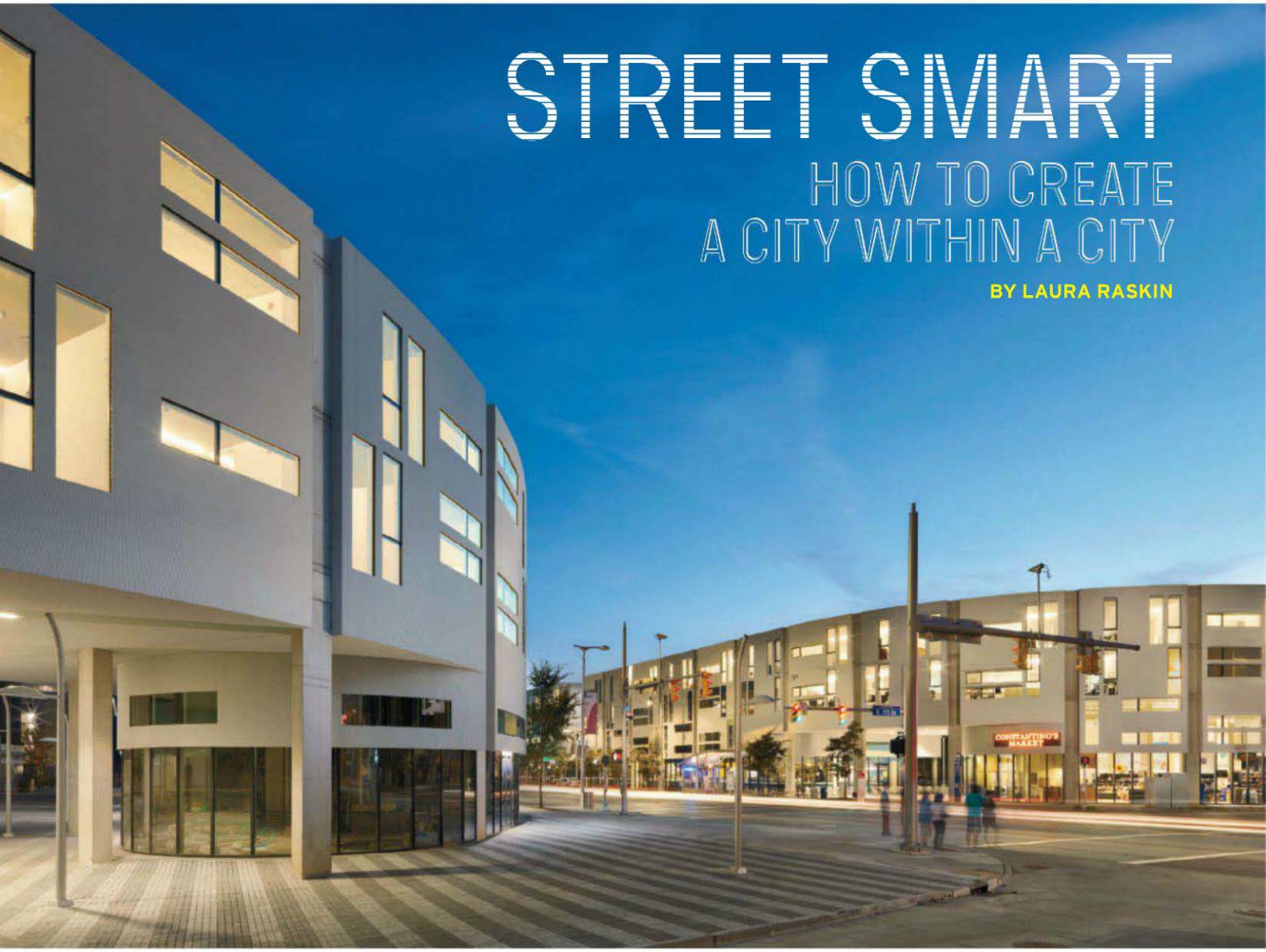
IMAGES (CLOCKWISE FROM BOTTOM LEFT): COURTESY LMN ARCHITECTS (2); © JASON MEYER/FEINKNOPF; COURTESY MUSEUM OF CONTEMPORARY ART CLEVELAND

Uptown | Stanley Saitowitz / Natoma Architects

STREET SMART

HOW TO CREATE A CITY WITHIN A CITY

BY LAURA RASKIN

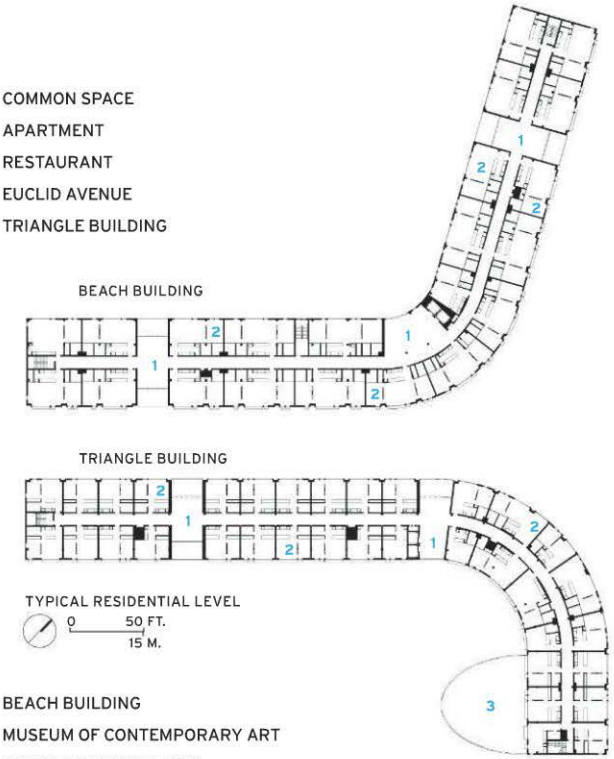


ROUNDING THE CORNER
The first phase of Uptown (above) was completed in August, comprising the Triangle, at left, and the Beach, at right. The two mixed-use structures sit across from each other on Euclid Avenue, providing studio, one-bedroom, and two-bedroom rental apartments on the upper floors and amenities on the lower level. While the buildings (opposite) line Euclid, they avoid uniformity with playful window patterns, ribbed aluminum facades that cast varying shadows, and plazas with landscape design by James Corner Field Operations.

CLEVELAND'S THREE largest employers—Case Western Reserve University, Cleveland Clinic, and University Hospitals—sit just shy of East Cleveland, the most bombed-out part of town, where foreclosures and population decline have taken the highest toll. Also clustered around this section of Euclid Avenue, called Greater University Circle, are thriving cultural institutions. Severance Hall is home to the Cleveland Orchestra, arguably the country's best. Then there's the Cleveland Museum of Art, a 1916 Beaux-Arts building with additions by Marcel Breuer and, most recently, Rafael Viñoly (page 114). The Cleveland Institute of Art, a college of art and design, will undergo a $5 million expansion to be completed by late 2014.

But a concentration of artistic and intellectual riches doesn't necessarily equal urbanity, especially if each institution exists on its own island. Over the last decade, the university and medical institutions, with help from the Cleveland Foundation and other local stakeholders, have been leveraging investments in and around the neighborhood to create a vibrant, connected center, with architecture and urban planning as the glue. One of the most recent projects is Uptown—San Francisco architect Stanley Saitowitz's mixed-use development, with 102 rental apartments, the area's only grocery store, a Barnes & Noble, restaurants, and other amenities on

1 COMMON SPACE
2 APARTMENT
3 RESTAURANT
4 EUCLID AVENUE
5 TRIANGLE BUILDING



6 BEACH BUILDING
7 MUSEUM OF CONTEMPORARY ART
8 PHASE III (CONCEPTUAL)
9 CLEVELAND INSTITUTE OF ART
10 EAST 115TH STREET
11 PHASE II (CONCEPTUAL)
12 PARKING

Case-owned land. Phase one was completed in August.

Saitowitz, in presenting Uptown to Case, the developer and owner MRN Ltd., neighbors, and entitlement authorities, showed photographs of London, Paris … and Cleveland. His emphasis was on each city's 19th- and 20th-century building stock and its interaction with the street. In his mind, the challenge of Uptown was "making an urban place": returning to the essence of what made these cities feel vital in their prime, but executing the idea in a 21st-century way.

Uptown's two buildings—172,000 square feet in total—sit across from each other on Euclid Avenue. The northern structure, called the Beach, makes a boomerang turn onto East 115th Street. The southern building, the Triangle, is shaped like a J and hooks around on East 116th Street. They could be monoliths, but they're deliberately not. Clad in white, custom-extruded ribbed aluminum panels, the facades of the concrete structures look to be varying shades of gray because the alternating vertical and horizontal ribs cast different shadows. The architect developed more than one Tetris pattern for the windows. The buildings relate but aren't identical. Alleyways slice through them to create casual shortcuts, aid circulation, and provide views. One immediate neighbor looks like a period at the southwestern end of the Uptown sentence: the Museum of Contemporary Art Cleveland (MOCA), which opens this month in its new home designed by Farshid Moussavi, an armored hexagon clad in reflective steel panels—another strategic element in place-making.

"It was a single-destination place," says Lillian Kuri, the Cleveland Foundation's program director for architecture, urban design, and sustainable development, of University Circle. "Uptown is already making a place where people come and do many things." It helps that local developer wunderkind Ari Maron, 34, whose family firm MRN Ltd. owns Uptown, has been an uncynical champion of the city's transformation through new construction, renovation, and adaptive reuse. (He played the violin, which he studied at Rice University, during a presentation of Uptown to University Circle leadership.)

Saitowitz has clearly been affected by Maron's and the community's enthusiasm. "The most exciting part of the project is to see how the area has been totally transformed by these buildings. MRN and Case are incredibly can-do," he says. "In San Francisco, everyone starts by saying no. In Cleveland, you can get a building permit in a month." The Beach was completed in May, the Triangle three months later; they are already 80 percent occupied, attracting the medical community, graduate students, and empty nesters. But the 20-foot-ceilinged amenities on the ground floors are meant for Case students. They've never had a Main Street.

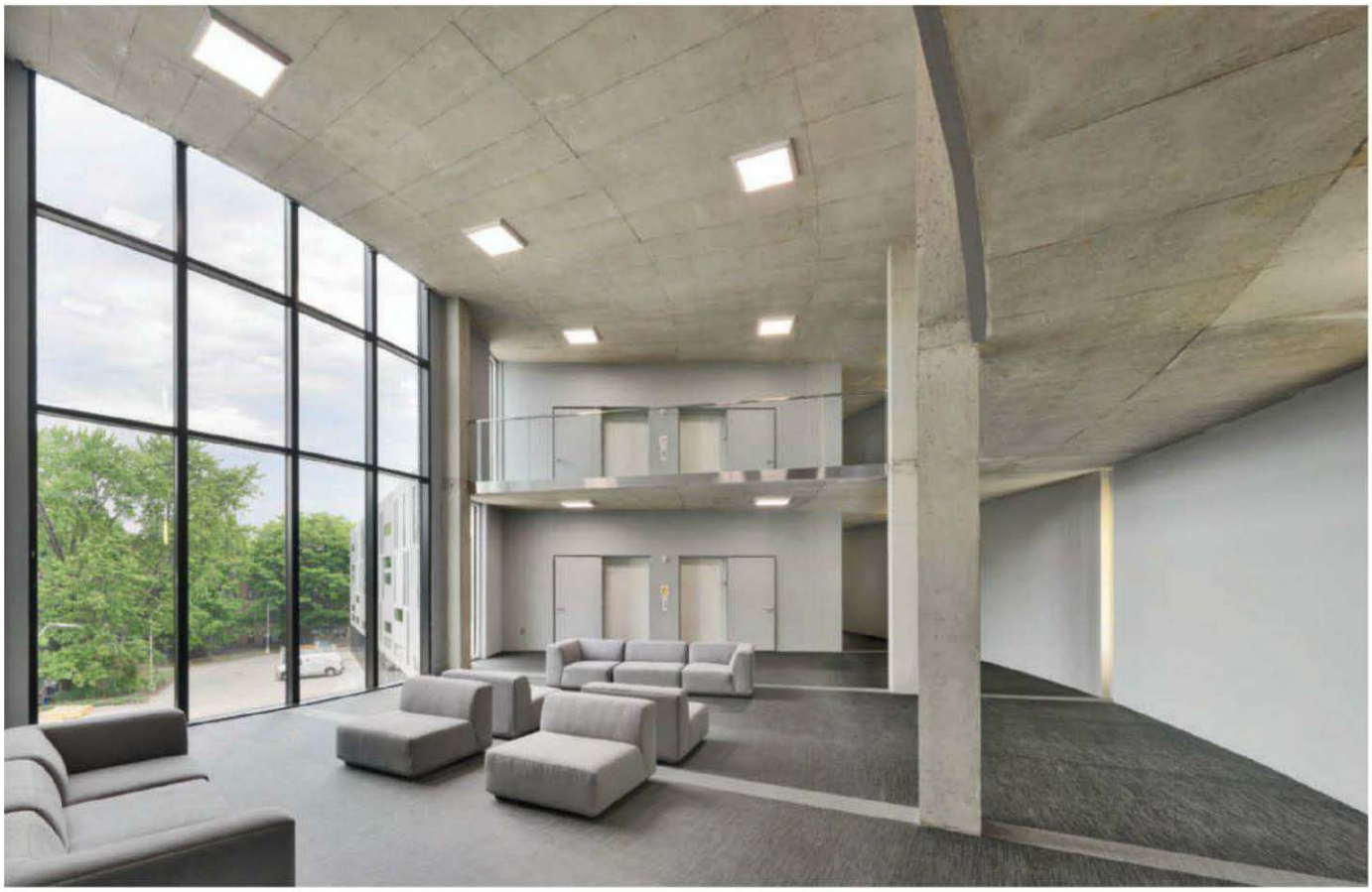
For Saitowitz, who has focused on urban infill housing for years, the project was a chance to expand on an organizing strategy where services in each apartment line one wall in "a kind of 'flat' version of a loft," he says. "It's a very clear service zone. The zone between that and the outer skin is less determined." The units are similar in both the Beach and Triangle buildings: white solid surfacing in the kitchen, sliding walls that reveal bedrooms on one or both ends of the combined living/dining space. Exposed concrete floors and ceilings helped with cost savings and create an adult, but not austere, palette. Hallways are broken up by double-height common rooms, where window walls bring in daylight.

The second phase of the project, to break ground in December adjacent to the Beach building, will provide student housing for the Cleveland Institute of Art as well as rental units. Phase three, to begin construction behind MOCA in mid-2013, will be 44 one-to-three-bedroom condos. The next phases will continue the language of Uptown but at a slightly taller scale. The entire project is on track for LEED Silver certification.

Uptown signals Case's continued dedication—along with that of other local institutions—to elevating design in Cleveland and catering to a sophisticated international population of students, teachers, and medical professionals. Case's campus includes Frank Gehry's 2002 Weatherhead School of Management. It is one of the architect's best buildings, with surreal brick walls that curl and melt as they're devoured by a swooping stainless-steel roof. In October 2011, the university announced that Ralph Johnson of Perkins+Will was designing its Tinkham Veale University Center, a wedge-shaped, green-roofed student center that broke ground this spring and is meant to be the much-needed "heart" of the campus.

Uptown reiterates an adamancy that architecture animate space and connect people, not simply advertise its creator. "It's not about objects," says Saitowitz of his practice and what he's done in Cleveland. "It's about the way architecture continues the lives of cities." ■

BUILDING NAME The building combines concrete and steel structural systems and five basic uses in different portions (plans, left; section, right). A multilevel observatory offers both indoor and outdoor galleries (beloThe tower's eight glass facades continue nearly 200 feet



PLACE SETTING Double-height common rooms (top) are meant to inspire a sense of community in the apartment buildings. The exposed-concrete ceilings continue in the individual units (above). Services and mechanicals line one wall, freeing up the rest of the apartments for loftlike living. Partitions with sliding doors separate the bedrooms from the living/dining space. Parking for the ground-level amenities, like a Barnes & Noble and grocery store, is located behind the buildings (opposite).

PHOTOGRAPHY: COURTESY MARKUS BISCHOFF (BOTTOM)

credits

ARCHITECT: Stanley Saitowitz / Natoma Architects – Stanley Saitowitz, principal; Neil Kaye, project architect; Markus Bischoff, project manager; Daniel Germain, job captain

ENGINEERS: Ebersole Structural Engineers (structural); Riverstone Company (civil); WHS Engineering (m/e/p); Glen W. Buelow (fire protection)

CONSULTANT: James Corner Field Operations (landscape)

CLIENT: MRN Ltd.

GENERAL CONTRACTOR: Rick Maron, MRN Ltd.

SIZE: 172,000 square feet

COST: withheld

COMPLETION DATE: August 2012 (phase one)

SOURCES

METAL PANELS: MG McGrath

CURTAIN WALL, GLAZING, METAL FRAME: All Metro Glass

DOORS: Babin Building Solutions

ELEVATORS: Gable Elevator

SOLID SURFACING: Corian

FLOOR AND WALL TILE: Daltile

CUSTOM MILLWORK: Royal Cabinet Design Company

PAINTS AND STAINS: Sherwin-Williams

MOISTURE BARRIER: Henry

Cleveland Museum of Art | Rafael Viñoly Architects

EARNING ITS STRIPES

A MUSEUM BUILDS ON ITS MANY LEGACIES

BY CATHLEEN MCGUIGAN

DIFFERENT STROKES Marcel Breuer's 1971 addition included a 115-foot-long concrete canopy and an education wing clad in horizontal bands of Minnesota granite (right). Rafael Viñoly gave a nod to Breuer with his 2009 east-wing addition (above), clad in bands of granite and white marble.

PHOTOGRAPHY: © BRAD FEINKNOPF

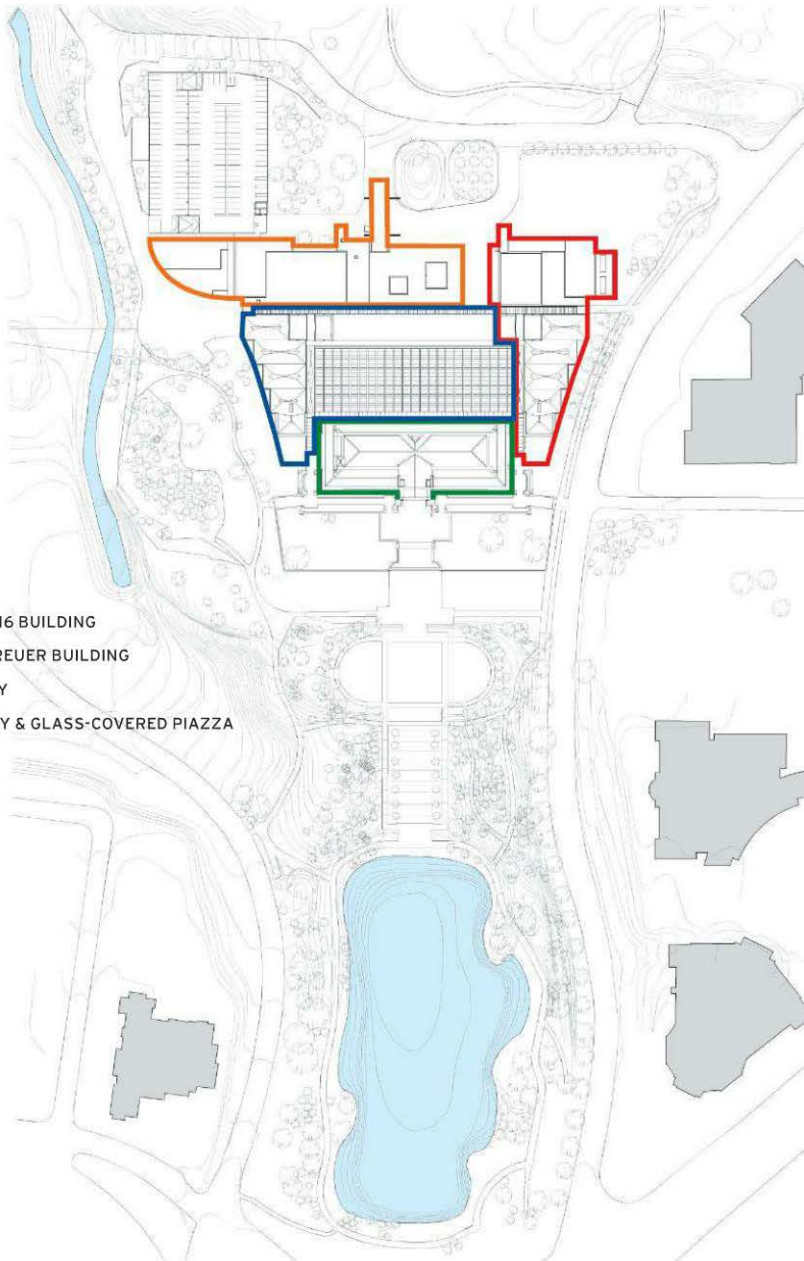
THE CLEVELAND Museum of Art is one of the city's enduring assets and a legacy of its history as an industrial powerhouse. Like other American temples for art built in the late 19th and early 20th centuries—in Detroit, St. Louis, Toledo—this Neoclassical pavilion, completed in 1916 on a rise overlooking a verdant Olmsted Brothers park, reflects the lavish patronage of a wealthier era. Among the finest art museums in the country, it has an encyclopedic collection with unsurpassed holdings of Asian art.

Even as the city's fortunes declined over the last half-century, the Cleveland Museum continued to add to its original building. Yet several expansions—including a 1971 education wing designed by Marcel Breuer—resulted in a hodgepodge of interior spaces and confused circulation. In 2001, Rafael Viñoly won a design competition to expand the museum again.

The idea behind the architect's scheme was surprisingly simple, inspired by the logic and symmetry of the original Beaux-Arts museum, which was designed by a local firm, Hubbell and Benes. "Whatever you say about the 1916 building, that it's a Greek temple or whatever, in terms of space and circulation it is spectacular," says Viñoly. "All you had to do was clarify it."

Over the years, the various additions had shifted the museum's center of gravity to the west, and the

WESTERN LEANING
An aerial photograph of the museum taken in October 2005 shows how various additions had shifted the plan west and resulted in confusing circulation. Viñoly's scheme restored the symmetry of the original 1916 building.



credits

ARCHITECT: Rafael Viñoly Architects – Rafael Viñoly, lead designer; Jim Herr, David Rolland, project directors; Daniel Gallagher, Mark Benton, project managers

ENGINEERS: Nabih Youssef Associates, Barber & Hoffman (structural); Arup, Karpinski (m/e/p); Moody Nolan (civil)

CONSULTANTS: Behnke Associates (landscape architect); George Sexton Associates (lighting); Akustics (acoustics); Vitetta (preservation)

GENERAL CONTRACTOR: Panzica/Gilbane

CLIENT: Cleveland Museum of Art

SIZE: 592,000 square feet, gross (new building)

COST: $350 million

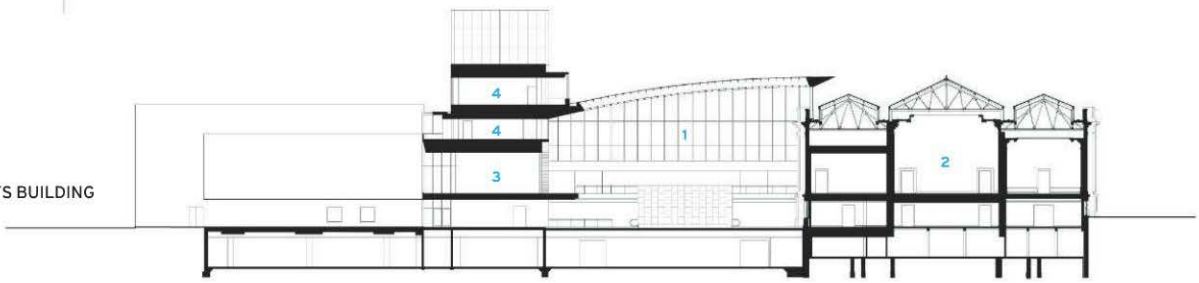
COMPLETION DATE: 2009 (phase one), 2012 (phase two)

SOURCES

ATRIUM: Josef Gartner

GLASS GALLERIES: NEC Mero

EXTERIOR STONE CLADDING: Global Precast



1 ATRIUM
2 EXISTING 1916 BEAUX-ARTS BUILDING
3 GALLERY
4 OFFICE

main entrance had moved to the boxy Breuer wing, beneath a massive, 115-foot-long concrete canopy. Viñoly's scheme called for razing everything between the original rectangular museum and the Breuer addition, which sat parallel to the north. The plan of the expansion is essentially a U shape, with a new bar building on the north end that wraps the length of the Breuer addition, and east and west wings that link it to the original museum building. That leaves an immense rectangular "hole" in the center of the Viñoly plan, where the architect has made his boldest move by creating a huge glass-roofed atrium. The new construction almost doubles the museum's size, to 592,000 square feet.

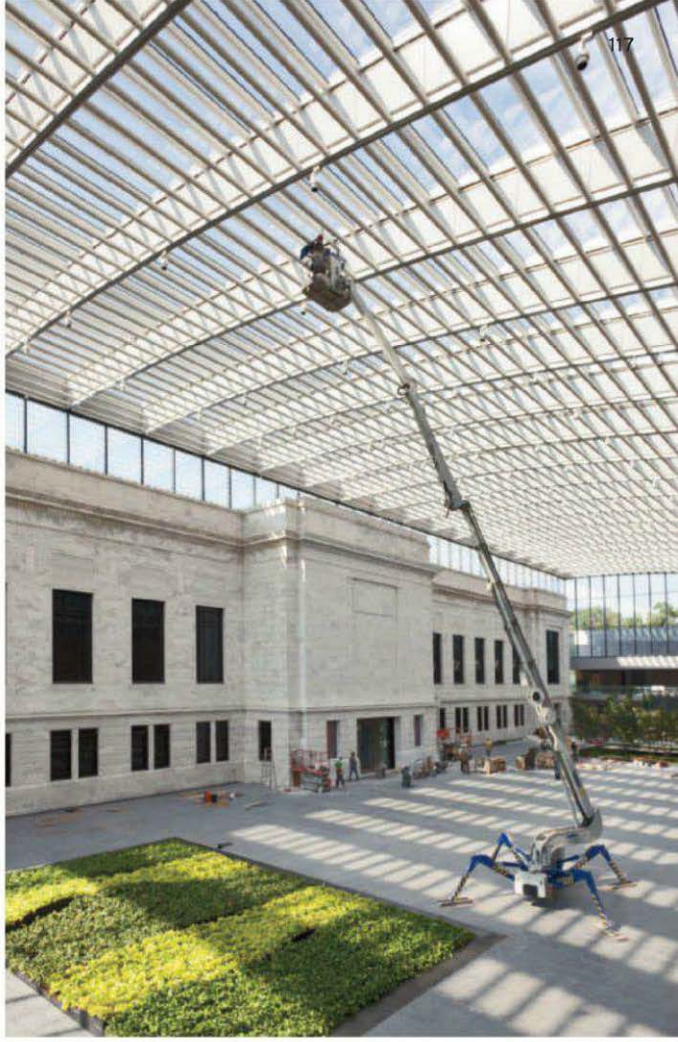
The $350 million project was so ambitious that its construction has been phased—a process that's been prolonged by the economic downturn. In 2009 the first phase opened: the new east wing, with three levels of galleries. Now the second phase is complete: the atrium and the new four-level north wing, housing more gallery space, a museum store, a learning center, and offices. A second-level balcony along its length overlooks the atrium and wraps around the interior of both new wings, connecting to the 1916 building on either end and creating an open loop of circulation. The final phase will be the opening next year of the west wing; it will contain a ground-floor restaurant and galleries above.

Grappling with the Breuer addition was difficult, says Viñoly. "A good furniture designer is usually a bad architect—and vice versa." An early version of his design called for replacing the Breuer entrance canopy, but that was abandoned, and it remains the primary museum entrance.

Viñoly has tried to bridge the stylistic chasm between Breuer's brownish Brutalism and the dazzling white prettiness of the original marble museum. The concrete 1971 structure is clad in alternating light and dark horizontal bands of Minnesota granite, a homage to such striped Italian Renaissance buildings as the cathedral in Orvieto. Viñoly's steel-frame east wing, which is staggered in profile to follow the curve of a road along the edge of the site, is clad in stone-faced precast-concrete panels. In a bow to Breuer, the stone is striped, using similar dark granite alternating with light bands made of the same white Georgia marble as the original 1916 museum. The new west wing mirrors the east, and as each wing's facade extends south to wrap the ends of the old museum, the dark stripes decrease in density and the white marble dominates. Atop the striped base of each wing is a glass-box gallery.

Inside Viñoly's skylit atrium—a space the length of a football field—the exterior north facade of the elegant old museum is revealed. An analysis of the wall's structure determined it could support the glass-and-mullion atrium roof, which rises in a gentle curve to a height of 61 feet, atop a row of slender steel columns that make it appear to float above the old museum. To prevent condensation on the glass, the architects employed an integrated technology widely used in Europe: Hot water is pumped through the mullions in the cold months, and cold water during the summer.

The atrium is poised to become a major urban amenity in the newly invigorated University Circle neighborhood. "The idea of the civic role of the museum is central in Cleveland," says Viñoly. As the museum's admission is free, this enormous sun-splashed room is a public space that belongs to everyone. ■



RAISE THE ROOF
A "hole" in the center of Viñoly's plan was topped by an enormous glass roof, creating an atrium between the original museum building, Breuer's addition, and two news wings. It almost doubles the museum's size and provides a new public amenity (right). Glass-box galleries sit on top of both the east and west wings' striped bases (bottom).

PHOTOGRAPHY (CLOCKWISE FROM LEFT): © FOCAL PLANE PHOTOGRAPHY; HOWARD T. AGRIESTI; BRAD FEINKNOPF

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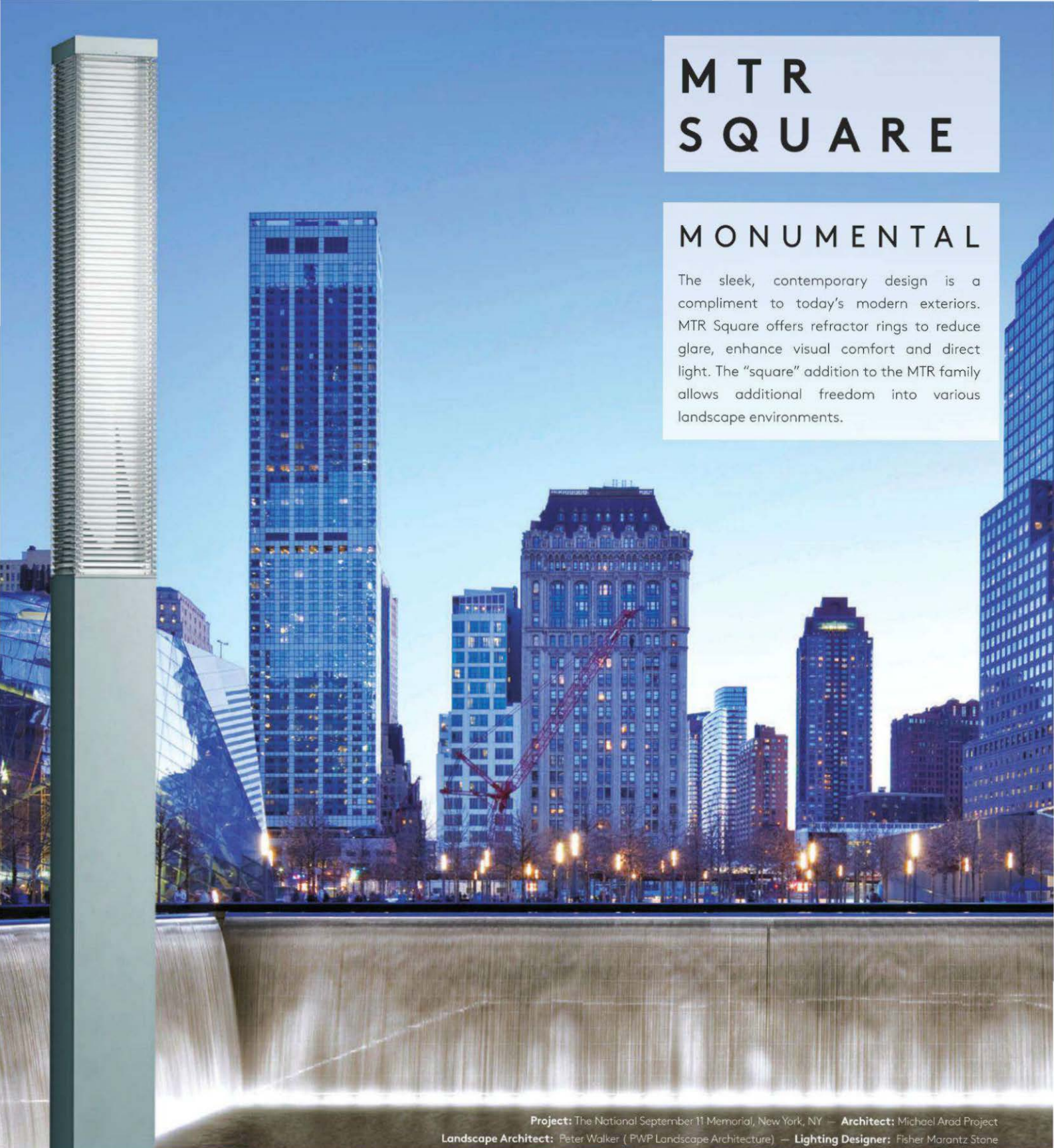

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Landscape Architect: Peter Walker (PWP Landscape Architecture) — **Lighting Designer:** Fisher Marantz Stone

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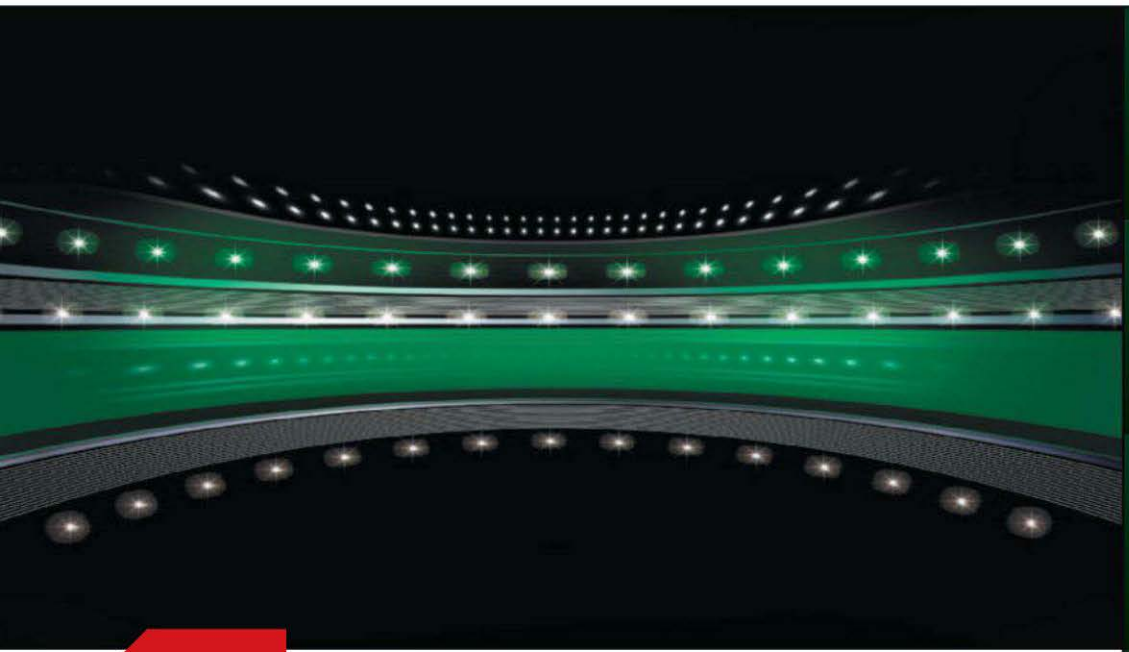

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Official contest rules, information and a listing of 2010 winners are available on the contest website.

REAL CEDAR

Left Picture - Architect: Alfred Waugh Architect
Right Picture - Architect: Bohlin Cywinski Jackson

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Set in Stone

New York City

Commemorating the legacy of FDR, Louis I. Kahn's last monument rises, 38 years after he designed it, on a watery urban site. By Beth Broome

PHOTOGRAPHY: © STEPHEN AMIAGA

LIKE A MAN stumbling out of his cryogenic pod, a project revived after cooling on ice for decades enters a world that is oddly familiar, but largely unknown. Resurrection is risky: Will the work still be relevant? Can it remain faithful to the designer's original intent? Such questions have swirled around the Franklin D. Roosevelt Four Freedoms Park in New York City, a memorial designed by Louis I. Kahn shortly before his death in 1974. Now, after 38 years, the park is ready to open to the public on October 24.

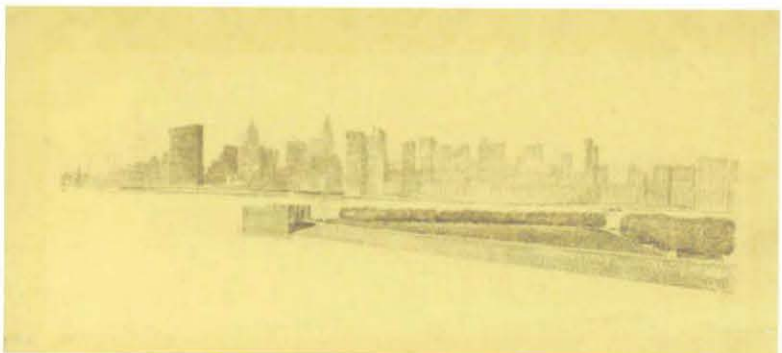
At the southern tip of Roosevelt Island, a gleaming white granite exclamation point braces against the currents of the East River between Manhattan and Queens. Composed of a triangle and a square, the symmetrical four-acre park has a simple, two-part idea. "I had this thought that a memorial should be a room and a garden. That's all I had…I just chose it to be the point of departure," Kahn said in a 1973 lecture. The garden is "a personal kind of control of nature. And the room was the beginning of architecture…an extension of self." As Kahn intended, too, it is a spiritual place. It not only imparts the feeling of the structure's eternity—which he understood as defining monumentality in architecture—but it also prompts the visitor, in the face of such heft and solidity, to contemplate her own role in the larger scheme of things.

Two miles long and 800 feet wide, Roosevelt Island, despite its proximity to Manhattan, was always on the fringes, hosting penitentiaries, almshouses, insane asylums, and hospitals for "incurables." In 1973—as plans to transform the island to a middle-class residential enclave developed—the New York State Urban Development Corporation (UDC) renamed the sliver of land, previously known as Welfare Island, and presented the public with a model of the Kahn memorial. The weight of the commission was not lost on the architect. New Deal programs had kept him employed early in his career. "Roosevelt was a very big deal in our house, and the betterment of mankind was a paramount theme within our family, as is apparent through my father's drive to enrich people's lives through architecture," says the late architect's daughter, Sue Ann Kahn, who has been informally involved with reviving the project since the 1990s.

Just before Kahn's death in March 1974, the Four Freedoms Foundation (FFF) and the New York State UDC approved the architect's preliminary design for the memorial. Of course, because he was known for holding off on decisions as long as possible, many of them—subtle, perhaps, but important—had yet to be made. A number of Kahn's staff, including his former associate and office manager, David Wisdom, worked together to complete the drawings, and entered a joint venture with the New York office of Mitchell/Giurgola (among other things, the team required an architect registered in the state who could sign off on the drawings). Aldo Giurgola, a friend of Kahn's, let the Kahn office take the lead. Over the years, despite numerous attempts to jump-start the project by the Franklin and Eleanor Roosevelt Institute (the successor of FFF) and its chairman, William vanden Heuvel, political will and financial might never seemed to coincide. Finally, in 2005, Chicago's Alphawood Foundation offered seed money, enabling vanden Heuvel to set up a project office, hire an executive director, and then, in 2008, establish the Franklin D. Roosevelt Four Freedoms Park, LLC (FDRFFP), as a subsidiary and construction entity. With private and public funding coming in, construction started in March 2010.

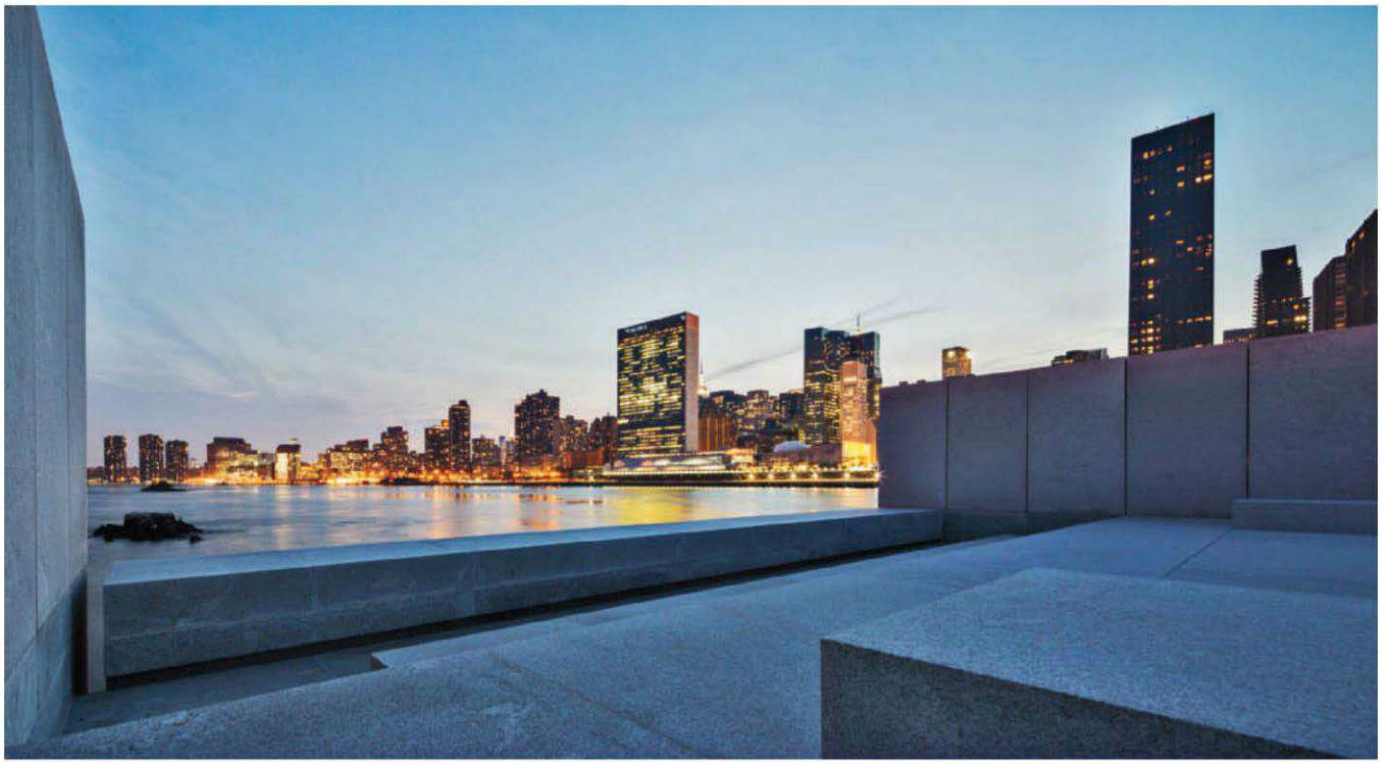
PHOTOGRAPHY: © PAUL WARCHOL, EXCEPT AS NOTED

Watch a video at architecturalrecord.com.



GRAND ENTRANCE Looking south, up the stair (top) and down the garden, a one-point perspectival view draws the gaze to the FDR bust. A granite embankment drops down to the east promenade (opposite), with riprap below. FDR Jr., Kahn, and New York Governor W. Averell Harriman (right) in April 1973 at a Four Freedoms Foundation dinner where a preliminary design was unveiled (images were not made public at the time). Kahn used colored pencil on yellow tracing paper for this perspective (above) from September 1973, when the name of the island was changed and the design was presented for the first time. (This scheme was not built.)

IMAGES: LOUIS I. KAHN COLLECTION, THE UNIVERSITY OF PENNSYLVANIA AND THE PENNSYLVANIA HISTORICAL AND MUSEUM COMMISSION (FAR LEFT); ESTHER ISRAELI KAHN COLLECTION, THE ARCHITECTURAL ARCHIVES, UNIVERSITY OF PENNSYLVANIA (LEFT)



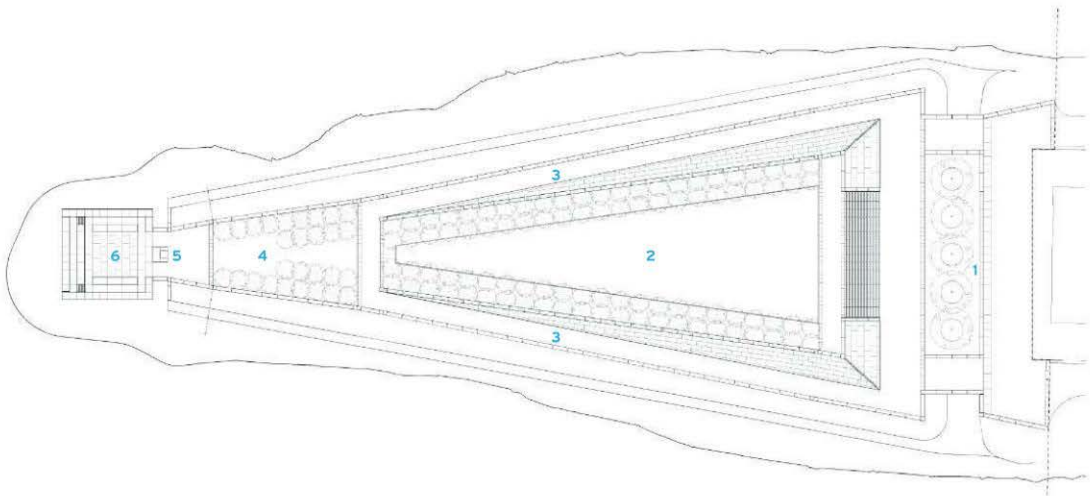
HEAD OF STATE FDR's 1,050-pound bronze bust (opposite) is an enlargement of a 1933 sculpture by Jo Davidson. The room (top) offers sweeping views of Manhattan's Midtown, including the U.N. complex. The Queensboro Bridge glows behind a granite block on which is engraved text from FDR's "Four Freedoms" speech (above).

Just to the south of the romantic ruins of James Renwick's 1854 Smallpox Hospital (and the nearby site of Cornell University and Technion-Israel Institute of Technology's forthcoming tech campus) a monumental granite stair leads up to the triangular garden, a swath of sloping turf flanked by allées of little-leaf linden trees. On either side, granite embankments drop down to swooping promenades, with broad riprap below that buffers the memorial from the East River (which is actually a tidal strait). Reflecting the influence of classical architecture on Kahn's work, forced perspective directs visitors' gazes and animates these expansive spaces. Beyond a cobblestone forecourt, the triangle comes to a literal head at the 1,050-pound bronze bust of FDR—an enlargement of a sculpture by Jo Davidson. It sits in a niche on the back of which is carved part of FDR's famous 1941 "Four Freedoms" speech to Congress, in which he articulated four essential human freedoms to which he believed everyone was entitled: freedom of speech and expression, freedom to worship, freedom from want, and freedom from fear.

The head marks the threshold to the room, which is walled in by monolithic, 36-ton blocks of saw-cut Mount Airy granite from North Carolina—the only stone used on the project, and one of three that Kahn had originally selected. They are set just 1 inch apart, and the faces inside the joint have a polished finish. "The difficulty of both fabricating a block of this size and keeping the very, very precise edges and the very tight tolerances that Kahn would have demanded was incredibly challenging to everybody," says FDRFFP executive director Gina Pollara, who trained as an architect and who, over the last six years, has helped shepherd the project to completion. Pollara notes that while the original drawings had a 1/32-inch tolerance, this team built with a (still impressive) 1/8-inch tolerance. The rigidity of the execution shows. And cinematic moments abound. A trench (or ha-ha) at the room's prow obviates the need for a railing, allowing sweeping views out to Manhattan—and, fittingly, the United Nations complex—and gives a visitor the impression that you could walk right off the edge into the water.

The team wanted to be as true to the original design as possible, but adjustments (particularly given improved technology) were inevitable. "In bringing the project up to current construction standards, and addressing building-code requirements and climate change, the challenge was to structure the underpinnings without changing the appearance

1 ENTRANCE
2 GARDEN
3 PROMENADE
4 FORECOURT
5 FDR HEAD
6 ROOM



PLAN

0 100 FT.
30 M.

MARCHING ORDER Looking north from the forecourt, the Renwick ruin signals the park entrance (left). Allées of little-leaf lindens shade gravel footpaths along the garden and continue into the cobblestone forecourt, which leads down to long promenades. All the stone throughout the memorial is Mount Airy granite. Below, a model produced by Kahn's office in February 1974.

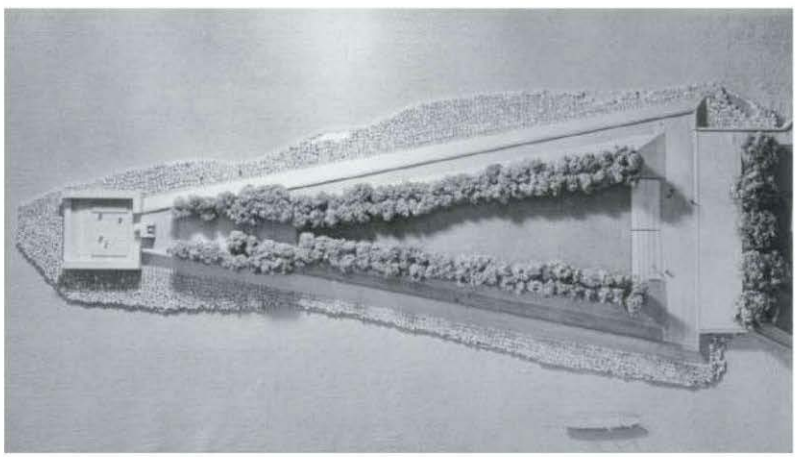


IMAGE: THE ARCHITECTURAL ARCHIVES, UNIVERSITY OF PENNSYLVANIA, PHOTO BY GEORGE POHL (RIGHT)

of the project in any way," says Paul Broches of Mitchell/Giurgola. The team raised the park elevation by about 15 inches to accommodate the rising sea level. In the room they added caissons to support concrete footings and threaded steel rods through the granite foundation walls and columns to resist environmental loading, including flooding, wave forces, and seismic load. The lighting scheme was expanded (to illuminate the little-leaf lindens and the bust, in addition to the specified beech trees), as was the tree grid, which grew from 10 by 10 feet to 12 by 15 feet on advice of consulting arborists.

The team availed themselves of advanced technology and products, such as modern grouts, and made updates in accordance with ADA accessibility, including replacing gravel on the footpaths between the allées with stabilized crushed granite, which, unfortunately, lacks the satisfying crunch and glint of the loose stone. "People have gone to every possible length to make the memorial as close to my father's intentions, insofar as they could determine what they were," says Sue Ann Kahn. "I do think it's a miracle it was accomplished. And I think he would be pleased."

Traversing the park is like being on a ship coursing into a bright beyond. Standing in the still coolness of the allées, or in the dazzlingly bright room where waves crash against the foundation and the big city skyline is surreally suspended across the water, is an experience that transcends time, like the structure itself, which feels both ancient and modern. "What was has always been. What is has always been. What will be has always been," said Kahn. "Such is the nature of beginning." It has been a long time coming, but what a beginning this is. Kahn knew as well as anyone that great monuments take time to build. ■

credits

ARCHITECT: Louis I. Kahn

CLIENT: Franklin D. Roosevelt Four Freedoms Park, LLC – Ambassador William J. vanden Heuvel, chairman; Sally Minard, president; Project Office: Gina Pollara, executive director; Stephen Martin, associate director; John Conaty, owner's representative

ARCHITECT OF RECORD: Mitchell/Giurgola Architects – Paul Broches, partner in charge; John Kurtz, design partner; Valerie DeLoach, project architect

ENGINEERS: Langan Engineering and Environmental Services (geotechnical/civil); Weidlinger Associates (structural); Loring Consulting Engineers (m/e/p)

CONSULTANTS: Harriet Pattison, Lois Sherr Dubin (landscape); Port Morris Tile & Marble (granite installation); Swenson Stone Consultants (stone quality assurance); Tillett Lighting Design (lighting); John Stevens Shop (engraving)

CONSTRUCTION MANAGER: F.J. Sciame Construction

LANDSCAPE CONTRACTOR: Steven Dubner Landscaping

SIZE: 4 acres

COST: $44.5 million

COMPLETION DATE: October 2012

SOURCES

GRANITE QUARRY & FABRICATION: North Carolina Granite Corporation

LIGHTING: iGuzzini

BRONZE HEAD: Polich Tallix Fine Art Foundry

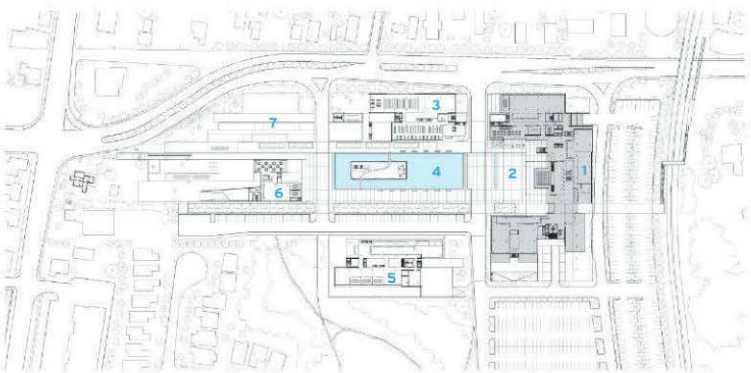
TREES: Halka Nurseries (little-leaf lindens); Whitmores Landscaping (copper beeches)

Stimulus Plan

Vaughan, Ontario

A city-hall complex creates a civic heart for a growing Toronto suburb.

By Clifford A. Pearson



SITE PLAN

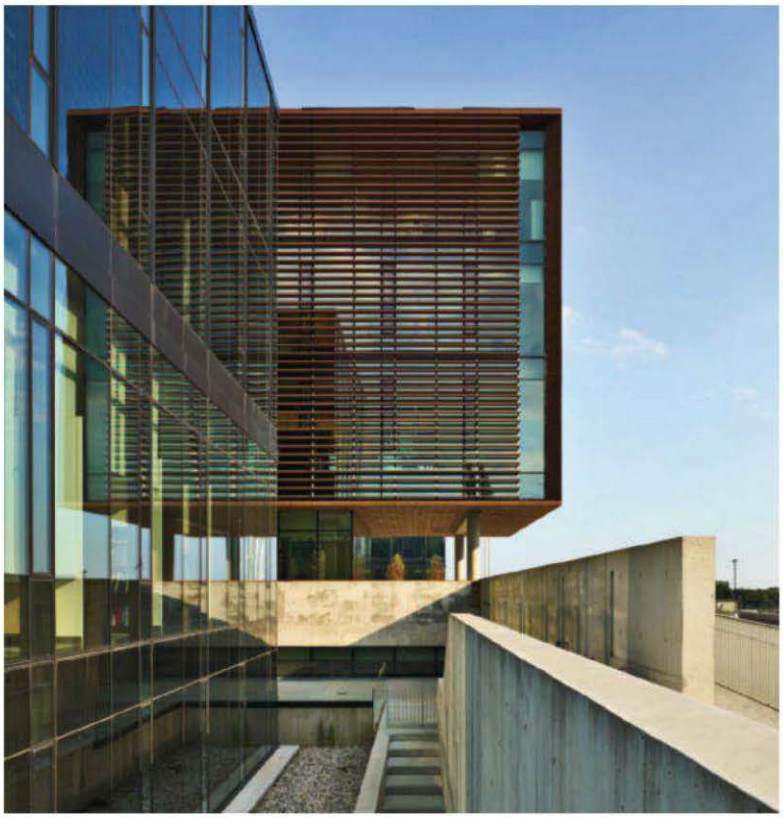
1 CITY HALL
2 CIVIC SQUARE
3 LIBRARY (FUTURE)
4 SKATING/WATER FEATURE (FUTURE)
5 EXPANSION OFFICES (FUTURE)
6 CHAMBER OF COMMERCE (FUTURE)
7 COMMUNITY GARDENS (FUTURE)

ONE OF THE fastest-growing places in North America, Vaughan, 14 miles north of Toronto, has morphed from a rural township of 16,000 people in 1960 to a sprawling suburb of 288,000 today. Now it is taking the next step—applying a layer of urban amenities onto an uninspired landscape of highways, shopping malls, and tract houses. A subway line to Toronto will open in 2015, and construction has begun on Vaughan Metropolitan Centre, a downtown district that will have apartment towers, office buildings, entertainment facilities, and pedestrian-oriented shopping.

Another important piece in this emerging urban mix is Vaughan's new city hall, a 325,000-square-foot complex that serves as both a symbolic and a practical manifestation of change. Although bordered on two sides by major arterial roads and on a third by an intercity railroad, the city hall aims to jump-start a 24-acre zone of civic activity that will eventually include a library, a chamber of commerce, public gardens, and an outdoor skating/water feature. In 2004, the Toronto-based firm Kuwabara Payne McKenna Blumberg (KPMB) won an invited competition to design a master plan for this civic center as well as the city hall. "We told them up

PHOTOGRAPHY: © TOM ARBAN

View additional images at architecturalrecord.com.



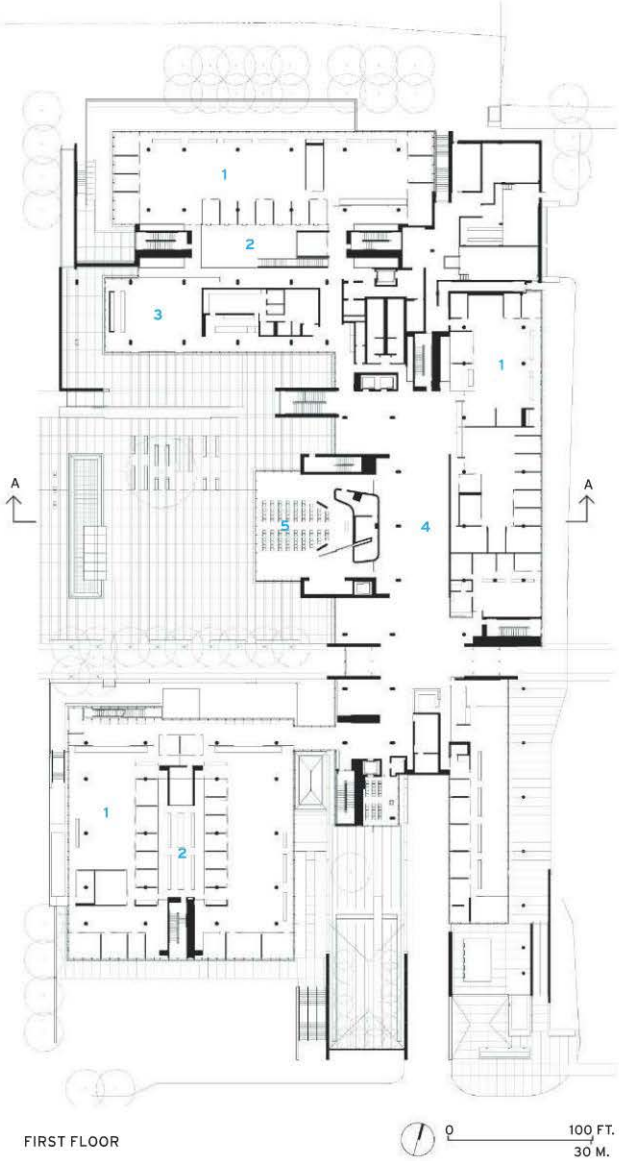
COMMUNITY VALUES Sustainability and transparency were two of the key concepts driving the design of the project. The glass-fronted council chamber (opposite, at left) cantilevers above a landscaped civic square, allowing citizens to see the workings of their government. The LEED Gold project features fixed terra-cotta louvers on many elevations (above), as well as fritted, low-E glass and a number of green roofs. When a skating/water feature and a library are built just west of the new city hall, surface parking (seen in photo below) will be tucked underground. A clock tower adds a vertical accent to the horizontal building forms and alludes to campaniles and the Italian heritage of many Vaughan residents.

front that we would break the competition rules," says Bruce Kuwabara, the design partner for the project. "We didn't want to design a fancy object surrounded by cars, so we told them it would be a set of buildings and have much of the parking underground." The firm's scheme creates a campus that echoes the traditional model of Canadian towns in which city hall, public square, market, and cenotaph cluster together. It also weaves buildings and outdoor spaces into three strips of development, referencing the east-west mapping of agricultural fields in the province. "Given the devastation of suburbia, we decided to re-till the landscape to create a new urban center," explains Kuwabara.

KPMB's master plan called for phased development, allowing the city government to stay in its bunkerlike 1970s building on the north side of the site while the new city hall was erected on the east side. The new building opened in the fall of 2011, so Vaughan can now raze the old one and move forward with future phases.

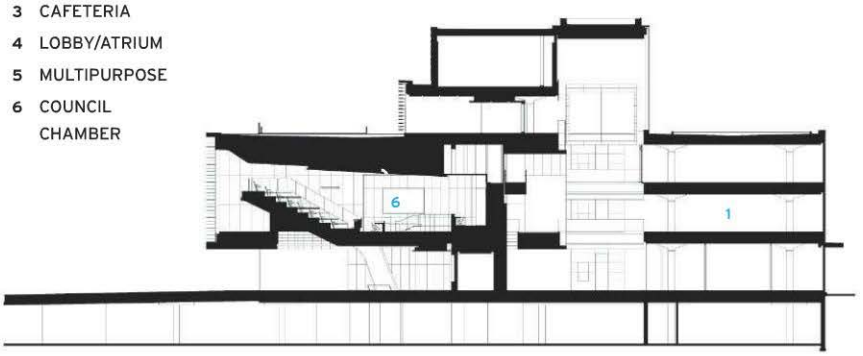
Facing a new civic square that serves as a gathering place for public events such as the mayor's annual barbecue, the building, which cost $108 million (in U.S. dollars), houses the city-council chamber, government offices, and spaces for permitting agencies. To visually anchor the composition of two-, three-, and four-story volumes, the architects attached a slender tower overlooking the square. "We needed to create a piece of civic architecture, not just an office building," states Kuwabara, citing a lesson his firm learned designing two earlier city halls: in Kitchener, Ontario (1993), and Richmond, British Columbia (2000). Although working in an abstract manner, the architects wanted to connect the Vaughan project to the city's population, which includes a large community of Italian descent. So they spoke of the tower as a campanile and used terra-cotta for louvers that shade the building and panels that clad it.

The building expresses the values of a growing and increasingly confident city, says Mayor Maurizio Bevilacqua, who took office in December 2010 after serving for more than two decades as a member of Canada's Parliament. "It's

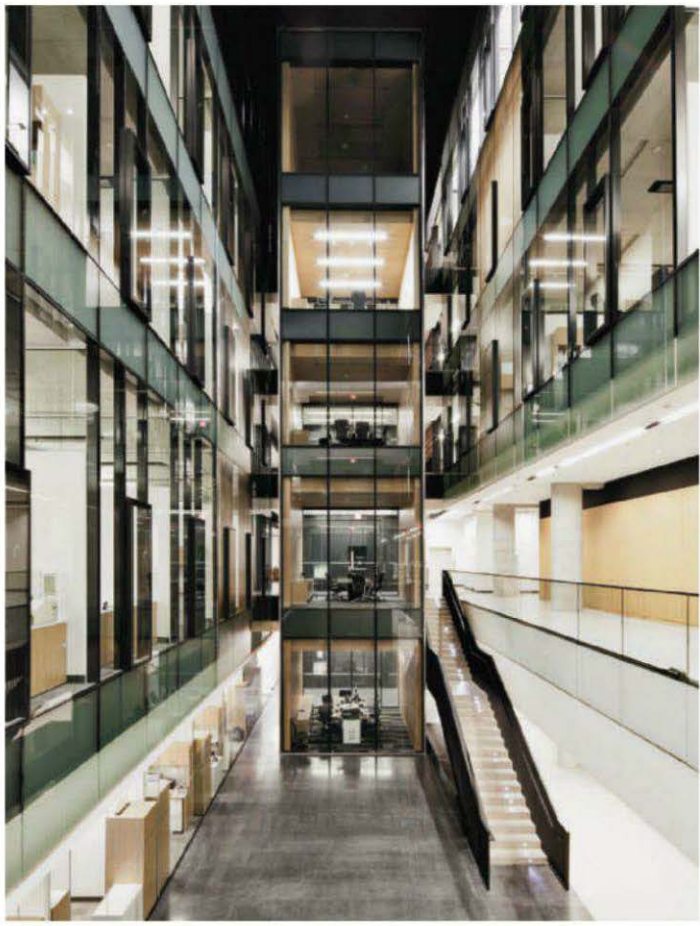


FIRST FLOOR

1 OFFICE LOFT
2 ATRIUM
3 CAFETERIA
4 LOBBY/ATRIUM
5 MULTIPURPOSE
6 COUNCIL CHAMBER



SECTION A-A



credits

ARCHITECT: Kuwabara Payne McKenna Blumberg – Bruce Kuwabara, design partner; Shirley Blumberg, partner-in-charge; Goran Milosevic, principal; Kevin Bridgman, project architect

ENGINEERS: Halcrow Yolles (structural); Stantec (mechanical); Mulvey+Banani (electrical); Conestoga-Rovers & Associates (civil); DST Consulting Engineers (LEED)

LANDSCAPE: Phillips Farevaag Smallenberg

CLIENT: City of Vaughan

GENERAL CONTRACTOR: Maystar General Contractors

SIZE: 325,000 square feet

COST: $108 million

COMPLETION DATE: September 2011 (phase one)

SOURCES

TERRA-COTTA PANELS AND LOUVERS: Boston Valley Terra Cotta

ENTRANCE DOORS: Assa Abloy Canada

GLASS OFFICE PARTITIONS: Unifor

CARPET TILE: InterfaceFLOR

a place for the human experience" where people can come together, he says. "It is also a reflection of a new era when transparency and sustainability are important."

Bringing daylight deep inside the complex was a critical factor in KPMB's design. So in addition to wrapping much of the poured-concrete structure with low-E glass, the firm created a trio of interconnected atriums with tall clerestory glazing. Operable windows looking onto each atrium draw air and light into open-office lofts on the upper floors, reducing loads on HVAC and electrical systems. Raised floors in the office areas bring air close to workers, so less heating and cooling is needed to keep indoor temperatures comfortable. And convincing the client to eventually put most of the 900 parking places underground will allow KPMB to cover much of the site with landscaping that will mitigate rainwater runoff. (Until the next phase of development brings the reflecting pool/skating surface above the garage, though, cars still park in a lot west of the civic square.) The project consumes less than half the energy per square foot as the old city hall, says Kuwabara; it earned LEED Gold certification.

Visitors enter the building from either the east or west, cued by an allée of maple trees that creates the illusion it is running through the lobby and out the other side. Inside, maple and walnut finishes on walls and soffits, along with Ontario Wiarton and Halton Blue Ice stone on the floors produce a sense of dignity leavened with warmth. Open walkways with glass balustrades on the second floor, and the glazed interior perimeters of the office lofts, mean that everyone enjoys long views through the building. The architecture indeed emphasizes the city's goal of transparency in governance.

KPMB faced many challenges, including budgetary constraints and three changes in mayors during the course of the project, but Vaughan City Hall offered it the chance to design "the infrastructure of government" and help a growing suburb become a more cosmopolitan kind of place. ■

INNER LIGHT Three atriums topped with tall clerestory glazing bring daylight into the center of each office block. By varying the design of the multistory spaces (above and opposite), the architects gave each atrium its own identity.

Shrine of the Book

Washington, D.C.

Adjaye Associates' Francis A. Gregory Library fits into a city park with serenity and dynamism.

By Suzanne Stephens

LIMPID LOOK The branch library on the edge of Fort Davis Park in Washington's Hillcrest neighborhood features a glass exterior wall of diamond-shaped lites. Floating above the pavilion is an aluminum-frame canopy. The plywood honeycomb containing the curtain wall's structure is fully revealed in the lobby (opposite).

DAVID ADJAYE, the Tanzanian-born architect with offices in New York City, London, and Berlin, has a lot going on in Washington, D.C. While he is busy working on the National Museum of African American History and Culture on the National Mall, Adjaye's New York office just completed two branch libraries for the District of Columbia Public Libraries (DCPL) system: the William O. Lockridge/Bellevue Library (page 139) and the Francis A. Gregory Library. The DCPL program, dedicated to creating architecturally distinctive structures in Washington neighborhoods, seeks to transform these small civic buildings from just repositories of books into incubators for learning as well as community interaction. Already branch libraries designed by the Freelon Group of Durham, North Carolina (RECORD, March 2011, page 88), and by Davis Brody Bond (RECORD, February 2012, page 96) lend the DCPL's portfolio a design heft. Interestingly, these two firms are also working with Adjaye on the African American museum, scheduled for completion in 2015.

With the Gregory library, Adjaye has created a shimmering pavilion at the edge of Fort Davis Park in the southeastern part of the city. The two-story, steel-frame structure, 23,000 square feet in size, both blends in with its wooded surroundings and distinctively stands out from them by virtue of its sleek, glass-enclosed, 24-foot-high volume tucked underneath a muscular, louvered aluminum canopy. Floating above the pavilion, the dark-gray canopy brings the library's height to 35 feet and bolsters its commanding presence in the neighborhood. In addition, it cantilevers 20 feet from the south entrance facade to provide a needed sunshade in the summer.

A diamond motif characterizes the library's curtain wall where the glass lites vary in width from 5 to 8 feet—an "expansion and contraction that reflects the notion of growth, like the forest," says Adjaye. Just behind the limpid glass exterior surface, an open web of diamond-shaped plywood modules subtly asserts its presence on the outside. The modules, 1 foot 3 inches deep, contain the actual structure of the curtain wall—an X-shaped steel diagrid next to the glass with vertical

PHOTOGRAPHY: © EDMUND SUMMERS

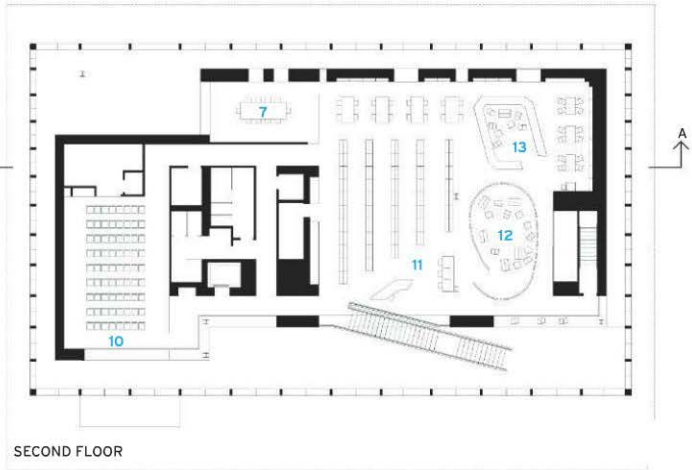
View additional images at architecturalrecord.com.

steel supports backing it up. The exterior glass that skims by the plywood modules in this seemingly effortless structural exercise alternates between low-E, double-insulated panes allowing views out and spandrel panels with a mirrored finish on the inner surface that reflects the leafy trees. Where access to the library is needed, such as at the entrance on one end of the south facade, Adjaye has inserted portals of composite metal panels into the curtain wall—one of the few gestures that interrupt the strong concept of the luminously abstract glass pavilion.

The glossy facade is a clue to the combination of simplicity and complexity integral to the architect's approach. This can be seen not only in the exterior planes and structure but in the interior's spatial disposition and functional resolution, as well as the overall play of colors and textures. Visitors enter a lobby of gleaming black surfaces: The circulation desk features a base of lacquered black medium-density fiberboard (MDF) topped by a solid-surface black counter. Along with the black-stained concrete floor and a 13-foot-high soffit of drywall with a bronze metallic finish, the architect has established a dramatic counterpoint to the skylit main hall extending along the south facade. Here the space soars upward to a 23-foot-high skylight composed of a diagrid of aluminum and glass. Free-standing shelves for electronic media edge the open-plan ground-floor reading areas, where one can also catch framed glimpses of the park in back.

Visitors can take the angular black stair, or elevators in either of two service cores, to the second floor. Here the children's reading and other areas extend toward the perimeter of the library's volume. Although these areas are enclosed by interior walls, deep windows with seats carved into them allow children to read while looking into the woods through clear diamond panes in the exterior walls beyond. If the acoustical ceiling of the children's browsing room seems rather low, the occasional skylight adds much-desired natural illumination. Also on this floor, a semi-enclosed comma-shaped space clad in Douglas fir functions as a children's program room, and a conference room with a large glass interior window overlooks the double-height teen reading room.

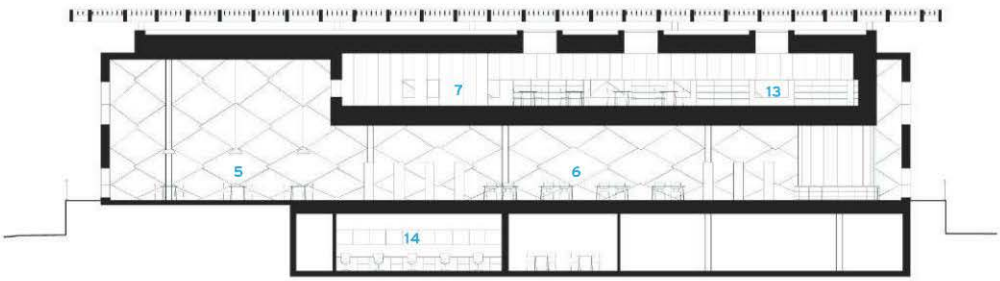
GROUND FLOOR



SECOND FLOOR

The architects attained a LEED Silver rating: The glass walls promote thermal gain during the winter, but the canopy cuts unwanted solar load in the summer. In addition, the ground paving is pervious to prevent storm runoff. (Yet the subzero air conditioning on a hot summer day is a reminder that LEED ratings do not guarantee energy-efficient operations.)

With a budget of $13 million, Adjaye has managed to give the branch library an unusual sense of elegance and sumptuousness, while still imparting a visual and physical accessibility to its neighborhood users. A break-in connected with theft of computer goods caused damage to the glass, yet, according to Ginnie Cooper, the DCPL's chief librarian, the community has been "warmly responsive" to its design. Many find it "jaw-dropping." ■



SECTION A-A

LIGHT TOUCH From the second-floor conference room, visitors can look through a glazed aperture into the teen room, where handcrafted lampshades are suspended over the seating in the double-height space.

1 ENTRANCE
2 BOOK DROP
3 CIRCULATION DESK
4 STAFF WORKROOM
5 TEEN SERVICES
6 ADULT READING
7 CONFERENCE ROOM
8 STUDY ROOM
9 ADULT LEARNING
10 MEETING ROOM
11 CHILDREN'S BROWSING
12 CHILDREN'S PROGRAM
13 CHILDREN'S READING
14 STAFF LOUNGE

credits

ARCHITECT: Adjaye Associates – David Adjaye, principal; Austin Harris, project director; Russell Crader, project manager; Edward Yung, architectural assistant

ARCHITECT OF RECORD: Wiencek + Associates

ENGINEERS: Setty & Associates (m/e/p); ReStl Designers (structural)

CLIENT: District of Columbia Public Libraries

CONSULTANT: Greenhorne & O'Mara (landscape)

SIZE: 23,000 square feet

COST: $13 million

COMPLETION DATE: June 2012

SOURCES

CURTAIN WALL: Tower Glass Company

LOUVERED CANOPY: Conservatek Industries

ACOUSTICAL CEILINGS: Ecophon

ELEVATORS: Kone

FURNISHINGS: Herman Miller, Vitra, Bernhardt, Spacesaver

CARPET: Mannington

Raised Expectations

Adjaye Associates tucks another library into a sloping site in D.C.'s Bellevue neighborhood.

A SECOND BRANCH—the William O. Lockridge/Bellevue Library, also completed by Adjaye Associates for the District of Columbia Public Libraries (DCPL) system—looks more like a Brutalist treehouse than the glimmering pavilion that is the Francis A. Gregory Library (page 136). Set on a steep, hilly site in southwest Washington, the branch was named both for a community activist and the Bellevue neighborhood. The design adheres to the same specifications as the Gregory branch in terms of size (23,000 square feet) and budget ($13 million), as well as the mandate to welcome the moderate-income community through varying programmatic spaces and services.

The tight, 30,000-square-foot site drops in grade about 40 feet, which prompted Adjaye to create a series of podlike structures spilling down the slope. He placed the library's entrance at the lowest point on the north, under large concrete pilotis supporting the building's poured-in-place concrete polygon. Smaller, attached, polygonal steel-frame structures with synthetic stucco surfaces contain more intimately scaled spaces—one for a children's activities room on the second level; two pods for teen services and meeting rooms on the third floor. Their fragmented geometries were meant to give the building a sculptural quality and prevent it from looming monolithically above the mostly brick houses nearby.

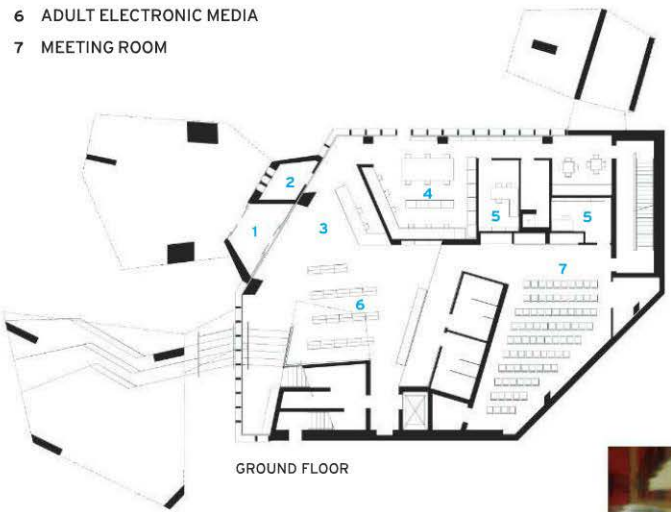
Nevertheless, the proposal caused a kerfuffle when David Adjaye first showed his scheme to the community in 2010. After several meetings the architectural ensemble became more Aalto-esque, with the addition of vertical Port Orford cedar fins that add scale and texture.

Today, as visitors enter the main volume, they find a large stair at one side leading up to the expansively glazed two upper floors. A rectilinear light well with green-tinted glass walls slices through the main pavilion without sacrificing transparency. The third floor's adult reading room, at grade with the upper part of the slope, looks into a wooded outcropping at the south. One summer afternoon, deer foraged the turf, oblivious to an audience in the nearby structure. They didn't seem uncomfortable with the architecture, a view that is evidently now shared by library visitors, judging from the heavily populated computer terminals and reading rooms on a hot summer day.—*Suzanne Stephens*

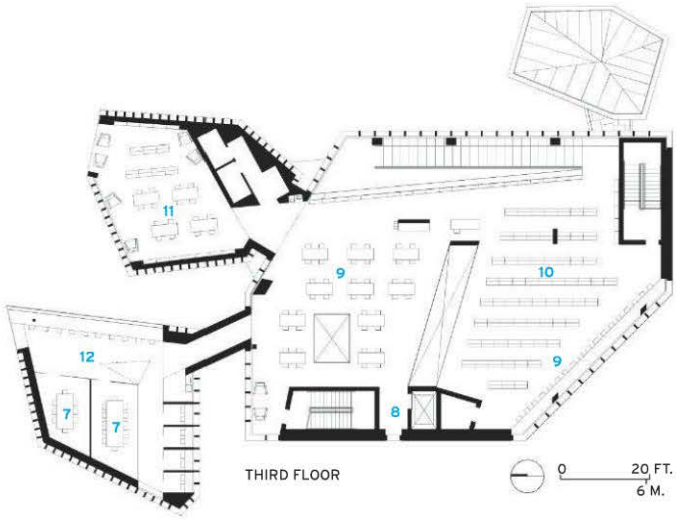
HEAVY DUTY The library (above) is divided into podlike structures of reinforced concrete for the main pavilion and steel-framed structures surfaced with synthetic stucco for the ancillary spaces. Vertical cedar fins break up the scale, while the concrete pilotis provide a sheltered entrance portico. Inside, a narrow rectilinear light well pierces the center of the main pavilion (left), bringing sunlight into the center.

PHOTOGRAPHY: © EDMUND SUMMERS

1 ENTRANCE
2 BOOK DROP
3 CIRCULATION DESK
4 STAFF ROOM
5 OFFICE
6 ADULT ELECTRONIC MEDIA
7 MEETING ROOM
8 ELEVATOR LOBBY
9 ADULT READING
10 ADULT INFO
11 TEEN SERVICES
12 ADULT PAVILION

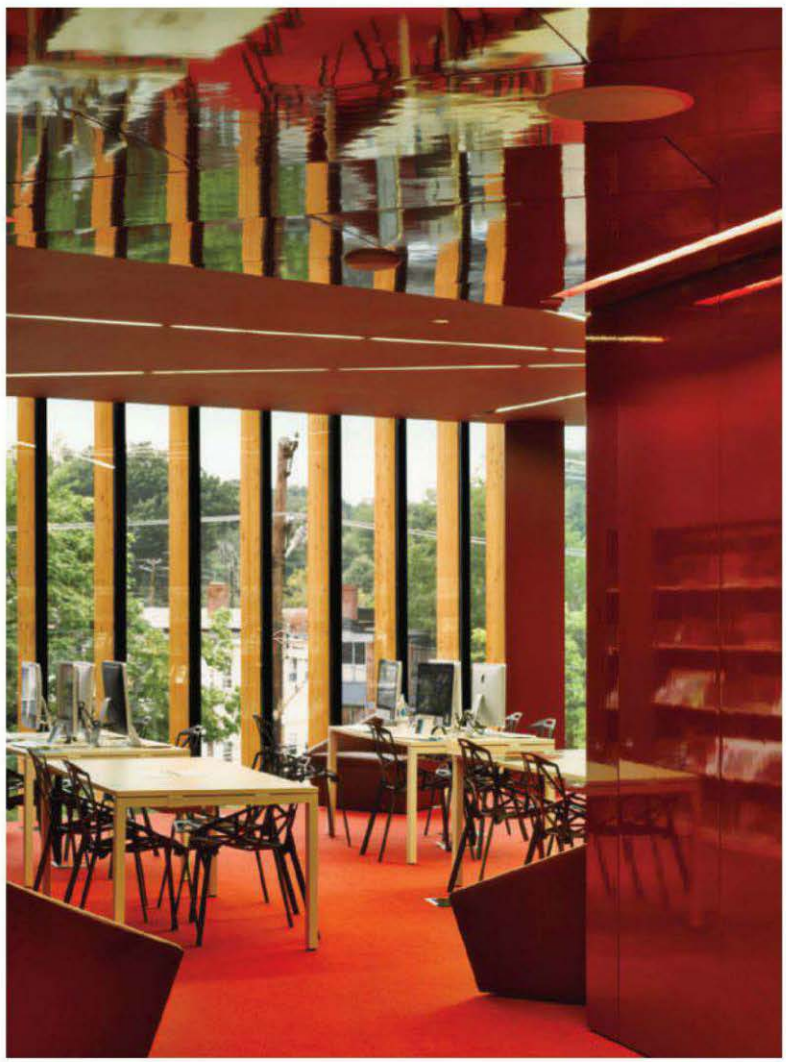


GROUND FLOOR



THIRD FLOOR

COLORFUL INSERTIONS Although the branch library's concrete work is raw, Adjaye contrasted it with the green-tinted glass enclosing a light well and a yellow lacquered medium-density-fiberboard-paneled stair with red carpeting on the ground floor (below). The teen-services pavilion on the third floor is distinguished by its red walls and ceiling (right). The durable aluminum Magis chair by Konstantin Grcic picks up the geometric motif.



credits

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ARCHITECT OF RECORD: Wiencek + Associates

ENGINEERS: Setty & Associates (m/e/p); ReStl Designers (structural)

CLIENT: District of Columbia Public Libraries

SIZE: 23,000 square feet

COST: $13 million

COMPLETION DATE: June 2012

SOURCES

METAL/GLASS CURTAIN WALL: Custom Tower Glass

FURNISHINGS: Herman Miller, Vitra, Bernhardt, Spacesaver

CARPET: Mannington

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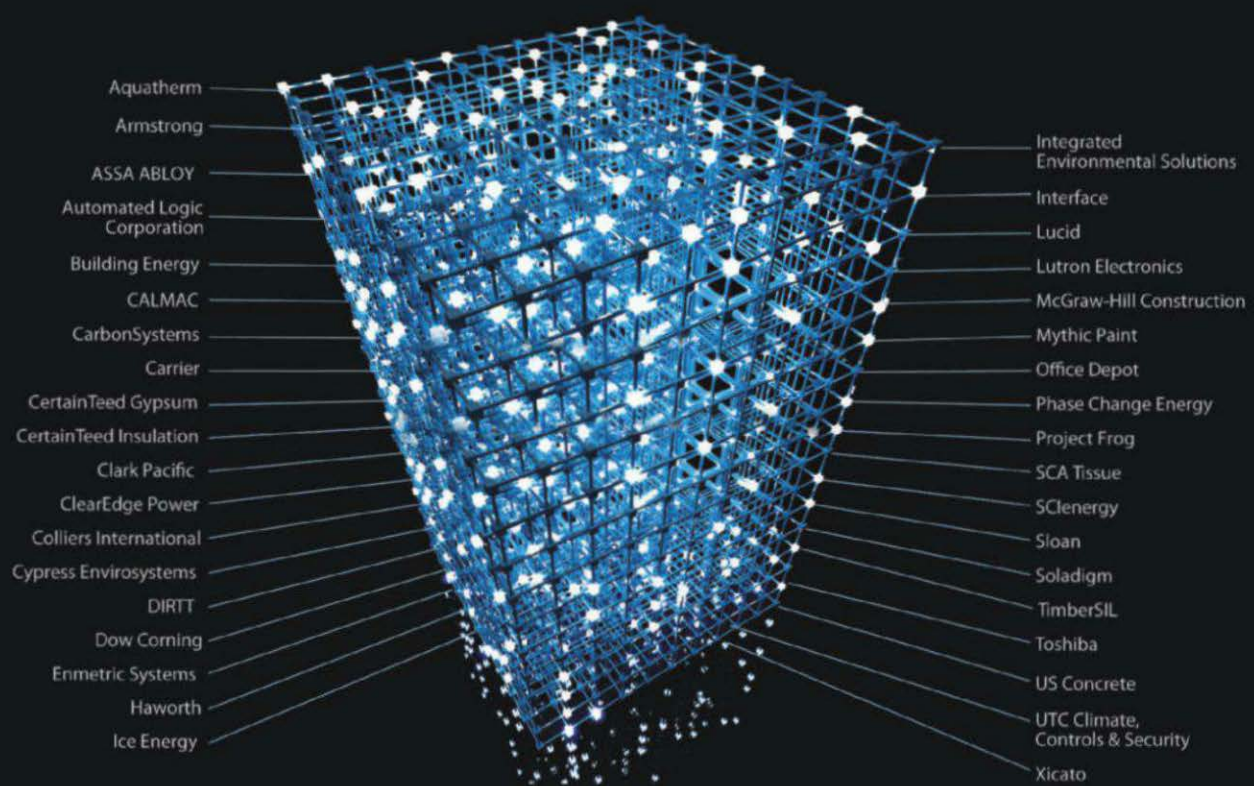

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Paradigm Shift

In an era of tight budgets and sophisticated digital tools, architects take modular construction beyond the single-family house.

By Joann Gonchar, AIA

AMERICAN ARCHITECTS have long been infatuated with the notion of prefabricated housing—not only as a solution for the single-family dwelling but also as a way to provide affordable and dense housing in mid-rise or high-rise buildings. But, with the exception of mostly architecturally nondescript projects, such as barracks, jails, and no-tell motels, the modular multistory approach hasn't yet gained a sturdy foothold in the U.S. That situation could be on the verge of changing, hastened by increasingly constrained client budgets and advances in technology, like the growing sophistication of building-information-modeling (BIM) tools.

Two projects on opposite coasts illustrate this emerging popularity among architects. One is a 102-unit studio-apartment building in Los Angeles. It will stack off-site-fabricated wood-framed units up to four stories above a stepped base that incorporates an existing one-story retail and parking structure into its volume. According to its designer, Michael Maltzan Architecture (MMA), the building will be the city's

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Learning Objectives

1 Discuss the advantages of modular construction for multiunit, multistory buildings.

2 Discuss some of the obstacles to constructing multiunit, multistory buildings modularly.

3 Describe the construction process for the Star Apartments and the proposed B2 Tower, outlining which work will be performed on site and in the factory.

4 Describe the role of building information modeling (BIM) in the construction of complex modular projects.

AIA/CES Course #K1210A

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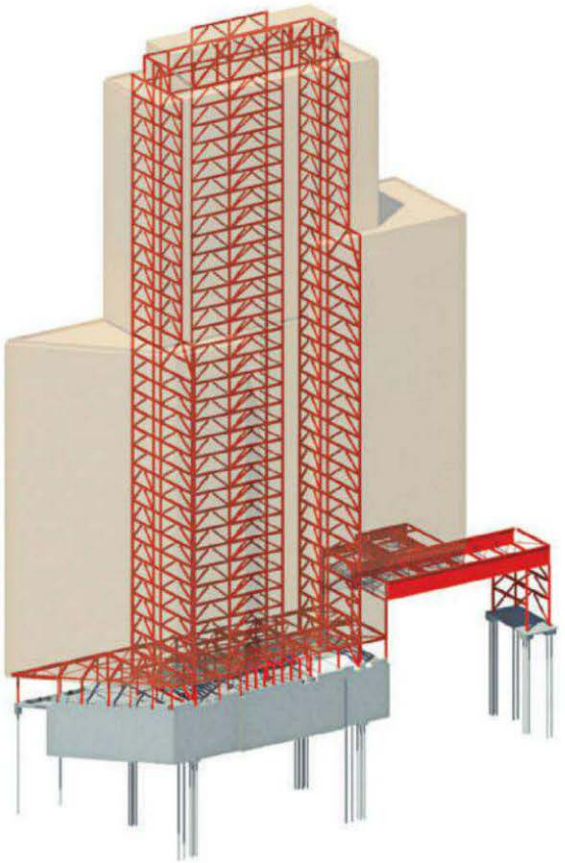
The developers of Atlantic Yards hope to build the B2 tower (this photo) from preassembled units. It is the first of three residential towers expected to rise directly adjacent to the new arena, Barclays Center (right), and one of 14 planned for the 22-acre development.

IMAGES: COURTESY SHOP ARCHITECTS, EXCEPT AS NOTED; ARUP (TOP)



ATLANTIC YARDS, BROOKLYN, NEW YORK

The developer's preferred scheme for building the 350-apartment B2 tower includes 930 modules (right), each with a steel-framed chassis. According to the plan, the modules, including bathrooms, m/e/p services, and finishes, will be assembled in a factory not far from the site. They will be lifted into place by crane around a steel-brace frame (above, in red) that will serve as the building's primary lateral-load-resisting system.

first multiunit residential project employing such a strategy. The other project—part of Forest City Ratner Companies' $4.9 billion redevelopment of Atlantic Yards in Brooklyn, New York—is a 350-unit, 322-foot-tall tower designed by SHoP Architects, made of steel-framed modules. According to the developers, the 32-story building will be the world's tallest modular structure.

Maltzan's project is the firm's third for the Skid Row Housing Trust, a nonprofit organization that owns and manages housing for formerly homeless individuals. The building, called the Star Apartments, is already under construction. A terraced slab that will support living-unit modules is now nearly complete.

The fate of the Brooklyn modular project is less certain. It hinges in large part on the outcome of negotiations with the unions representing the local construction trades. "We expect the unions to cooperate, although we don't have an agreement yet," says Robert Sanna, Forest City Ratner's director of construction and design development. If all goes well, ground will be broken for the tower, referred to as B2, by the end of 2012 on a site that sits directly adjacent to Barclays Center. That just-completed arena, which has a facade by SHoP, will serve as home court for the National Basketball Association's Nets.

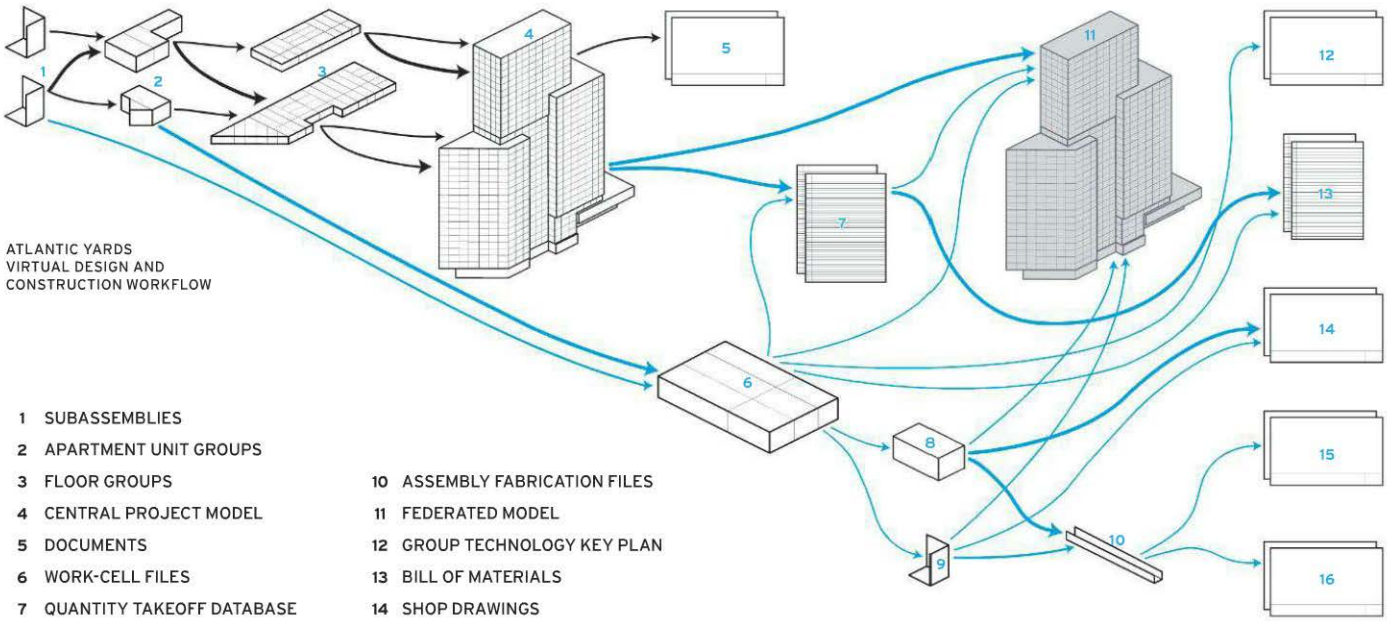
In case negotiations with the unions don't work out, Forest City Ratner has a backup plan to construct the high-rise conventionally. The modular B2 and its alternate would look identical: Both schemes call for a predominantly metal-and-glass-clad tower broken up into four volumes, each articulated by panels of different hues, patterning, and reflectivity.

At 340,000 square feet, the B2 tower will be more than three times the size of the Star Apartments. But though the scales of the projects are different, the goals are the same: By minimizing on-site construction, the teams behind both buildings say they will shorten project schedules, deliver high-quality housing, and save money. Forest City Ratner claims that using the approach will move 60 percent of the work off site and shave at least four months off an 18-month construction timeline. The developer also estimates that the modular B2 tower would cost 20 percent less than a conventionally constructed building with a concrete flat-slab structure (the typical construction method for high-rise residential buildings in New York).

These savings are especially significant since the Atlantic Yards site, which covers 22 acres, is ultimately projected to include 14 residential buildings. Of the 6,430 planned rental and condominium apartments, 2,250 are reserved for low- or middle-income households. As each tower is built, the developer anticipates that its modular-construction process would improve. "We expect to find even greater levels of efficiency," says Sanna.

Similarly, the Skid Row Housing Trust, which has a portfolio of 1,600 units in 23 buildings in Los Angeles, sees modular building as an economically viable alternative to conventional construction. "We want to continue to develop housing even in the context of a tough fiscal environment," says Mike Alvidrez, the organization's executive director.

The trust expects Star to be completed in April 2013, approximately 14 months after workers began retrofitting



the reinforced-concrete-and-masonry structure that will serve as the apartment building's base, converting it into space for retail tenants, social-service providers, and recreation, including a running track and basketball court. A more typical construction timeline would be 18 to 24 months, says Theresa Hwang, community designer for the organization. She also points out that the residential floors represent only about 25 percent of the $19.7-million construction cost, even though they make up more than half of its 95,000 square feet. "Our per-unit costs are dramatically lower," she says.

Proponents of modular construction say the efficiencies are realized by performing work in a factory environment, where labor costs are lower and the construction is not subject to weather-related delays. The savings also come from the ability to perform foundation construction and other site-bound work simultaneously with unit assembly. Advocates of the approach also tout benefits such as reduced noise and less construction-related disruption in the neighborhood surrounding the building site, as well as improved job-site safety, since so much of the work normally done outdoors, many stories in the air, is performed on the factory floor. And they cite green advantages, like reductions in construction waste and the potential for better energy performance, which they attribute to tighter quality control. (Both project teams hope to achieve LEED certification, with the B2 targeting Silver and Star seeking Platinum.)

For the Star Apartments project, Guerdon Modular Buildings began assembling four prototypes of the units, which typically are 12 feet wide, 30 feet long, and 10 feet 6 inches tall, at its 225-employee factory in Boise, Idaho, in late August. According to Lad Dawson, the company's CEO, Guerdon has the capacity to build between four and six of Star's units each day and plans to deliver the first modules to the site by the middle of October. Meanwhile, workers from Westport Construction, the project's general contractor, have been reinforcing the existing building's structure and forming the multilevel, moment-framed concrete deck that will receive the modules.

It should take Guerdon about 20 working days to lift the modules by crane and install all of Star's units, stacking them in clusters of nine to 12 modules around outdoor spaces and joining them to each other with a variety of connection types.

The Star Apartment modules are built to withstand the loads of transport as well as the forces they will sustain once the project is completed and occupied. Their frames are made primarily of wood, but they have wall assemblies that include a composite material combining sheet steel and gypsum board to help the units resist shear forces, explains Tim Williams, MMA managing principal. Binding the units to each other also improves performance, explains Brad Smith, principal of BW Smith Structural Engineers, the firm's structural consultant. "Together they are seismically stronger," says Smith.

After they are in place, Star's clustered modules will receive stucco facades, applied by Westport, whose workers will also install the building's open-air, steel-framed corridors. In addition to providing the main circulation infrastructure for the building's residents, the walkways serve as the distribution channels for utility lines that will connect above each dwelling unit's entrance to the factory-installed electricity, gas, and water services in individual apartments.

Forest City Ratner plans to build the modules for the B2 tower in Brooklyn, not far from the Atlantic Yards site, in a

ATLANTIC YARDS

As part of the BIM workflow for the modular B2 project, the architect and engineer are creating virtual subassemblies, inserting those into a module, and grouping the modules into apartments and floors. The team will be able to use the model to generate documents such as shop drawings, a bill of materials, and fabrication tickets.

DIAGRAM: COURTESY SHOP ARCHITECTS

factory it is setting up with XSite Modular, a modular-building consulting firm. Because the larger apartments will be made of multiple modules, fabricators will need to assemble 930 in all. Although very few are exactly the same, there will be about 24 "families" of similarly configured modules, says Jonathan Mallie, a SHoP principal.

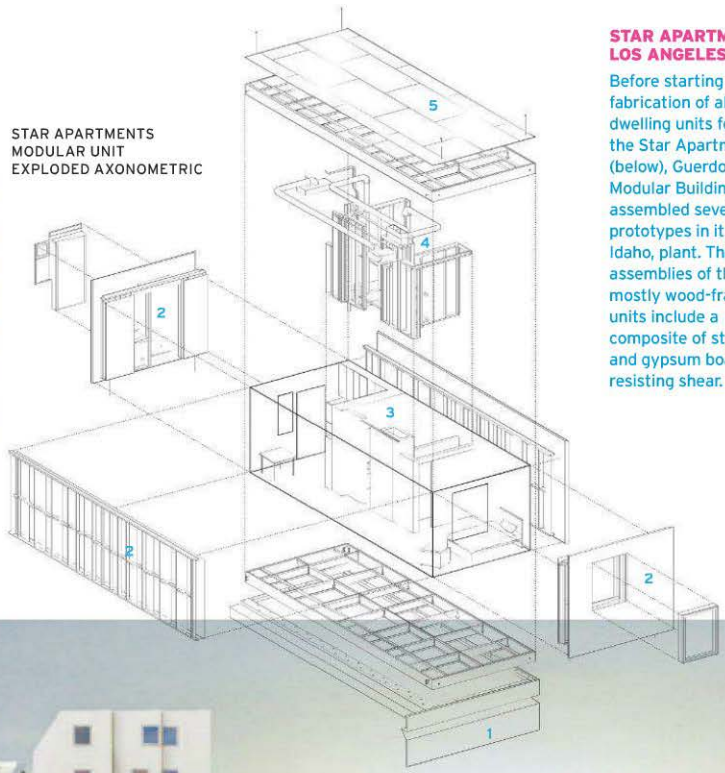
Each module in the B2 tower will have a tubular steel chassis that will be fabricated outside the city and delivered to the Brooklyn factory assembled. The chassis, which are 15 feet wide, 10 feet tall, and up to 45 feet long, are made up of Vierendeel trusses, which are distinguished by fixed joints and the absence of diagonal members. The configuration facilitates placement of openings between the modules, explains David Farnsworth, a principal at Arup, the B2 modular project's structural and mechanical engineer. However, diagonals will be added in some locations where they won't obstruct the connections between rooms.

Carpenters, plumbers, and electricians will perform almost all the fit-out work of the B2 chassis in the factory, building a floor and ceiling assembly for each module and adding partitions, finishes, and subassemblies, including bathrooms, cabinets, and m/e/p services. Only one hallway in each apartment will be left incomplete, to allow contractors to make riser connections between units in the field without disrupting already in-place finishes. The building's metal-and-glass cladding will also be installed at the factory. Each module's section of exterior skin will mate to the one next to it with self-sealing joints, much like those typically used on unitized facade systems.

After transporting the modules to the site and stacking them by crane, workers will connect the ceiling of one B2 module to another from the outside, creating a structural diaphragm that is tied to a steel-brace frame. The frame, which serves as the building's primary lateral-load-resisting

1 FLOOR ASSEMBLY
2 WALL ASSEMBLY
3 INTERIOR COMPONENTS
4 M/E/P CORE
5 CEILING ASSEMBLY

STAR APARTMENTS
MODULAR UNIT
EXPLODED AXONOMETRIC



STAR APARTMENTS, LOS ANGELES

Before starting fabrication of all 102 dwelling units for the Star Apartments (below), Guerdon Modular Buildings assembled several prototypes in its Boise, Idaho, plant. The wall assemblies of the mostly wood-framed units include a composite of steel and gypsum board for resisting shear.

IMAGES: COURTESY MICHAEL MALTZAN ARCHITECTURE, EXCEPT AS NOTED; GUERDON MODULAR BUILDINGS (TOP LEFT)

system, will be erected on site, with erection advancing a few levels ahead of module stacking.

One important advantage of using modular construction methods to build B2 would be a reduction in weight, says the team. According to Arup's estimates, the superstructure would be about 40 percent lighter than that of a concrete flat-slab building. The reduction translates into the need for a less hefty foundation system, a particular boon at the Atlantic Yards site, which straddles a busy transportation hub. "Every pile costs much more than it would on a greenfield site," says Farnsworth.

Multistory modular construction does pose special challenges. For instance, the depth of the floor-and-ceiling sandwich tends to be greater than with common site-built construction methods, since each module has its own, structurally stable lid and base. At Star, for example, the dimension from the underside of the ceiling to the top of the floor is just over 26 inches, compared with a depth of about 14 to 16 inches for a similar wood-framed building in the same fire-resistance class. The extra inches can prove problematic, especially when dealing with building-height restrictions set by zoning laws.

Resolving modular construction's complex architectural and engineering puzzles, like trying to maximize the number of stories while minimizing overall height, requires intense collaboration among project-team members, close attention to tolerances, and careful orchestration of fabrication and construction sequences, especially since every decision is multiplied hundreds, if not thousands, of times. "There can't be a screw that hasn't been thought through," says Williams.

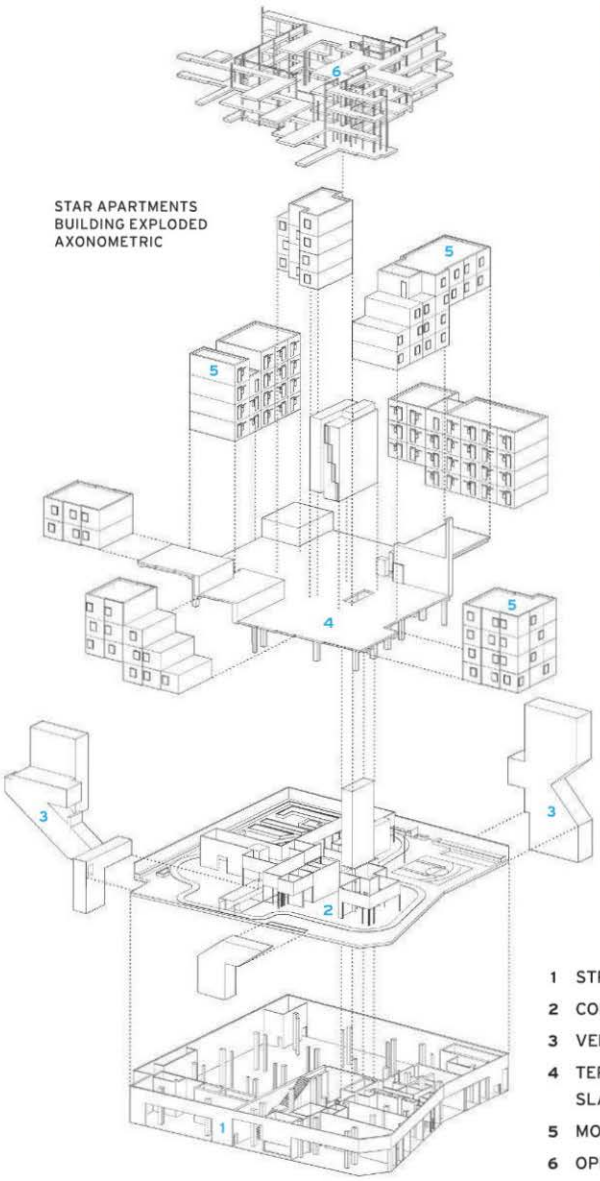
To facilitate the necessary coordination, the teams for both the modular B2 and the Star Apartments have relied heavily on BIM for tasks like identifying potential conflicts among the modules' many small components, construction scheduling, estimating the quantity of specific materials, and creating cost estimates.

For the Brooklyn project, the architect, engineer, and others are working with a cloud-based "federated" model—one that allows consultants to input and share discipline-specific models. With the architect's affiliate, SHoP Construction, serving as virtual design and construction coordinator, the team is modeling B2's subassemblies, inserting those into a module, grouping the modules into apartments and floors, and then placing those in the building. The model should help contractors and subcontractors avoid duplicating work, since it can be used to generate documents like a bill of materials, shop drawings, and fabrication tickets. "The project is not so much about product innovation," says Mallie, "as it is about supply-chain integration."

Whether the new design and construction paradigm proposed by the modular B2 and the Star Apartments projects will become commonplace remains to be seen. But Forest City Ratner, at least, seems to be envisioning demand well beyond New York for the modules it hopes to build in Brooklyn. "We could even ship the modules overseas," says Sanna. His comments suggest that modular construction could be more than just an efficient way to build. It might be the key to the revival of a moribund manufacturing sector. ■

STAR APARTMENTS

The dwelling units at the Star Apartments stack up to four stories above a stepped podium. This base incorporates an existing building that has been retrofitted to accommodate a varied program, including retail and recreation space, parking, and social services.



STAR APARTMENTS BUILDING EXPLODED AXONOMETRIC

1 STREET-LEVEL RETAIL
2 COMMUNITY PROGRAMS
3 VERTICAL CIRCULATION
4 TERRACED CONCRETE SLAB
5 MODULAR UNITS
6 OPEN-AIR CORRIDORS

IMAGES: COURTESY MICHAEL MALTZAN ARCHITECTURE

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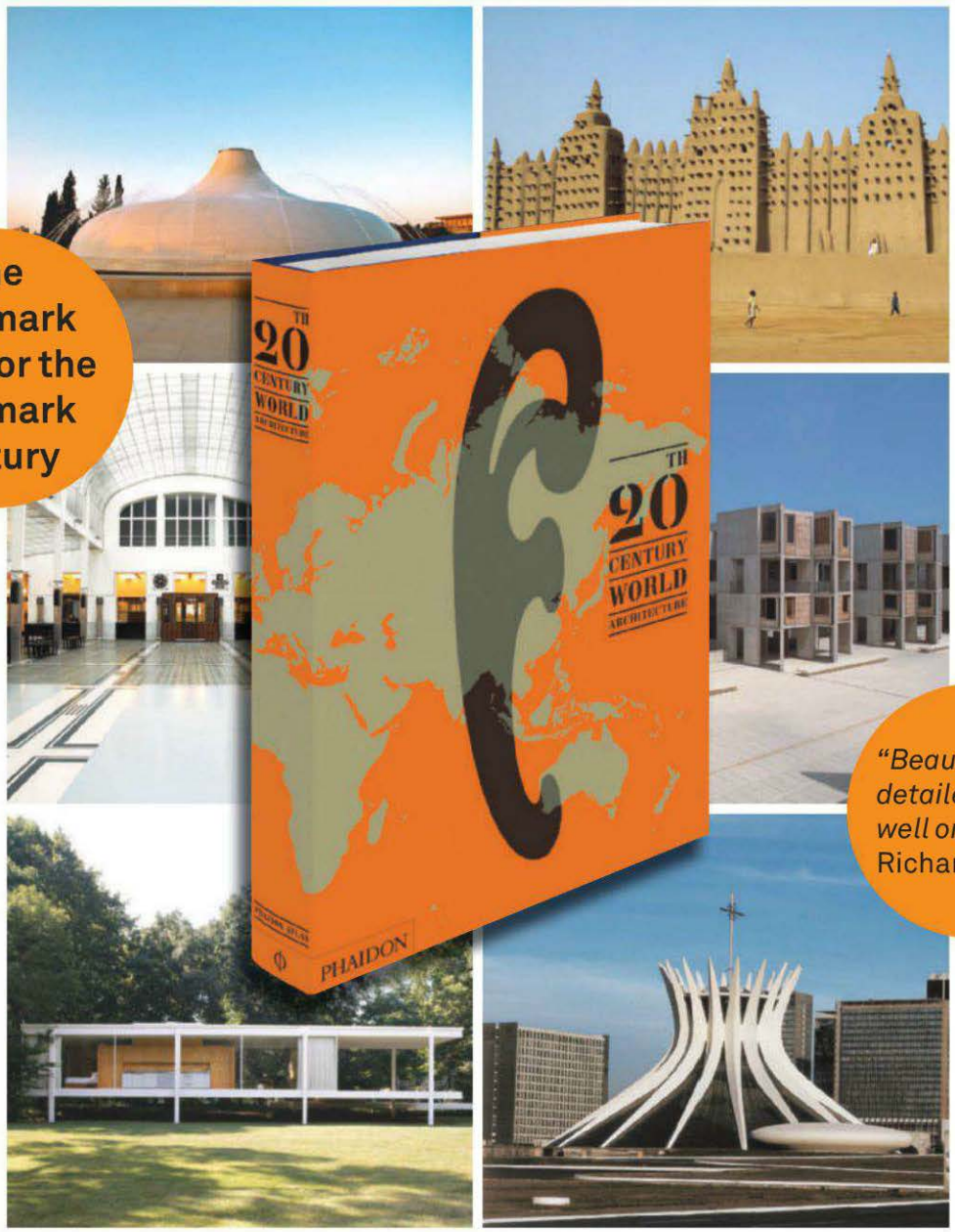

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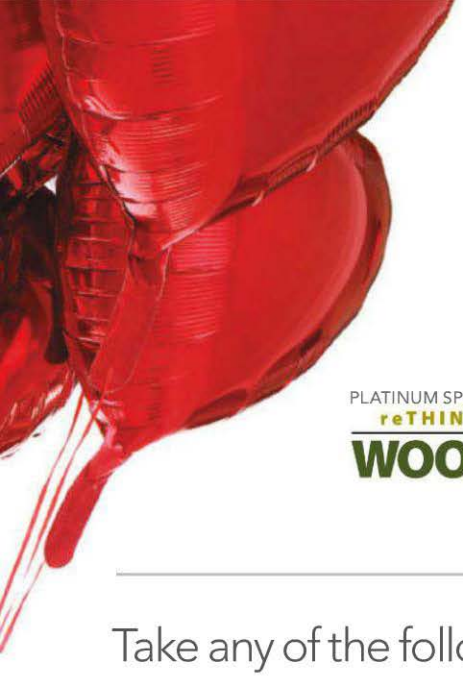

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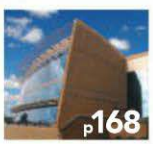

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Rethinking Wood as a Material of Choice

Costs less, delivers more

Sponsored by reThink Wood | *By Layne Evans*

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

COST CONSCIOUS

As a material grown throughout North America, wood can be locally sourced and is usually less expensive than alternative building materials (see Cost Calculator box on the next page). Wood building systems also typically cost less

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Learning Objectives

After reading this article, you should be able to:

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

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

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Photo by Timothy Hursley

Cathedral of Christ The Light, Oakland, California. Design architect: Skidmore, Owings & Merrill.

Photo by Matt Todd, courtesy of WoodWorks

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

to install when construction is viewed as a whole, for a number of reasons. Wood is readily available and tends to be delivered quickly, and most communities have a large pool of qualified tradespeople with wood framing experience, which minimizes construction delays and keeps labor costs competitive. Wood's adaptability and ease of use also translate into faster construction schedules, while a smaller foundation may be needed because of its light weight.

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

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

Often, even when wood is chosen to meet other goals, cost is still the deciding factor. For the Marselle Condominium project in Seattle, Washington (see the case study[1] in the online portion of this course), wood construction helped the building meet requirements of the local Master Builders Association Built Green program. But while the environmental recognition was an added benefit, the developer considered the decision to use wood framing purely financial. "If the project had been built using all concrete, for instance, it would have cost about 30 percent more," according to Kory Knudson, vice president of Norcon, NW, Inc. "If we had built the entire project out of steel, it would have taken much longer and we would have had to make many energy modifications."

COST CALCULATOR

A cost calculator is now available to demonstrate wood's cost advantages. Users simply select a building type and U.S. average or state/city, and the calculator draws on current construction cost data to provide a comparison of wood and non-wood materials (aggregate of steel and concrete) for the shell or whole building. Each calculation is accompanied by graphs showing cost index and price variation of materials to demonstrate performance over time. Source: www.woodworks.org

INNOVATIVE USES FOR A TRADITIONAL BUILDING MATERIAL

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

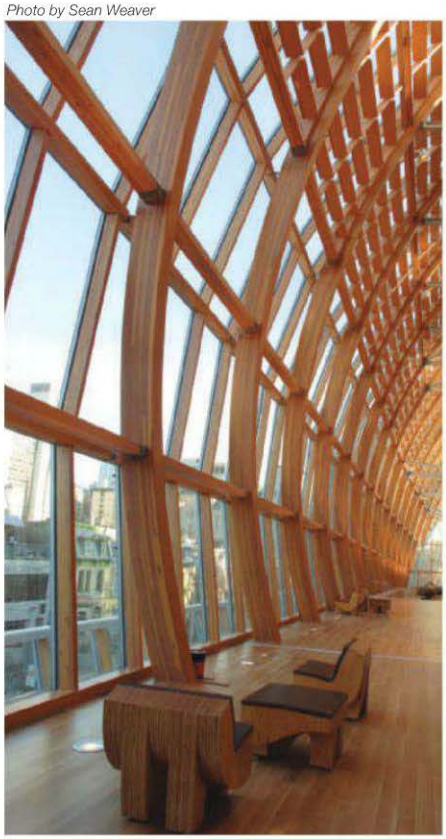
For example, the Cathedral of Christ The Light in Oakland, California, is an extraordinary timber cathedral designed to last 300 years using a unique structural system. Designed by Skidmore, Owings & Merrill LLP (SOM), the soaring 36,000-square-foot, 1,500-seat structure replaces another cathedral destroyed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

An example with farther-reaching implications is the Long Hall in Whitefish, Montana, the first commercial building in the U.S. to be built from cross laminated timber (CLT). Although the Type VB structure was

built to 2009 *International Building Code* (IBC) requirements, CLT was completely new to code officials. Darryl Byle, PE, of CLT Solutions worked with the local building department more than six months in advance to address concerns and keep the project on schedule. Among the challenges, the team needed approval of the CLT system as a stand-alone, one-hour rated assembly in order to feature exposed CLT on the interior. Byle used data on fire design from sources such as the *National Design Specification® (NDS®) for Wood Construction* and experimental CLT fire test data from manufacturers and independent sources to demonstrate that CLT panels could be expected to perform well in a fire event.

In addition to CLT, parallel strand lumber (PSL), glued laminated timber (glulam) and prefabricated paneling systems are among the products contributing to a wider range of wood buildings. They have made wood a viable choice for applications such as arenas, gymnasiums and lobbies, which require tall walls and large open spaces with minimal, intermediate supports. For example, glulam can be manufactured to achieve spans as long as 100 feet and walls up to 20 feet. (See the case study online of the Art Gallery of Ontario renovation designed by Frank Gehry.)

Photo by Sean Weaver



Galleria Italia at the Art Gallery of Ontario. (See case study online.)

THE TREND TOWARD TALLER WOOD BUILDINGS

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

WOOD AND THE ENVIRONMENT

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

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

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

A comprehensive 2007 review of scientific literature[2] looked at research done in Europe, North America and Australia pertaining to life cycle assessment of wood products. It applied LCA criteria in accordance with ISO 14040-42 and concluded, among other things, that:

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

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

LCA IN CODES, STANDARDS AND RATING SYSTEMS

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

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

In the U.S., LCA is encouraged in the Green Globes rating system, and included in the American National Standard based on Green Globes, *ANSI/GBI 01-2010: Green Building Assessment Protocol for Commercial Buildings*. It is also included as a pilot credit in LEED.

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

COST-EFFECTIVE GREEN SCHOOLS

Bethel School District (BSD) is proving that building green doesn't have to cost a lot. While the District reports an 81 percent ENERGY STAR rating overall, several of their 17 elementary and six junior high schools have a rating ranging from 95 to 98 percent. While size, configuration and age of the 23 facilities varies, one thing remains constant: each is wood-frame.

Wood-frame schools can be easily designed to meet and exceed the demanding energy efficiency requirements of environmentally-minded school districts. And, they can do so cost effectively. One of BSD's new elementary schools, completed in 2011, had a total construction cost of $197.70 per square foot—a significant savings compared to the average construction cost of an elementary school in western Washington, which is $250.07.

BSD credits several factors in their success. In western Washington, wood studs cost almost half as much as metal; $0.53 per lineal foot for wood versus $0.98 for metal studs. Also, wood studs don't transfer heat and cold the way metal studs do, so wood helps improve the energy efficiency of the exterior envelope. Finally, wood-frame walls, floors and roofs easily accommodate inexpensive batt insulation, making it simple and cost-effective to over-insulate.

Of their 23 schools and one learning center, 18 have earned the ENERGY STAR label, and the BSD has received national recognition from the U.S. Environmental Protection Agency as an ENERGY STAR Leader.

Photo by Bethel School District

Spanaway Junior High School, Bethel School District, Eugene, Oregon

Sustainable Source

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

Wood is also the only building material that has third-party certification programs in place to demonstrate that products being sold have come from a sustainably managed resource. Sustainable forest certification allows forest companies to demonstrate the effectiveness of their practices by having them independently assessed against a stringent standard that considers environmental, economic and social values. As of August 2012, approximately 500 million acres of forest in the U.S. and Canada were certified under one of the four internationally recognized programs used in North America: the Sustainable Forestry Initiative (SFI), Forest Stewardship Council (FSC), Canadian Standards Association's Sustainable Forest Management Standard (CSA), and American Tree Farm System (ATFS). This represents more than half of the world's certified forests.

Carbon Footprint

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

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

In all of these cases, the cycle begins again as the forest regenerates and trees once again begin absorbing and storing carbon.

Putting these benefits into perspective, a new carbon calculator[5] (see box below) found that the Avalon Anaheim Stadium, a five-story building constructed of wood (Withee Malcolm Architects, engineering by VanDorpe Chou Associates Inc.) in Anaheim, California, stored 3,970 metric tons of carbon dioxide equivalent (CO_2e) in its lumber and sheathing, while the emissions avoided by not using steel or concrete increased the carbon benefit by another 8,440 metric tons of CO_2e. According to the U.S. Environmental Protection Agency's Greenhouse Gas Equivalencies Calculator, this equates to the annual emissions from 2,370 cars or the energy to operate an average home for 1,050 years.

Energy Efficiency

In terms of operating energy, wood has the advantage of low thermal conductivity compared to steel and concrete. As a result, wood is easy to insulate to high standards while steel and concrete must overcome problems from thermal bridging

CARBON CALCULATOR

A new calculator estimates the carbon benefits of wood buildings. Users input the volume of wood products, and the calculator estimates the amount of carbon stored in the wood and the greenhouse gas emissions avoided by using wood. If volume information isn't known, users may select from typical building types.
Source: www.woodworks.org

and the possible consequence of moisture condensation on cold surfaces. However, because there are many factors that have a greater influence on a building's energy efficiency (such as insulation and air tightness), the more relevant point for many designers is that wood building systems lend themselves to structures that are highly energy efficient—with less impact on the environment in terms of embodied energy, air and water pollution, and carbon footprint.

Any wood structural system can be designed to achieve a tight building envelope. However, with new systems such as CLT, precise manufacturing results in tight tolerances and exceptional air tightness. The added aspect of dimensional stability also ensures that the building remains airtight over time. Wood is also proving to be a good choice for designers who want to meet the Passive House (Passivhaus) standard or create a net-zero energy or net-zero carbon building.

Recycle/Reuse

One of the most important sustainability factors for a building material is often underestimated or overlooked completely: what will happen to the material at the end of the building's working life? A "Survey on Actual Service Lives of North American Buildings" showed that buildings in the U.S. often have a service life of less than 50 years, regardless of material, because of changing needs or increasing land values as opposed to performance issues. When one considers the embodied energy in these structures and issues related to disposal, the adaptability of wood structures and building systems, either through renovation or deconstruction and reuse, is a significant advantage. (See "Adaptive Reuse" case study on the Barn at Fallingwater in the online version of this article.)

Photo by www.naturallywood.com

Thunder Bay Regional Health Sciences Center in Ontario, designed by Salter Farrow Pilon Architects Inc., was the first hospital in Canada to gain approval for the use of wood as a primary structural element.

BRINGING NATURE TO THE INTERIOR ENVIRONMENT

As buildings become increasingly dependent on and designed for technology, the human need to connect with nature doesn't change, but it can get harder to accommodate. Wood has unique characteristics that most people respond to intuitively. This positive connection is now being documented by a growing body of research, and can be a valuable asset in spaces filled with electronic devices and screens, synthetic materials and artificial lighting.

People feel an instinctive connection and attraction to natural materials, and many building designers cite the warm attributes of wood as a reason for its use. Evidence also suggests that exposed wood can contribute to an individual's sense of well-being. In an office or school, wood is thought to improve performance and productivity; in a hospital, it may have a positive impact on patient recovery.

A study[6] at the University of British Columbia and FPInnovations found that the presence of visual wood surfaces in a room lowered activation of the sympathetic nervous system (SNS). The SNS is responsible for physiological stress responses in humans such as increased blood pressure and heart rate while inhibiting the parasympathetic system responsible for digestion, recovery and repair functions in the body. The study immersed 119 university students in one of four different office environments, some with wood surfaces and others without. Stress as measured by SNS activation was lower in the wood rooms in all periods of the study. The study concluded that wood is one way to create a healthier built environment.

Study author David Fell says that research on wood and schools is underway, but the results of the office study apply to any interior environment. "The stress-reducing effects we found for wood in office environments are in theory transferable to any building type as these are innate reactions to natural materials.

See endnotes in the online version of this article.

Continues at ce.architecturalrecord.com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Ceiling Technology and Aesthetics

Innovative ways to boost performance while adding color and pattern

Sponsored by Hunter Douglas Contract | *By C.C. Sullivan*

The application of design sensibility to what some architects call "the fifth wall"—the ceiling plane—brings a number of specific challenges that impact building effectiveness and indoor environmental quality (IEQ). Chief among them is design treatment, including the use of color, texture, and form without compromising performance or incurring excessive cost. Other challenges include acoustical performance, which has a direct effect on human productivity and health, yet may conflict with the use of large monolithic planes or the use of special shapes and visual effects. Sustainable design goals often fade in the drive for low-cost, low-value ceiling systems.

Yet a good ceiling specification can benefit indoor-air quality, energy efficiency, daylighting efficacy, and long-term building operations. New tests for flame spread and smoke development help ensure ceilings are safer, too. In sum, ceiling design has a direct effect on the facility's return on investment, or ROI.

In addition, architects are increasingly taking advantage of innovative design techniques that

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Learning Objectives

After reading this article, you should be able to:

1. Describe the modern development of suspended acoustical ceiling systems in terms of building performance and green building benefits.
2. Explain how ceiling products and designs impact acoustics, occupant comfort and other indoor environmental quality (IEQ) factors.
3. Discuss the effect of ceiling system choice, including printed and mass-customized materials, on three or more LEED credit categories.
4. List the goals of sustainable design or occupant health that affect ceiling product selection.

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

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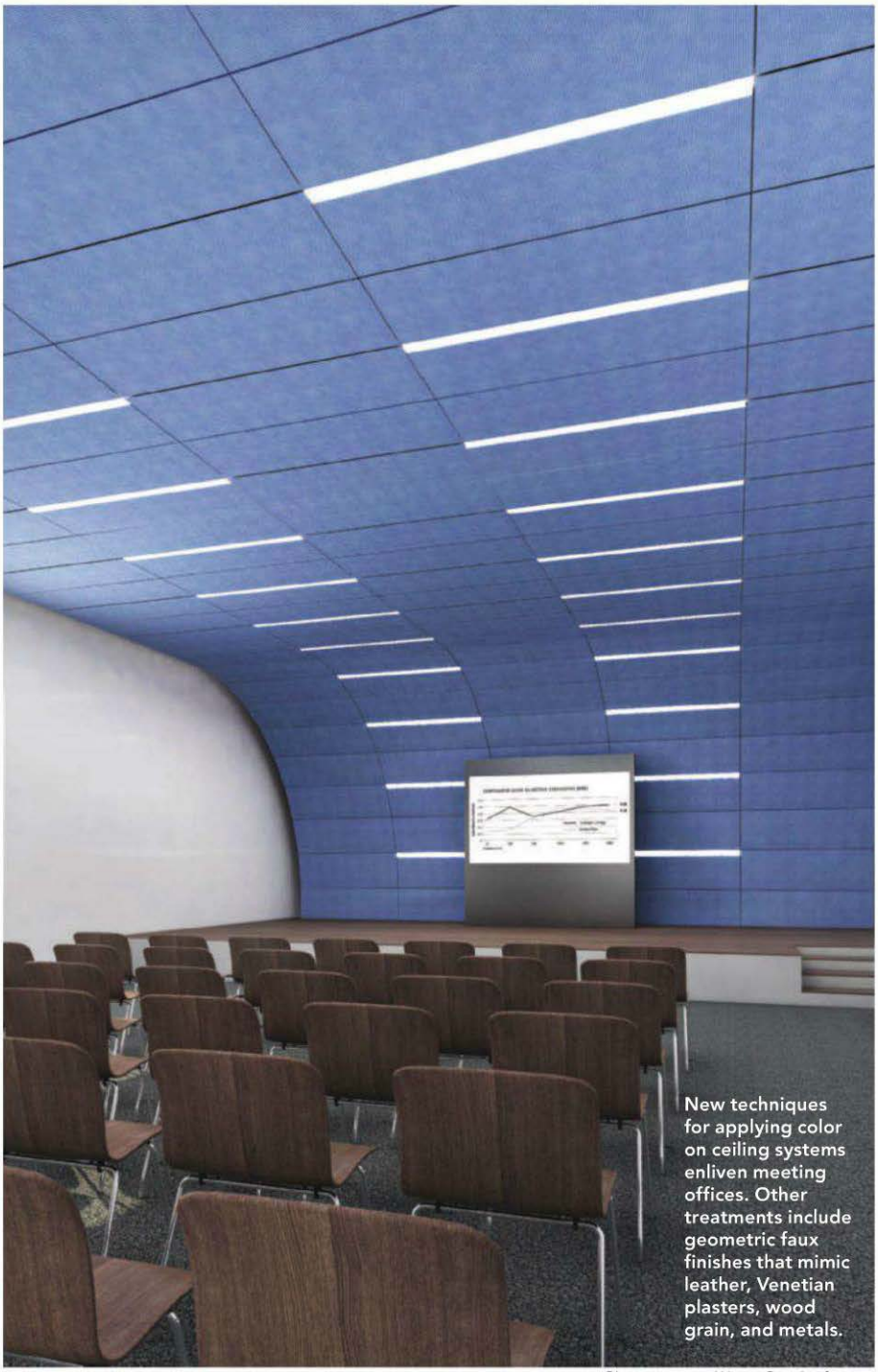


New techniques for applying color on ceiling systems enliven meeting offices. Other treatments include geometric faux finishes that mimic leather, Venetian plasters, wood grain, and metals.

Photo courtesy of Hunter Douglas Contract

elevate the fifth wall to a higher plane, so to speak, in terms of advancing architecture. A slew of innovations have emerged for ceiling design, including new sizes, shapes, color, and patterns as well as systems for supporting the assemblies and accessing the plenum above.

Innovative techniques for printing and patterning interior surfaces are available, often using fewer material resources than traditional ceiling treatments. Some of these manufacturing technologies allow cost-effective custom runs to match a project's design needs, while retaining desired acoustical and lighting properties. In many cases, they contribute to better occupant health and safer, more sustainable buildings—and more visually impressive interior spaces.

A SHORT HISTORY OF MODERN CEILINGS

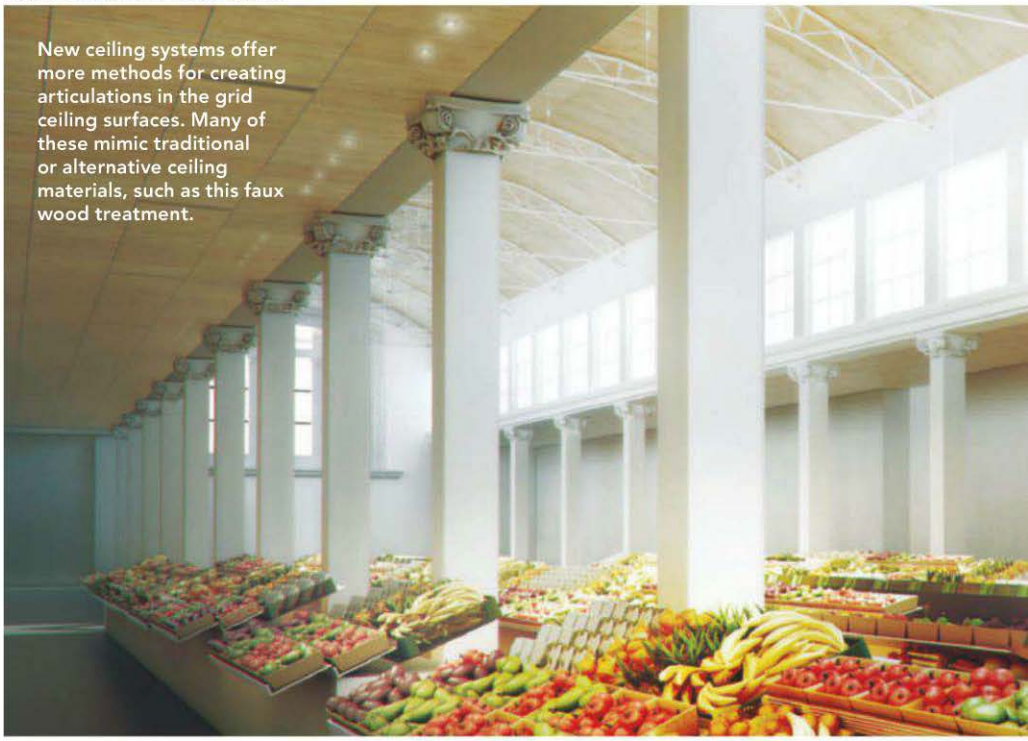
A look back at the development of suspended ceiling technology provides helpful context for understanding today's advances. "Eighty to ninety years ago, suspended ceilings were invented to hide HVAC ducts, pipes, and other systems routed along the ceiling," says Ko Kuperus, general manager at Hunter Douglas Contract, Denver. "The acoustic tiles were dropped into metal grid, and the same is true today. The concept has not changed in almost 100 years."

True, it has become a cliché of modern construction and the architect's default spec. Suspended ceilings are also known as false ceilings and dropped or drop ceilings. The concept was created as a secondary ceiling plane, typically hung from the steel beams or a concrete or metal structural deck above. "Acoustical ceiling tiles have typically been smooth and white or off-white, with little in the way of a pattern," says Hiro Isogai, a principal with WDG Interior Architecture in Washington, D.C. Estimates by Kuperus suggest that at least 90 percent of the applications have historically been white—"a missed opportunity for design," he adds.

The metal grid suspension system has been integral to the systems. Companies such as Chicago Metallic Sash Co., which made zinc profiles for stained glass windows in the early 1900s that were popular among architects like Frank Lloyd Wright, began shifting to the manufacture of ceiling suspension grids in the 1930s, often using a 5/8-inch metal profile. Contractors in Florida adopted channel moldings—typically used for exterior siding in the 1950s—as trim to support acoustical ceilings inside houses, which would not easily nail into the masonry walls or ceilings.

The system was popularized by companies like Acousti Engineering Co. in Florida and by many companies elsewhere. An American patent was awarded in 1961 for the concept of "Accessible Suspended Ceiling Construction," decades after the product had been in common use in Europe and the United States. Some suspension-type

Photo courtesy of Hunter Douglas Contract



New ceiling systems offer more methods for creating articulations in the grid ceiling surfaces. Many of these mimic traditional or alternative ceiling materials, such as this faux wood treatment.

ceilings had inverted T-shaped members to support ceiling tiles. Since then, others have used a concealed grid system of Z-shaped bars with splines to connect interlocking panels. While the concealed grids allow access to the interstitial space above by means of a key panel, the drop-in ceiling tiles have been seen as more convenient, allowing faster access.

Yet the concealed grid held appeal among many architects because of its sleek, monolithic presentation, which worked well with mid-century modern interiors for offices and other nonresidential settings. Eventually, the trend toward larger tile sizes and more concealed suspension grids became an important objective for architects, according to Jeffrey L. Fullerton, a LEED-accredited director of architectural acoustics with Cambridge, Massachusetts-based consultant Acentech. Suspended ceilings were seen as an alternative to surface-applied products such as troweled plaster, creating larger expanses of uninterrupted surface area with minimal reveals or joints—an effect similar to drywall, says Fullerton.

In parallel with this trend toward smaller reveals and smoother surfaces, other architectural styles demanded articulations to the grid ceiling surfaces. Suspended ceiling systems were developed with stamped or sculpted tiles that produced optical patterns or effects that echoed traditional worked plaster or metal panels or suggested coffered, cove or beam-style ceilings. Many architects maintained traditional or alternative ceiling materials, included plasters, gypsum board, wood, and pressed or perforated metal panels. Some ceiling systems employed a stretched fabric, such as polyester or polyvinyl chloride (PVC), over a light metal or plastic frame.

While traditional ceiling techniques have included moldings, rosettes, wood panels or trims, and colored paints, the modern suspended ceiling tended toward white and lightly textured surfaces. In most cases, color and pattern applied to the ceiling systems—whether in manufacture or on the jobsite—has been relatively rare.

TRADE-OFFS IN DESIGN AND PERFORMANCE

In spite of the limitations, in much of the market the roll-formed suspension systems have become a habitual spec—and the bane of many architects interested in more creative ceiling treatments. One reason has been that typical cellulose ceiling tiles could not be made much larger than 2 feet or 3 feet in length; they would sag over time, or fall out of the grid. Another was the limitation placed on interior aesthetics by the commercial products.

One reaction was the antithesis of the suspended system: Architects started to favor the open ceiling, with structural elements and mechanical, electrical, and plumbing (MEP) systems exposed for visual effect. This style emerged and found adherents in 1970s

and 1980s commercial construction, led by "functionalist" architects like Richard Rogers and Renzo Piano, with their seminal Centre Pompidou in Paris (1971) and the Lloyd's of London office building. "This framework must allow people to perform freely inside and out, to change and adapt in answer to technical or client needs," said the architects.

Yet open ceilings tend to suffer from poor acoustical performance. On top of that, the convenience and cost-benefit equation provided by suspended grids has proved too good to leave behind. For these reasons, architects have looked for alternatives to cellulose, such as fiberglass, metal, cellular plastic mats, and stretched fabric, among others. Advances in ceiling systems over the last few years have opened up new possibilities for larger ceiling panels and the application of new design ideas, says Kuperus. "On the one hand, manufacturers have made sizes of demountable tiles much larger, so you can still service the plenum volume above but through larger smooth areas with fewer joints and reveals," he explains. "Another advent was the introduction of colors and patterning in the systems."

New techniques for applying color and pattern have included geometric patterns and faux finishes that mimic leather, Venetian plasters, wood grain, and the like, as well as painted metals and thin wood veneers over a metal substrate. Some of these finishes are applied on site, often by skilled trades. Other finish solutions are factory applied, which reduces work on the jobsite and, in some cases, the amount of coatings and associated volatile organic compounds (VOCs) introduced in construction.

Two recent trends have contributed to interest in color and pattern in ceiling systems. One has been the movement toward *therapeutic environments*. Typically associated with healthcare facilities, these psycho-socially supportive spaces can benefit patient recovery and satisfaction as well as organizational productivity and outcomes, according to HOK senior associate Ron Smith, AIA, ACHA, and Nicholas Watkins, Ph.D., HOK's director of research and innovation. "The effects can be positive or negative," they wrote in the *Whole Building Design Guide*. "No environment is neutral."

The principle that colors may have medical value or healing benefits is known as color therapy or chromatherapy, according to PVA Architecture's Maryia A. Boykins, Assoc. AIA, who notes that the seven discrete primary colors of the visible spectrum "improve balance and healing in the mind and body." In his seminal studies on the subject, Roger Ulrich, Ph.D., of Texas A&M University, has called color and pattern a "positive distraction" to explain this therapeutic effect.

While the effects of chromatherapy have been considered as part of evidence-based design (EBD) studies for healthcare environments, they are seen as useful for other building types, too. In a recent white paper on correctional facility design commissioned by Norix Group,[1] the designer Tara Rae Hill, ASID, observed, "Leading research shows that interiors which have an interesting use of material and color and that are not overly neutral will increase morale and mental well-being, ultimately reducing inmate and staff anxieties." Color selection also impacts spatial perception and the "visual weight" of interior surfaces, according to color experts at paint manufacturer Sherwin-Williams.[2] For example, solids and simple patterns reduce visual weight while bold patterns add visual weight; for ceilings, light colors tend to attract attention, while dark-colored ceilings tend to direct the occupant's eye back to walls, furnishings and accessories in a room. Applied to the ceiling, red hues tend to be "weighty and annoying," while orange can be "energizing."

A second trend involves manufacturing advances supporting the use of visual effects on ceiling panels. In addition to more precise assemblies, there have been more curved and articulated shapes that still conform to a regular grid of square or rectangular supports. In addition, the emergence of *mass customization* has exploited flexible, computer-aided manufacturing systems to produce individualized, custom output while still keeping unit costs low.

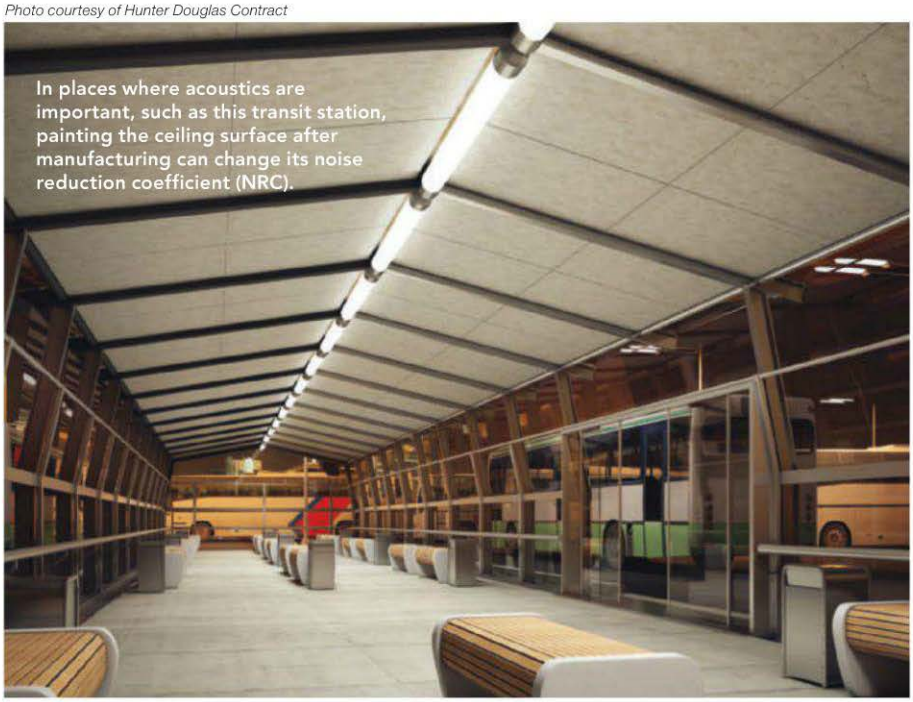
Mass customization is based on methods for "effectively postponing the task of differentiating a product for a specific customer until the latest possible point in the supply network," as explained in *Operations Management for Competitive Advantage* (McGraw-Hill/Irwin, 2006).

With a growing belief that ceilings can contribute more to interior architecture—and with supplier processes that support the need—today more architects are adding color and pattern to ceilings, wall panels and other surfaces.

Therapeutic environments in healthcare buildings, schools and other facilities include the use of chromatherapy to positively affect the experience of occupants and visitors.

Photo courtesy of Hunter Douglas Contract

Photo courtesy of Hunter Douglas Contract



In places where acoustics are important, such as this transit station, painting the ceiling surface after manufacturing can change its noise reduction coefficient (NRC).

REDISCOVERING CEILING COLOR AND PATTERN

Beyond its performance in the physics of sound, light and air, ceilings are vital aesthetic elements in architecture. Since Michelangelo finished painting the vaults of the Sistine Chapel in Vatican City in the fall of 1512, architects have looked for ways to encourage visitors of their buildings to look upward, as if to the heavens, for inspiration and enjoyment. On today's ceiling surfaces, that often means applied colors, textures, patterns, and special lighting fixtures. As the architect Jack Diamond, principal at Diamond and Schmitt Architects of Toronto, has said, once the project team has established the objectives for a building project, "Colors and textures become an integral means of achieving design ends."

In Michelangelo's day, paint was a common treatment for ceilings, and that remained true for centuries. For suspended grids and tiles, however, paint may not be ideal. Though custom matching colors are frequently applied on the jobsite rather than in the factory—mainly because the majority of ceiling systems are stocked only in white—painting an acoustical surface changes its noise reduction coefficient (NRC) and ceiling attenuation class (CAC) properties. The coatings may also introduce VOCs and other chemicals into the indoor environment. Architects must proceed with care.

As an alternative, ceiling panels are now manufactured with factory-applied color, patterning, and either optical or tactile textures. This brings a few benefits to sustainable design: First, less energy and coloring agent and fewer resources are expended—in some cases, up to 25 times less pigmentation material by volume or weight. Second, a significant portion of the VOCs or toxins are captured in a controlled industrial environment. Third, in many cases there is greater range of application technique and effect at the factory or shop—in other words, greater design flexibility and more surface presentations for the architect to choose from.

Moreover, not all manufacturing approaches are alike. Some industrial coloring systems require large amounts of dye and pigment in order to produce a visually effective surface. Other, newer processes reduce the base materials needed, making the products relatively more efficient in terms of resources needed. In addition, some coloring methods produce no VOCs at all, and some use air instead of water to convey the dye, so that no hazardous waste is emitted and water waste is reduced or eliminated.

In addition, recent advances in pigmentation and visual effects have been adopted in the manufacture of architectural surfaces, fabrics, wallcoverings, and ceiling materials. One of the most valuable is sublimation printing technology, also known as dye sublimation. The process combines dyeing, or impregnating color into a material, with a phase change process that goes directly from solid to gas—called sublimation—without the materials becoming liquid. While the term is used to describe how inkjet printers work, industrial processors for interior finishes such as ceiling panels are very different: Solid dye particles are changed into gas using heat and pressure, then bonded with polymers present on the target surface, and then return to their solid state.[3]

The colorant particles employed in dye sublimation printing are engineered to bond with polymers only. This means that higher levels of certain materials in the substrate, such as polyester and rubber, will tend to attract and bond with more dye material. For ceramics, glass and metals, a polymer coating (usually a polyester liquid) can be heat-applied so that the dye sublimation process adheres to the surfaces. Done properly, the process results in brighter color rendition and longer-lasting surface treatment than many other coloring methods, with less fading and discoloration over time.

Dye sublimation is an effective approach for a range of product processes, including digital textile printing—for fabrics and wallcoverings, for example—and digitally produced signage. As compared to UV-curable, latex, or solvent printing, the resulting materials are known for a high-end feel or texture—called *hand* in the interior finish industry. That means the final product stands up to close inspection by building occupants.

MASS CUSTOMIZATION OF INTERIORS

There are other benefits to the innovative color-printing processes enabled by dye sublimation. The techniques are highly efficient and allow for quick changes in the selected digital inputs, meaning that a custom run of ceiling tiles can be accomplished at a low relative cost. This is one reason that sublimation printing has become popular in such industries as point-of-purchase signage, entertainment, events, and exhibitions.

See endnotes 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 and building products.*

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An Ecological Basis for Selecting Ceramic Tile

Evaluating ceramic tile for use in green building projects

Sponsored by Tile of Spain

Definitions of sustainable design and green building are hardly stagnant. Every year, as the architectural profession and industrial leaders learn more about building performance, environmental challenges, and the effects of our choices on people and the planet, we add to the body of knowledge on sustainability. In this way, our standards and definitions change accordingly, hopefully getting more "ecological."

While green building tends toward many novel solutions—building integrated photovoltaics (PV), for example—the recent evolution of green thinking is playing into the hands of architects who favor time-tested and even traditional building methods. This includes niche products—rammed-earth and straw bale construction leap to mind—but also classic materials and systems including natural ventilation, brick masonry, and ceramic tile. Even the traditional manufacturing

Photo courtesy of Tile of Spain / Vives

Modern ceramics more easily render woods in wide or long planks, multi-widths, exotic woods or stains, and even aging compared to their "natural" counterpart.

CONTINUING EDUCATION

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Learning Objectives

After reading this article, you should be able to:

1. List the general environmental benefits of ceramic tile based on its technical performance.
2. Review the requirements in green building standards and describe how ceramic tile contributes to those needs.
3. Identify technical advances and innovations in the ceramic tile industry and ways to reduce consumption using ceramic tile.
4. Discuss ways to reduce resource consumption, chemical emissions including VOCs, and cleaning and maintenance needs based on the properties of tile.
5. Describe the modern development of ceramic tile in terms of building performance and construction benefits.

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Photo courtesy of Tile of Spain / Grespania

Large-format porcelain slabs create a lightweight performance "skin" for residential and commercial spaces.

centers, such as the tile-making operations clustered in Castellón near Valencia, Spain, showcase long-established methods for more efficient construction material production.

Yet there are other changes in green building that are shifting attention to long-standing construction methods and materials. The emphasis on a more comprehensive approach to the evaluation of materials, including life-cycle analysis (LCA), is just one trend, but perhaps the most significant. Related to this is a growing language among practitioners in understanding material durability and flexibility, also called functional resilience or simply resilience. A second is the emphasis on indoor environmental quality (IEQ), which tends to favor nontoxic and inert building products, which emit fewer volatile organic compounds (VOCs), as well as finishes that physically comfort or safeguard occupants. In addition, interest in the better ways to address ongoing repair and maintenance in the use phase of buildings, when most of the energy and environmental impact is felt, is a contributing factor to these revived approaches.

Interest in promulgating better standards and codes for green building is also helping expand the use of long-established and time-honored construction techniques.

One of the materials of particular focus today is ceramic tile, which is seeing a surge in green applications according to trade groups such as Tile of Spain. With surviving examples of its use in construction dating to column claddings in ancient Mesopotamia as early as 900 B.C., ceramic tile is certainly a deeply established, proven construction approach. New findings from the last decade or two, however, have added modern evidence of its vital benefits for green building.

TILE APPLICATIONS AND GREEN CAPABILITIES

While the cone-shaped tiles used in Mesopotamia served as elements of column structures, over the years ceramic panels and various setting techniques have been used for interior surfaces, special occupancies (such as healthcare), and outdoor uses including paving and building cladding.

Interior wall covering and flooring dominates the interior use of ceramic tile and its market dynamic overall. From mosaic tile to subway tiles to large-format, modern ceramic panels, properly installed ceramics provide a strong and lasting finish.

Tile's resistance to water, moisture, and bacteria—thanks to ceramic tile's dense composition and often glazed finishes—has encouraged its use in wet locations such as lobbies, foodservice areas, kitchens, restrooms, gymnasiums, hospitals, natatoriums, and more. Studies of microbiological growth show that ceramic and porcelain tile actually reduce bacteria, mold, and mildew in these areas when properly installed.

The inherent strength of tile surfaces has also opened doors for reuse opportunities. One of the most valuable in recent years is the advent of slim porcelain and ceramic tiles, which range from 3mm to 7mm in depth, some of which are even suitable for flooring installations for tile-over-tile retrofits using the original tile as a substrate. In addition to saving project time and cost, this technique obviates both the heavy tile construction waste as well as the need for new virgin or recycled materials for use in replacing the subfloor. The tile surface is stable and strong enough for point loads as well as typical environmental variations.

GREEN REASONS FOR CERAMIC TILE

Specialty contractor Studio Tile & Stone of Melbourne, Florida, lists ceramic tile's positive impacts in a number of areas, including:

INDOOR ENVIRONMENTAL QUALITY:
Resistant to fungus, mold, and mildew.
Inherently nontoxic and inert.
No emissions or off-gassing.
Uses nontoxic adhesives.
No sealing or stripping required.

ROBUST, DURABLE MATERIALS:
No absorption of water.
Used in hygienic locations.
Resists fire, flame, and heat.
Resists chemicals, caustics, and corrosives.
Moisture and freeze resistant.

REDUCED OPERATIONAL IMPACTS:
Cleanable using water only.
Does not require professional cleaning.
Not affected by ultraviolet (UV) light.
Retains color permanently.
Resists insects and pest damage.

OCCUPANT COMFORT AND HEALTH:
Cool surface for warm climates.
Improves thermal comfort (TC).
Increases thermal mass.

RESOURCE BENEFITS:
Made of plentiful materials, such as clay.
Can be made with recycled materials.
Recyclable at end of use.
Very good life-cycle (LCA) profile.

Photo courtesy of Tile of Spain

Designed by Estudio C O R, the award-winning MUCA Auditorium and Music Complex in Algueña, Spain employs a rainscreen of iridescent ceramic tiling.

As flooring, ceramic tile offers a very resilient and protective finish, making it ideal for high-traffic zones, places where long-term aesthetics are important, and specialty interiors, such as healthcare settings, where cleanability and hygiene are concerns. In locations with direct ultraviolet (UV) exposure from sunlight and the potential for reconfiguration, tile demonstrates its resilience, durability, and flexibility. "Because ceramic tile will not fade due to UV light, the reconfiguration of spaces is much easier since furniture, rugs, or even cosmetic interior walls can be moved without the worry of light and dark patches of flooring," says Ryan Fasan, a consultant to the Coral Gables, Florida-based trade group, Tile of Spain.

The inherent durability of porcelain and ceramic tile has attracted sustainable design adherents to their use in high-traffic, high-use areas. Novel tile designs that mimic wood and stone finishes offer the look of another natural surface with today's expected engineered performance. Other finishes may have a lower initial cost, but a tile installation can be amortized over a very long lifespan. An LCA study by the Tile Council of North America (TCNA) comparing popular finish materials showed ceramic tile to be the lowest cost option for timeframes up to 40 years.

Another factor is thermal comfort (TC), according to Fasan, which has become an important buzzword in terms of occupant health and safety. Defined as the perceived warmth or coolness of a space, TC can be achieved using methods with low energy costs, or no energy cost at all, such as tile finishes. For example, studies by the U.S. Environmental Protection Agency (EPA) show that subfloor radiant heating in combination with hard, dense surfaces like ceramic tile tend to be among the most efficient ways to heat a space. Where geothermal power can be incorporated, both heating and cooling can be easily achieved with lower operating costs.

OUTDOOR AND EXTERIOR APPLICATIONS

Studies of TC in commercial and residential interiors have also shown that thermostats are set an average of 2 degrees lower in areas of bare foot traffic when flooring feels warmer or cooler than the ambient room temperature. In addition to these long-term green solutions, ceramic and porcelain tile add thermal mass to the building assembly, which further stabilizes IEQ and energy draw through weather swings and occupancy changes.

Thermal mass is especially effective as part of the building exterior, and ceramic and porcelain tile offer longstanding uses as a finish for outdoor areas. According to the Glen Ellyn, Illinois-based Ceramic Tile Distributors Association (CTDA), many ceramic tiles are frost resistant and can be used in both exteriors and interiors, while other materials quickly degrade in the outdoors. This offers design continuity, for example, where an interior floor material continues outdoors to a balcony, patio or terrace.

While outdoor uses such as paving, base, and wall finish—in addition to interlocking tile roofs—offer literally centuries of demonstrated effectiveness, recent design concepts bring tile panels into high-performance, engineered assemblies.

Most noteworthy are the cutting-edge façade and cladding applications using ceramic tile and porcelain tile, which are increasingly popular. These ventilated enclosure systems have been favored by architects and engineers due to their redundant nature and ability to provide continuous, protected insulation layers and air/moisture barriers. The result, say experts such as Avellaneda and Gonzalez at the Universitat Politècnica de Catalunya, improves the "energy efficiency, occupant comfort, and acoustical performance" of the enclosure.

Overcladding with rainscreens is an effective retrofit approach for many buildings, according to architects like Mark Sealy, AIA, LEED AP, a principal with the Charlotte, North Carolina-based firm BJAC, "allowing the addition of thermal insulation for the building envelope," he explains. "Rather than potential costly exterior wall deconstruction, repair, or replacement, existing buildings with moisture infiltration may benefit by sealing the existing

TILE EXPERTS AND GREEN BUILDING

Recent industry activity has focused attention on the potential for ceramic and porcelain tile use in green building. The Ceramic Tile Distributors Association (CTDA), for example, has formed a Green Building Committee "to educate industry on the green building movement and to influence the way in which ceramic tile is viewed within the green building movement." For its part, the Tile Council of North America (TCNA) has formed its Green Initiative Committee and indicates it will work collaboratively with CTDA to further advance the use of ceramic tile in green building projects. Related developments include an insurance group, Institute for Business and Home Safety (IBHS), which has developed a program to reward increased robustness, longevity, and durability—combined with improved disaster resistance—in building design. These life-cycle analysis (LCA) focused developments tend to reinforce the use of tile.

Ceramic tile is one of a small number of cladding materials rendered in color that is unaffected by exposure to sunlight.

exterior and adding a rainscreen."

Aesthetics matter too, and ceramic tile is one of a small number of cladding materials rendered in color that is unaffected by exposure to sunlight. Beyond its durability, ceramic and porcelain tile in light colors can reduce a building's heat load and contribution to urban heat-island effects, which increase local ambient temperatures. These performance factors further build a case for using tile enclosures.

A BASIS FOR GREEN BUILDING COMPARISONS

These cumulative environmental benefits and performance capabilities offer compelling reasons to use ceramic tile and porcelain tile. However many building materials lend some advantages in green building, so it is useful to compare the attributes of varied assemblies, materials, and finishes to determine which best meets the sustainability needs of any given project.

"LCA is becoming one of the most valuable tools for green design professionals to utilize when selecting material finishes," says Fasan. "Unfortunately it has been difficult to assess competitive materials simultaneously on embodied energy, maintenance, replacement frequency, costs, and aesthetics to create an even playing field." Fasan points to the use of reference service life (RSL), also known as RCA, to rank disparate LCA studies on competitive materials. RSL allows design professionals to ensure a building project or material will have an estimated service life that meets or exceeds its design life. This means fewer premature renovations or repairs.

Ceramic tile fares well in RSL analysis, which amortizes the embodied energy and virgin resource usage of ceramic tile over an appropriate building lifespan. As a result, studies demonstrate it as one of the most efficient choices available. In the context of functional resilience, tile also delivers resistance to both daily wear-and-tear and exceptional instances such as hurricanes, flooding, and other weather disasters. This addresses the concerns of groups like the Institute for Business and Home Safety (IBHS), a national association representing the insurance and re-insurance industries. IBHS has developed a program called FORTIFIED®, which focuses on the need for more durable, disaster-resistant construction methods, according to the Portland Cement Association (PCA).

Functional resilience is hardly limited to disaster resistance, says the group. Add to it product robustness, longevity, and durability, and the result is less energy needed for product "repair, removal, disposal, and replacement of building materials and contents due to routine maintenance and operations, as well as disasters," says PCA. "Functionally resilient buildings create safe, secure, comfortable, and productive environments."

The fact is that ceramic tile is not only green by the current definition but a truly sustainable building material that has protected buildings and their occupants for millennia. The material's ability to survive in-situ for the life of the building is the main criterion; as a secondary factor, the material must be both cost-effective and resource-effective to produce, install, and maintain.

EVALUATING TILE AND OTHER MATERIALS, FINISHES

The environmental basis for comparing building finish materials may include owner and occupant preferences, the design team's prerogatives, and industry standards. While LEED is among the most common standards used, today there are others including the International Green Construction Code, introduced in early 2012, and state and regional codes including California's CalGreen, which went into effect in that state in January 2011.

Continues at ce.architecturalrecord.com

Edited by C.C Sullivan in collaboration with Tile of Spain

Photo courtesy of Tile of Spain / Inalco

This large-format, grey porcelain floor tile is slimmer in thickness and lighter in weight than typical floor tiles, and available with digitally produced patterns and textures.

Photo by George Faulkner Jr., AIA

The selection of a unitized flashing system was part of the overall moisture proofing strategy for the Hampton University Student Dining Facility in Hampton, Virginia. Architect of record: Livas Group Architects, P.C. in Norfolk, Virginia.

Moisture Management in Masonry Buildings

Unitized flashing provides an integrated design solution

Sponsored by Mortar Net® USA, Ltd. | *By Celeste Allen Novak, AIA, LEED AP*

Masonry construction, one of the oldest building systems in the world, requires a complex integration of a variety of elements to control moisture. The construction of a masonry building requires the knowledge of how this material weathers and reacts to seasonal changes such as snow, sleet, wind-driven rain, and humidity. Ancient civilizations building in equatorial zones using 3-foot-thick walls did not have to worry about a freeze-thaw cycle when they chose masonry, stucco, and brick as their most common building material. However, as civilization moved north to more temperate climates, new construction methods reduced the impact of moisture from seasonal temperature variations on buildings. The modern development of wood and steel structural frames with masonry cladding included the development of flashing systems that can expel moisture from these new building enclosures. The main line of defense that protects a wall system from moisture damage is in the construction detailing of wall flashing.

Early technical manuals such as the AIA's *Ramsey and Sleeper Architectural Graphic Standard* as well as 21st century editions provide numerous details for preventing moisture damage in masonry and masonry clad buildings. In the 1939 *Brick Engineering Handbook of Design*, the author states that at "the outset, it might be stated that no flashing at all is better than poor flashing."[1] The International Masonry Institute and the Building Enclosure Council provides information on codes, technical and non-technical bulletins on materials and techniques. Flashing materials and assemblies require code-compliant standards for durability, plasticity, and permeability. With all of this support, the evidence is clear that the variety and compatibility of moisture-proofing materials, flashing, expansion and control joints are providing many choices for successful field applications of flashing in masonry buildings.

Contractors are required to monitor the installation and compatibility of numerous materials specified by design professionals who are often not aware of the specific field conditions during construction. A lot can and

Photo courtesy of Mortar Net® USA, Ltd.

New Jersey's Louis I. Kahn Trenton Bath House uses a unitized flashing system on two new walls.

does go awry when building a masonry building. There is also an increasing emphasis on the design of high-performance buildings for energy efficiency and durability as part of a sustainable design portfolio. To design a moisture-proof, high-performance building, architects need to carefully detail and specify all of the components that are part of this system. They may also want to choose from a new variety of engineered products that unitize some of the basic components of the flashing system to improve the constructability of masonry wall systems.

As architects explore new forms: curved walls, canted overhangs, multifaceted edges, and masonry cladding in high-rise buildings, the integration of materials for moisture proofing wall systems can be an important design component. Three-dimensional detailing as part of information modeling has helped develop a more focused look at the many corners, breaks, and openings in modern buildings. "Designers sometimes forget how beautiful details are!" says Jim Stevens, AIA, an associate professor of architecture at Lawrence Technological University. Stevens reports that the plans for the renovation of a courthouse in St. Louis displayed corner boots, end dams, and flashing pieces that could have been exhibits of modern sculptures. A review of the components in wall flashing will show how unifying the components allows for easier installation and better moisture control in buildings.

MOISTURE AND MASONRY

Masonry is a porous material and all masonry buildings absorb moisture. From roof to foundation, what may appear to be an impenetrable building component is in fact, a system that needs to breathe to expel moisture. Masonry walls are typically constructed with an air gap between the brick veneer or exterior wythe of brick and the structural wall. Brick veneer is primarily decorative and is connected to the structural wall system by metal brick ties. Between the veneer and the structural wall is an air gap that is the "lungs" of the wall system—the place where air and moisture is channeled to be expelled at any place where the solid wall is interrupted by an opening such as a window, an interior or exterior corner and primarily at the end of the vertical wall. The Brick Industry Association (BIA) defines a cavity wall as having a continuous air space. Depending upon the skill of the mason, mortar droppings can fill a wall cavity so the BIA recommends a 2-inch minimum cavity to allow for proper drainage and airflow. However, the BIA Technical Note 21A allows rigid insulation to occupy one-half of the 2-inch cavity creating an even tighter allowance for proper mortar placement.

The most common reasons for excess water in a brick wall cavity can come from:

- Inadequately filled or over-sanded mortar joints
- Extreme acid cleaning
- Design details – Rowlocks or Soldier courses
- Construction materials – weather exposure

A publication of best practices from the 2006 AIA Convention, describes the need for considering moisture penetration as part of an early design phase. "Effective prevention involves implementing a successful water management system, understanding the sources of moisture ingress, and identifying potential problems. Studies have shown that uncontrolled rainwater penetration and moisture ingress are two of the most common threats to the performance of a building's envelope and together they represent up to 80 percent of all construction-related liability claims in the United States."[2] Detailing of the drainage system through proper flashing is considered one of the top means of effective moisture management.

Photo courtesy of Mortar Net® USA, Ltd.

Unitized flashing systems can be specified using any of the most common flashing materials.

EFFECTIVE FLASHING

Flashing is a membrane installed within a masonry wall to either prevent moisture infiltration, or divert moisture, which does penetrate the wall, back to the exterior of the building. Flashing provides a controlled path for water through walls. Unless specified as a unified component, the pieces that comprise a flashing system are membranes, weeps, termination bars, drip edges, and adhesives. Driving rain or sleet and the build-up of condensation on the interior of a masonry wall is directed by gravity to the lowest point in a building. Without flashing, the collection of moisture increases maintenance costs and can even cause building failures. Water can be prevented from getting out of a wall by the omission or incorrect installation of wall flashing and weep holes that can be clogged by mortar. Damage to masonry buildings due to moisture penetration can include efflorescence, spalling, steel stud failures, mold penetration, and even the collapse of the entire wall system.

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Learning Objectives

After reading this article, you should be able to:

1. Identify the components of a proper flashing system.
2. Compare and contrast membrane systems used in typical flashing systems.
3. Summarize design methods and materials to provide a moisture-proof masonry wall system for a high-performance building.
4. Review a variety of flashing details for corners, curved walls, and other wall systems.

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ADVANTAGE OF UNITIZED FLASHING MATERIALS

When installed at the base of a masonry wall, flashing spans from the exterior to the interior of that wall. Flashing covers the gap between the masonry and the substrate backup wall or in the case of a single wythe system, covers the open cells in blocks. Flashing should primarily be durable and resist and direct moisture as part of a complete system. Flashing materials should be tough enough to resist puncture by a mason with a trowel as subsequent layers of mortar and masonry are added to the wall. The flashing material should be flexible enough to be formed and placed on the wall. Flashing is adhered to the wall with adhesives that allow for expansion and contraction without cracking during seasonal changes. The flashing material must be compatible with the masonry, back-up substrate wall, adhesives, sealants, air barriers, mortar, salts, and masonry. Flashing materials should not cause staining on the wall and should be almost invisible when placed along the wall surface.

The estimated life of the flashing should match the life of a building. Replacing flashing, particularly in high-rise buildings, is difficult and expensive. Lower-cost solutions for building flashing, for example the use of asphalt-impregnated felts or tar paper, almost always lead to higher replacement and maintenance costs for the building owner.

The advantages of selecting a unitized flashing system are that the design professional will specify a material that:

- Decreases the probability of improper installation of materials—especially at difficult locations such as overlaps, rough openings, inside and outside corners.
- Manages mortar damming so water can easily flow out of the wall cavity.
- Prevents air pressure differentials that can force moisture in the building envelope.
- Can specify a material that has recycled content to help with LEED® certification.
- Assists with timely delivery on site.
- Provides compatible materials and prefabricated components for end dams and corner boots.
- Is one product instead of five separately manufactured and sourced products.
- Predetermines overlaps and enhances uniform installation.
- Avoid excessive labor installation costs of multiple layers of materials.

Unitized flashing systems can be specified using any of the most common flashing materials as a membrane. Unitized flashing has pre-designed laps, screws, weeps, termination bars, drip-edges, and a mortar collection device that meets the requirements of the ASTM E-514 water test. These durable systems are easy to install, particularly for high-rise buildings as well as buildings with numerous changes of materials and wall orientation. New products include roll flashing with a mortar collection system directly attached to the flashing membrane, clean lap spaces, and weeps. This adds to the ease of installation and reduces the cost of labor. In addition, the uniform placement of weeps and the clean edges of the flashing are almost indiscernible on the building facade.

COMPONENTS OF FLASHING SYSTEMS

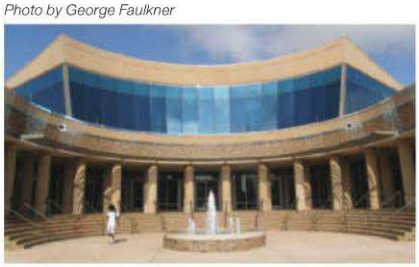
There are several components of a flashing system that needs to be installed and work together for moisture collection. The flashing membrane is the material that extends from the inside to the exterior of the wall system. Mortar collection is a strategy that in the past has been provided by a variety of installation techniques but now can be specified as part of a collection system. In addition, a flashing system includes weep hole vents, termination bars, and drip edges—all of which may be adhered to the wall by screws or adhesives that must be compatible with a variety of materials. The latest flashing systems provide prefabricated corner "boots" and end dams that allow for more precise fittings at different edges and corners of the building. All of these components can be specified in a variety of materials, and weep hole vents and drip edges can also be selected by color. One of the advantages of unitized flashing systems is that these components can be easily coordinated and specified.

COMPOSITE, UNITIZED FLASHING CHOSEN FOR HAMPTON UNIVERSITY

Architect George Faulkner Jr., AIA, senior designer and project architect for the Hampton University Student Dining Facility worked with moisture consultant, Stephen Hentz, P.E., of Hentz Engineering, to detail this important campus building. The dining hall will serve as an institutional focal point that will be located on the shoreline of the Hampton River on the campus of Hampton University overlooking downtown Hampton, Virginia.

The 80,000-square-foot facility will be housed on two levels with the second floor set back from the main façade to create a dramatic two-story atrium along the waterfront. The main floor will house a central dining area with food service kiosks around the perimeter of the atrium. The second floor will house a full-service market-style food court and administration areas. The design will also include exterior eating areas with views of the river. To maximize the benefit of its prime waterfront location, the composition of the building will be designed to accommodate views to downtown Hampton through a three-story convex glass curtain wall that will be the length of the building. The building is also designed to complement the other masonry buildings on this historic campus. A contrast of old and new, reflective and permanent, major building materials are brick, precast concrete, and glass. The building is designed with a canted facade, curved walls, and defined edges between the masonry and glass detailing.

Photo by George Faulkner



Controlling water penetration on campus buildings was important when designing a building that is clad in brick, glass, and precast concrete.

The exterior brick veneer wall system for the dining facility was installed over a 2-inch air cavity with a commercial air and moisture barrier applied to a 5/8-inch fiberglass sheeting backed up with 6-inch or 8-inch steel studs. The veneer is drained to the base of the wall through a unitized flashing system that incorporates a mesh cavity drainage material, membrane flashing, termination bar, and stainless steel drip into a panelized product. The flashing panels were installed and sealed together at the end laps using multiple sealant beads. At termination points in the flashing, pre-molded end dams were utilized to direct water to the exterior of the wall cavity. Due to the varying slopes and curves of the curtain wall system, several custom brick veneer cavity closures were fabricated and sealed to the moisture barrier using flashing membrane tapes and stainless steel for rigidity and long service life.

During construction, site visits were performed to observe the installed components for compliance with the project documents. Working with a moisture proofing consultant, the architect commented that the "choice of unitized flashing was presented by the consultant who had previous experience with this unique product." This selection is part of the overall requirements to design a long-lasting, permanent campus facility.

Membranes

The choice of the flashing material is important when specifying any flashing system. There is a wide variety of materials to select from for a typical flashing system as well as for a unitized flashing system, including the following products that have been re-engineered to meet higher performance standards. According to Steven Fechino, engineering and construction manager at Mortar Net® USA, Ltd., some of these types of flashing include the following:[3]

Copper laminate. Copper flashings are one of the oldest of all flashing materials and one of the most permanent. New systems include a laminated mesh of polyethylene on both sides of the copper. This durable product is almost impossible to damage with a trowel during installation. Copper flashing can cause staining on masonry if not properly detailed. Many new copper laminates are compatible with most building products as they do not contain asphalt as a binder.

Stainless steel. This high-end product is usually specified for institutional buildings and those buildings meant to be a legacy for future generations. One of the most expensive flashing materials, installation is labor intensive and requires bending, soldering, mechanical fasteners, and adhesives.

Photo courtesy of Mortar Net® USA, Ltd.

Multicolored weep vents blend in and are less noticeable along the face of a building.

Rubberized asphalt. One of the most common types of flashing used by masons and often is installed with a "peel and stick" placement on the back up wall. The type of primer used with this product as well as proper installation is the key to successful moisture management. It is sensitive to ultra-violet rays and can be damaged if left exposed during construction. Rubberized asphalt can also be incompatible with polyvinyl chloride (PVC) molds used for corners and end dams. The plasticizers in the PVC may leach into the asphalt and reduce the plasticity of the asphalt over time.

Thermovinyl plastics with non-migratory plasticizers (PVC): The current PVC flashing materials have been developed from products well-tested and used for roof flashing. This product is durable, flexible, and strong. It is compatible with many polyurethanes, polyethers, and butyls.

Thermoplastic polyolefin (TPO). This flexible membrane has a 30-year life span when installed on a roof and almost unlimited life span when used as wall flashing. The laps on this product can be sealed with a butyl rubber or primed polyether adhesives as well as with heat welding.

Ethylene propylene diene monomer (EPDM). Another roofing material that has migrated for use in wall flashing, EPDM is durable, flexible, and easy to install but may need to be specified with matching EPDM components to avoid incompatibility with some PVC corner boots and end dams.

Comparison of Common Flashing Material Properties

Material	Advantages	Disadvantages
Stainless Steel	Durable	Difficult to bend. High installation costs. Must be preformed at factory. Usually requires steelworkers for installation.
Cold-Rolled Copper	Durable, flexible	May leave stains
Lead-Coated Copper	Easier to form	Lead-coated, does not stain
Galvanized	Widely accepted	Will deteriorate in acidic environment
Copper Laminates	Easier to form and join than metals	May tear. Asphalt degrades in sunlight.
EPDM (Man-made rubber)	Not affected by UV rays, good corrosion resistance, tear and puncture resistance	Requires adhesives for bonding. More difficult to work with than rubberized asphalt, resulting in higher labor costs.
Rubberized Asphalt Flashing System	Flexible at low temperatures, excellent tear/puncture, self-sealing around small holes	Affected by UV rays
Polyvinyl Chloride	Not recommended for through-wall flashings (BIA)	

Source: Mortar Net® USA, Ltd.

See endnotes in the online version of this article.

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Architect Celeste Allen Novak, AIA, LEED AP, specializes in sustainable design and planning in Ann Arbor, Michigan.

Robots Update the Parking Garage

Automated parking doubles storage capacity and delivers appealing design and developer opportunities

Sponsored by Boomerang Systems, Inc. | *By Karin Tetlow*

Photo courtesy of Boomerang Systems, Inc.

Robots store and retrieve cars on steel trays in this latest-generation automated parking system in Crystal Springs Resort, Hardyston, New Jersey.

According to the 2010 Census, 81 percent of the U.S. population now live in urban areas, and that number is steadily on the rise. Similarly, the United Nations report "State of World Population 2007" projected that the world's urban population is expected to rise from 3.3 to almost 5 billion by 2030. Despite efforts to increase the utilization of mass transit, many urban dwellers still want to own an automobile. The swelling urban population and desire to own an automobile have combined to make the provision of adequate parking supply a major problem for developers and planners.

The most popular solution for increasing parking density to date has been the construction of ramp-access self-park garages. Despite the fact that some experts feel the parking garage "defines how people live and what industrialized society has become,"[1] the economic and structural realities of building ramp-access garages have historically relegated them into a "blind spot" within urban design. The major reason being that in order for ramp-access garages to be cost effective, they require construction methods that make them unattractive and difficult to conceal. When faced with the task of designing a ramp-access parking structure, many architects have taken great pains to make their garages attractive, but this is not easy to do.

It appears this may need to change soon. Since it is so difficult to integrate enough shops and restaurants into highly efficient parking structures, their use creates "dead zones" in the city. Devoid of natural foot traffic, these massive ramp-access parking structures often fall into disrepair, becoming magnets for crime. Many municipal governments have realized how disruptive ramp-access garages are to the urban fabric of our cities, and are looking for ways to mitigate their negative impact.

MECHANICAL VS. AUTOMATED PARKING SYSTEMS

Automated parking systems represent a practical and affordable solution to increase parking density since they use up to 50 percent less volume to park the same number of cars as a typical ramp-access self-park garage. As a result, more architects are becoming aware of new developments in parking technology and the significant benefits they offer.

When the topic of automated parking systems is raised, many in the design community will call to mind images of the open-air steel framed parking systems found on the streets of Manhattan. While these systems, commonly referred to as "stackers," are highly space efficient, they are not considered to be fully automated parking systems. They are instead considered to be "mechanical parking systems" simply because they require a trained valet driver to remove cars one by one to reach the uppermost vehicle.

Conversely, a fully automated parking system is distinguished from mechanical parking systems (such as those pictured on the right) by the automated parking system's ability to store and retrieve vehicles within a multi-level garage without human intervention. Thus many developers turn to fully automated parking systems in order to maximize parking density while minimizing the expense and difficulties inherent with employing a team of valet drivers.

Additionally, automated parking systems often only require one driveway, parking several cars deep on each side of the transit aisle, whereas mechanical systems require a lot of space for driveways to allow drivers to access each system.

Photos courtesy of Boomerang Systems, Inc.

Left: Cantilever or "stacker" systems use hydraulics to park one car over another. These mechanisms require a trained valet driver to operate safely. Right: Four-post stackers use hydraulics to store up to five cars on top of each other. These mechanisms require a trained valet driver to operate safely.

Three-Dimensional Movement

Automated parking systems are capable of moving cars along three dimensions (i.e. vertically, laterally, and longitudinally) within a parking structure. As a result, they are sometimes referred to as three-dimensional (or 3D) automated parking systems, as opposed to the one-dimensional (vertical) and two-dimensional (vertical and lateral) movements of mechanical parking systems.

To guide this unaided movement through three-dimensional space, automated parking systems use advanced computer systems to control electro-mechanical systems and an array of sensors to measure the dimensions and guide the movement of the vehicles. As a result of this complex interaction, these automated parking systems are also often referred to as "robotic" parking systems.

The primary reason for choosing 3D automated parking systems is that the use of precision robotics to transport the vehicles allows the vehicles to be parked closer together and eliminates the need for ramps and most of the internal driveways required for circulation within a conventional ramp garage. In fact, a typical automated parking system can park anywhere from 30 percent to 110 percent more cars in the same volume of space than is possible in a conventional ramp-access garage.

Since accessory parking is mandated by almost all local governments for all new construction projects, and space is becoming increasingly scarce in urban environments, automatic parking systems could very well be a critical factor in determining the viability of many future projects. Moreover, projects that were once thought not to be viable due to difficulties meeting the parking requirements will now become viable.

Historical Perspective

The oldest mention of a mechanical parking system is a two-floor structure in Paris by architect Auguste Perret, a specialist in reinforced concrete construction. Constructed in 1905, the garage had a surprisingly similar layout to today's automated systems. Later, in 1956, Krupp built a mechanical system for the Deutsche Bank in Munich, Germany.

Since then, advances in computer and automation technology led to the widespread adoption of automation for use in moving palletized goods in warehouse storage and retrieval systems. The maturing of this technology plus an increase in shortages of urban space has led to many automated parking systems being built in Japan, Korea, China, and to a lesser extent, in parts of Europe.

The use of automated parking is now accelerating. As of 2002, there was only one system in the United States. Now, a decade later there are 12 systems operating, two under construction, and at least as many more planned in the near future.

The User Experience

From a superficial perspective, most automated parking systems seem to function in a similar manner. The parker drives into an available parking bay and is guided by sensors and digital signage to park in the center of the parking bay floor. He or she exits the vehicle and walks out of the parking bay to a kiosk on the wall, where they may be asked to estimate their time of departure. Regular users can either swipe a parking pass or enter a personal code, while transient users will be issued a paper ticket for identification purposes.

At this point the parker leaves, the exterior parking bay door closes, and sensors check to make sure nobody is inside the parking bay. Once cleared for storage, the automated machinery removes the car from the parking bay, often depositing it on a lift, which carries it to the storage level, where the machinery stores the car. Vehicles will often be turned 180 degrees at some point in the process so they are ready to be driven straight out of the parking bay when exiting.

Upon returning, the customer scans his or her card, enters a code or inserts the paper ticket, which signals the system to retrieve the car. In a matter of minutes, the customer's ding-free car is delivered to a nearby parking bay, facing outwards, making it easy to drive away.

Retrieval times typically range between 1 and 5 minutes, with an average of about 2.5 minutes, which is similar to the amount of time required to retrieve a car from a conventional ramp-access garage. The actual retrieval time depends on a

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Learning Objectives

After reading this article, you should be able to:

1. Explain the forces driving the adoption and subsequent evolution of automated parking systems (APS).
2. Discern between the various types of mechanical and automated parking systems.
3. Identify concerns that drove the evolution of automated parking systems.
4. Discuss the application of Automated Guided Vehicle (AGV) technology to improving parking solutions.
5. Identify the economic benefits of using an automated parking system.
6. Summarize how automated parking systems can expand design possibilities and contribute to LEED® points.

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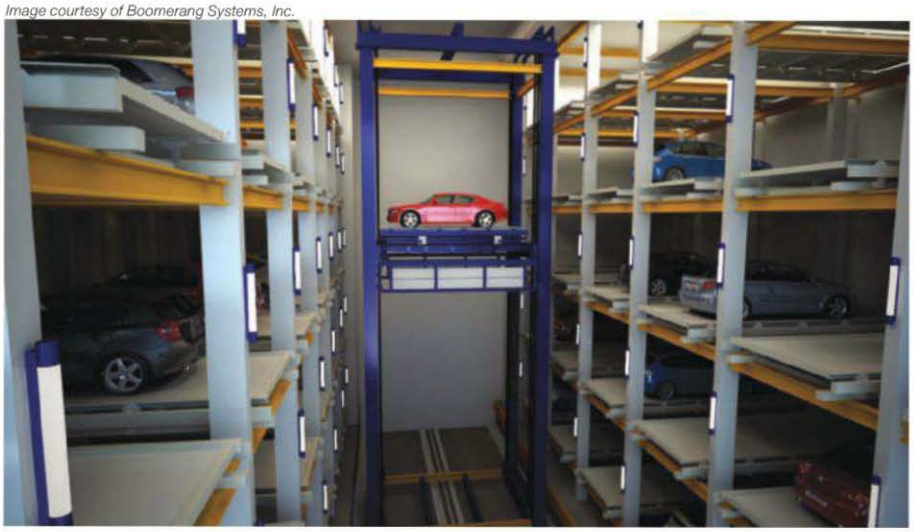
Image courtesy of Boomerang Systems, Inc.



First-generation "mono-path" rolling hoist systems process transactions serially (one car at a time).

number of factors at the time of each retrieval request, including but not limited to: the number of paths of lateral movement, location of the target vehicle, the current occupancy level, and number of overlapping retrieval requests.

Car owners like to use automated parking systems because, instead of requiring parkers to drive around and around hunting for a space, they now have immediate access to a conveniently located VIP parking space. Other advantages include being safer for both the driver and the car; no traversing across silent, darkened, exhaust-polluted garages; no backing and turning to squeeze in and out of a tight space; no scratches, dings or dents; no theft; and, since drivers keep their keys, no worries about joyriding or privacy violations by garage attendants.

Different Approaches to Automated Parking

Given the high frequency of vehicle damage and personal assaults in ramp garages, along with the inconvenience of driving around and around hunting for a space, one would think that automated parking systems, which are far more safe and convenient, would be far more prevalent today.

The aforementioned functional description is nearly identical for all automated parking systems; however, the various systems that have evolved over time, differ dramatically in *how* they perform these tasks. Each approach to automated parking results in fundamental differences in cost, reliability, and performance, which must be understood before implementing this technology in a development project.

"MONO-PATH" AUTOMATED PARKING SYSTEMS

The first- and second-generation automated parking systems, each of which will be described in more detail, have been broadly adopted in Asia and to a lesser extent in Europe. The movement of the vehicle transportation machinery varies in each successive generation of technology and has a material impact on the capabilities and performance of the system; however, as their name suggests, "mono-path" automated parking systems are all distinguished by their having a single pair of rails through the center of the system along which machinery would ride to store and retrieve the cars (i.e. its "path").

Advantages of all mono-path systems include:

- Vertical and visual transparency, which can create interesting designs by exposing the vehicle rack and mechanical movements.
- In a few municipalities, mono-path systems are treated as a single floor for FAR requirements much like a warehouse. (FAR or floor area ratio is the ratio of the building's total floor area to the size of the parcel of land it stands on.)

Unfortunately, mono-path systems have been slow to catch on in the U.S. because conservative developers and traffic engineers have been concerned that the mono-path design of first- and second-generation systems will cause bottlenecks to form when processing simultaneous transactions. This, in turn, limits these systems' hourly throughput, and in the event of certain mechanical failures, may take them offline altogether.

Those who were willing to ignore the fact that systemic design limitations could cause limited or no functionality, often encountered difficulties securing approvals. The open atrium typically found in the middle of many mono-path systems allows fire to spread rapidly and could represent a significant life safety hazard to firefighters who must extinguish a car fire in the upper levels of the system.

First-Generation Mono-Path Systems

The first generation of mono-path systems use a rolling hoist that follows rails mounted in the floor and ceiling of the garage. These devices move laterally and vertically at the same time and then move longitudinally to store and retrieve the target vehicle. They are actually very fast for one transaction, but they have a number of significant limitations.

Disadvantages of first-generation mono-path systems:

- They can only process one transaction at a time, so queues form instantly.
- If the system is down for maintenance or there is a mechanical failure, the entire facility is shut down.
- The floor-to-ceiling central atrium allows fire to spread easily and poses a life safety threat to fire fighters, thus making approvals of these systems very difficult.
- Erecting the rack is complicated and requires specialty construction methods.
- If the structure shifts or the steel rail expands causing misalignment of the rails, the system may be crippled or unusable.
- This is a single-purpose structure that will be difficult to repurpose if the technology is ever obsolesced.

Second-Generation Mono-Path Systems

The second generation of mono-path systems evolved in order to increase processing capacity and limit exposure to mechanical failure by utilizing multiple retrieval shuttles. These shuttles move cars laterally along rails affixed to the front of each side of the storage area on each level of the garage. They then deposit or retrieve the cars into two or more stationary lifts to transport the cars vertically through the structure, where another shuttle will remove the car from the lift and transport it to its storage space.

Disadvantages of second generation mono-path systems:

- The use of rails to guide lateral movement means there is still one lane of lateral movement on any single level, which prevents shuttles from being able to pass by each other and thus limits the processing capacity of the system.
- While redundancy is improved over the first generation, a mechanical failure on the entry/exit level can cripple these systems since 100 percent of the cars must pass through this area on their way in and out of the garage.
- When employed, the floor-to-ceiling central atrium allows fire to spread easily and poses a life safety threat to fire fighters, thus making approvals of these systems very difficult.

- Specialty construction is required to erect the mono-path structure.
- If the structure shifts or the steel rails expand causing misalignment of the rails, the system may be crippled or unusable.
- This is a single-purpose structure that will be difficult to repurpose if this technology is ever obsolesced.

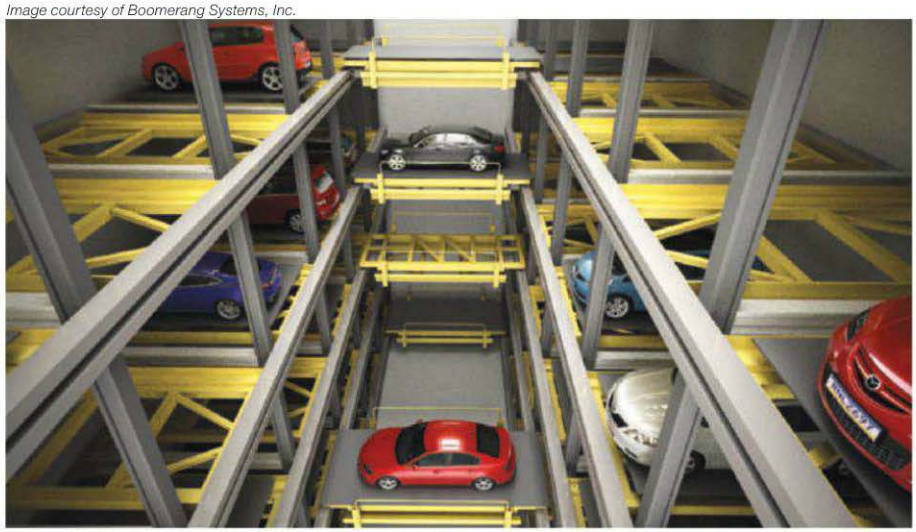
THIRD-GENERATION MULTI-PATH SYSTEMS

A recently introduced third generation of automated parking systems has come on the market, using AGVs or Automated Guided Vehicles, which are omni-directional battery-powered robots, to store and retrieve cars that are parked atop steel trays. While use of AGVs is revolutionary to the automated parking industry, AGVs have been widely used in car factories and warehouses around the world for the last 30 years.

From the outside, these AGV-based multi-path systems appear to work like other automated parking systems, but when the parking bay door closes a low-profile rectangular AGV rolls under the car and uses its onboard electric motors to raise four posts and thereby lift the tray. The robot then rolls out of the parking bay carrying the tray with the car onboard following its guidance system. Since they are battery operated with four independent wheels, each AGV can move forward, backward and side-to-side, and can spin 360 degrees anywhere in the garage (provided there is room to do so). AGVs can also travel up or down between storage levels in specially designed lifts.

Since the AGVs are not constrained to move along a rail, they are free to move laterally through the garage along multiple paths, which is why they are referred to as "multi-path" automated parking systems. This multi-path functionality enables the AGVs to work around obstacles, thereby avoiding the creation of bottlenecks in the main transit aisle.

Image courtesy of Boomerang Systems, Inc.



Second-generation "mono-path" shuttle and lift system

Benefits of Multi-Path Automated Parking Systems

The vehicles in a true multi-path system are supported above the concrete slab on elevated trays so the AGV can "drive" in any direction throughout the garage underneath parked cars. This ability enables AGV systems to process multiple transactions while avoiding bottlenecks that would have formed in the center transit aisle of first- and second-generation systems.

Additionally, when the ability to move laterally along multiple paths is combined with sophisticated logistics software, suppliers can add many more robots to attain a significantly higher hourly throughput than would otherwise not be possible in a mono-path system.

The ability to move laterally anywhere in the garage, enables greater density to be achieved without impacting performance. By way of example, just imagine a grid of nine parking spaces, three across and three deep. The software that controls a multi-path system would be programmed to first park three cars deep in the left and right rows of the nine-car grid—leaving the center row empty and thereby attaining 66 percent occupancy. Since the robots can move a parked car laterally into this still-empty center row, a multi-path system can typically retrieve any car without the need to move any other cars up until this grid (and similarly, the entire garage) exceeds 66 percent occupancy. This is compared to the 33 percent occupancy threshold at which similarly designed three-deep mono-path system starts requiring cars to be moved for retrieval.

These systems offer the same environmental advantages as first and second-generation mono-path systems, but the multi-path systems provide greater density, reliability, throughput, safety, design flexibility, and are easier to integrate within a larger building.

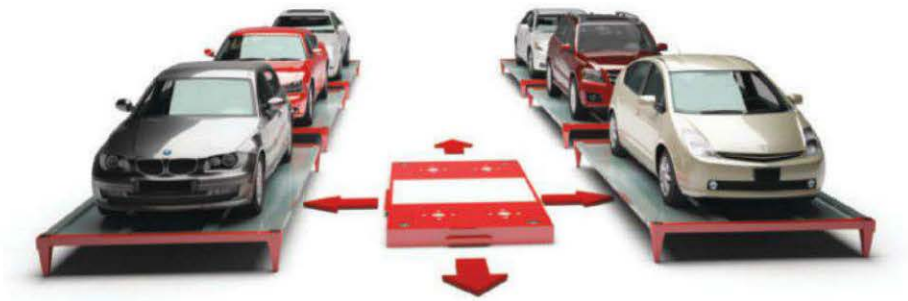
As a result of these many benefits, these multi-path automated parking systems have been met with very positive response by government fire and building officials and real estate developers leading to a recent surge in their adoption. When compared with earlier first and second generation mono-path systems, it is easy to see why many have concluded that multi-path automated parking systems are much better suited for larger, higher-demand parking garages.

See sample layout of a multi-path system in the online version of this article.

Endnote:

1. The Parking Garage: Design and Evolution of a Modern Urban Form *by Shannon S. MacDonald*

Image courtesy of Boomerang Systems, Inc.



Multi-path automated parking system

Continues at ce.architecturalrecord.com

Advancements and Applications in Resinous Floors and Walls

Safe, cleanable, and durable, resinous flooring can be specified in numerous applications

Sponsored by Stonhard | *By Karin Tetlow*

Faced with the task of specifying a flooring product, design professionals are guided by the specific needs of the project. Cost-effectiveness, durability, safety standards, overall performance, and design goals are all features that need to be evaluated when selecting a flooring system for any of today's many commercial and industrial applications. One material that meets multiple requirements is resinous flooring. Formulated from different resins, it has many advantages over other flooring systems.

TRADITIONAL FLOORING SYSTEMS

Before discussing those advantages, it is useful to review the characteristics and drawbacks of commonly used traditional commercial flooring systems, such as vinyl composite tile (VCT), vinyl sheeting, terrazzo, carpeting, and sealed concrete.

Vinyl Composite Tiles and Vinyl Sheeting

Vinyl flooring is composed of colored vinyl chips formed into solid sheets of varying thicknesses for vinyl sheeting and cut into 12-inch squares for vinyl tiles. It has a low cost, durability, and ease of main-

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Learning Objectives

After reading this article, you should be able to:

1. Discuss resinous flooring products and their applications.
2. Summarize the advantages of resinous flooring.
3. Identify the sustainability features of resinous flooring and how they contribute to LEED® points.
4. Describe the steps required to ensure a successful flooring installation.

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Photo courtesy of Stonhard

Decorative troweled epoxy floor unifies the design of a corporate office.

tenance. Vinyl flooring is water resistant and can be repeatedly refinished with chemical strippers and mechanical buffing equipment. Its drawbacks include:

- Inability to stand up well to heavy loads and can be damaged by sharp objects.
- Vinyl tiles are easy to replace, vinyl sheeting is not.
- Vinyl tile joins and sheet flooring seams may present cleaning problems and can harbor bacteria.
- While vinyl is generally resistant to stains, it is susceptible to discoloration when it comes in contact with rubber such as rubber-backing matting.

Terrazzo

Terrazzo is a composite material poured in place or precast. It consists of marble, quartz, granite, and glass and is typically poured with a cementitious binder. It is then cured, ground, and polished to a smooth surface. Waterproof, durable, easily cleanable, and environmentally sustainable, its major disadvantages are its expense and slipperiness when wet.

Carpeting

While aesthetically preferable in some settings, carpeting is a potential health risk for many commercial and industrial applications. It can harbor bacteria, is expensive to maintain, and needs frequent cleaning. A dry concrete subfloor is essential, otherwise mold can develop beneath the underside of the carpeting.

Sealed Concrete

Eco-friendly, a sealed concrete floor is one of the most cost-efficient floor coverings and offers a multitude of design options. Drawbacks include the need for resealing every few months in high-traffic areas; it transmits sound easily; and can be expensive if several colors and designs are specified.

RESINOUS FLOORING

Typically comprised of materials that include polymeric materials such as epoxy, polyurethane, and acrylic (MMA) (see sidebar), resinous flooring is cast in place. In addition to its many advantages over traditional systems, poured-in-place resinous flooring has the significant benefit of meeting multiple requirements for a wide range of applications (see sidebar about defining performance on the next page). Through a strategic mix of materials typically categorized by manufacturers as different products, resinous flooring will serve heavy-duty manufacturing plants to signature corporate lobbies. Advantages of resinous flooring include:

Cleanability

With no joins or seams, a poured-in-place system cannot harbor bacteria or present cleaning difficulties. No buffing or waxing required.

Safety

Aware that cleanability can be associated with a high slippage index (a smoother floor can be more slippery), manufacturers offer resinous flooring systems in different textures. Data sheets will include both a Coefficient of Friction for a dry floor and Slip Index for a wet floor.

Resistance to Chemicals

A major advantage of resinous flooring is its resistance to corrosive chemicals. A manufacturer will typically test for the damaging effects of corrosive chemicals by totally immersing samples of cured flooring in different chemicals for seven days at normal room temperatures. The rated results are categorized by acids, alkalis and salts, and solvents and other chemicals and are available on a manufacturer's data sheet. Manufacturers also test for VOC (volatile organic compound), one of a number of chemicals, including benzene and acetone, that evaporate or vaporize readily and are harmful to human health and the environment.

Durability

Resinous flooring systems have a wide range of durability depending upon materials and configurations. Physical characteristics, such as strength and hardness data, are available for each product from the manufacturer.

RESINOUS FLOORING MATERIALS

The three materials commonly used for resinous flooring are epoxy, polyurethane, and acrylic (MMA).

Epoxy

A copolymer derived from two or more monomeric species, epoxy is formed from two different chemicals, referred to as the "resin" or "compound" and the "hardener" or "activator." Epoxy has a wide range of applications the include flooring, fiber-reinforced plastic materials and general purpose adhesives.

Polyurethane

Polyurethane polymers are formed by combining two bi- or higher functional monomers (a molecule that may bind chemically to other molecules to form a polymer). Polyurethanes are used in the manufacture of a wide range of products, from foam seating, rigid foam insulation panels to microcellular foam seals and gaskets and high-performance adhesives.

Acrylic (MMA)

Acrylic resin is a general term for any one of the plastics (resin) generated through chemical reaction by applying polymerization initiator and heat to a monomer. Methyl methacrylate monomer (MMA) is a transparent, colorless fluid substance and emits highly offensive odor during application. Surrounding areas must be properly ventilated and evacuated during installation.

DEFINING PERFORMANCE

Typically a manufacturer will conduct its own performance tests according to American Society for Testing and Materials (ASTM) standards.

VOC content (ASTM D-2369, Method E) tests for VOC (volatile organic compound) content. Results are in grams per liter (g/L). An epoxy stain-resistant flake system, for example, could have a VOC content of 34 g/L. Test results for other chemicals are available from the manufacturer.

Slip resistance index (ASTM F-1679, F-2508) is directly related to the smoothness of the floor (the smoother the floor the less slip resistance). Measured in ranges from 0 to > 1. The greater the number the more slip resistant. Troweled epoxy mortar system could have a Slip Index of 0.66 when wet.

Abrasion resistance (ASTM D-4060 CS-17) is the ability to withstand rolling loads. Abrasion resistance is measured by running a gritty surface across a coating for a selected number of times and determining how much of the coating has been removed. The sample is weighed prior to and after the test. Units are in gram max weight loss. Typical example: 0.03 g for decorative epoxy mortar.

Tensile strength (ASTM D-2794) is the resistance of the material from being pulled apart from two opposite forces. Tensile strength is measured in terms of psi (pounds per square inch). Typical example: 1200 psi for a resilient urethane flooring system

Compression (ASTM C-579) is the resistance of a material from being compressed to the point of cracking or other failure standard. Compressive strength is measured in psi (pounds per square inch). Typical example: 10,000 psi for a heavy-duty troweled epoxy system.

They are also crack resistant. Unlike ceramic or quarry tile, resinous systems will not crack or present tripping or cleaning hazards.

Design and Color Palette Versatility

Resinous flooring is available in a range of colors and appearances and can be poured according to custom design specifications.

Low-Cost Life Cycle

While its initial costs are higher than vinyl systems, decorative resinous flooring has lower long-term costs compared with terrazzo, high-grade carpeting, VCT, rubberized terrazzo, and non-formulated vinyl.

APPLICATIONS OF RESINOUS FLOORING

With multiple product choices manufactured for different needs, resinous flooring has a wide range of applications:

Construction markets
Healthcare
Pharmaceutical/Biotech
Food & Beverage
Chemical Processing
Education
General Manufacturing
Electronics
Hospitality
Public Spaces

Interior environments
Traffic Aisles
Airport Concourses
Processing Areas
Cafeterias
Control Rooms
Operating Rooms
Packaging Lines
Classrooms
Assembly Areas
Corridors
Machine Areas
Lobbies

RESINOUS FLOORING OPTIONS

When specifying resinous flooring systems, design professionals should be aware that resinous material—epoxy, urethane, and acrylic (MMA)—have different characteristics regarding curing time, heat limitation, chemical resistance, and so forth (see table of resin options in the online version of this article). For instance, acrylic (MMA) has the fastest curing time, while urethane flooring is partially renewable and excellent for chemical resistance.

Flooring System Configurations

Liners, coatings, troweled mortar, broadcast systems, and terrazzo alternatives are all types of resinous flooring. Configurations vary according to specific needs such as performance requirements, withstanding high temperatures, static and non-sparking properties, withstanding high traffic and noise reduction. Fillers and components are utilized in different products to enhance performance and sustainability.

Coatings. A resinous coating is used to protect and prolong the life of the floor. Available in a wide range of finishes, pigmented or clear, epoxy and urethane formulations, coatings can be applied in conjunction with a resinous floor system, or as a coating over a concrete subfloor. Thicknesses range from 8 mls to 30 mls. A manufacturer may categorize coatings as "complementary" products.

Troweled mortar. A troweled epoxy mortar is a typical choice for flooring with chemical, abrasion, and impact requirements. Hand-troweled like concrete, mortar is applied at thicknesses ranging from 3/16 inch to 3/8 inch. It is suitable for heavy-duty environments such as commercial kitchens or industrial facilities. Some systems include recycled glass fillers and rapidly renewable soy-based resins to increase texture and to withstand thermal cycling/thermal shock

Photo courtesy of Stonhard

A seamless troweled epoxy floor is easy to maintain in classrooms.

for use in food environments.

Troweled epoxy mortar is also utilized for renovating and replacing damaged floors.

Broadcast systems. Many configurations for moderate to high-performance needs require one or two layers of aggregate between the primer, undercoat, and sealer. In addition to durability, aggregates add texture, color, and static control. Silica sand, colored quartz sand, recycled glass fillers, or other aggregates are broadcast over a wet epoxy primer or undercoat by methods that date back to when farmers cast seeds on newly prepared soil. Today, installers ideally use machines to achieve a regular even spread. The entire floor is coated and broadcast to refusal (meaning that it has enough aggregates in the material to make it appear dry; otherwise wet spots will appear and affect the look and consistency of the texture). Reclaimed broadcast materials should not be reused.

The thickness of broadcast layers ranges from 1/16 inch to 3/16 inch. As in all flooring systems, the condition of the concrete substrate is critical to the performance of the floor. With its extensive range of finishes and color options, a vinyl flake broadcast system is often specified for decorative finishes. Flakes come in both small and large sizes.

Configuration of decorative troweled mortar flooring.

Terrazzo alternatives. A cost-effective alternative to terrazzo is a decorative troweled epoxy mortar system. Recommended for pharmaceutical, research, education, and healthcare applications and used extensively in commercial environments, it is smooth, stain and wear resistant and has low maintenance. Also typically available in decorative custom patterns in an extensive palette, it is, unlike terrazzo, slip resistant. Some decorative epoxy systems utilize recycled glass chips. Typical thicknesses range from 3/16 inch to 1/4 inch.

Continues at ce.architecturalrecord.com

Photo courtesy of Stonhard

TRANSFORMING PRODUCTION FACILITIES

THE BILTMORE WINERY, ASHEVILLE, NORTH CAROLINA

The Biltmore Winery at the Biltmore Estate in Asheville, North Carolina, is the most visited winery in the country. Each year, the winery harvests and processes 250 tons of grapes in its extensive production facilities, operating under a vigorous schedule that takes a heavy toll on the floors.

Many floors in Biltmore's production facilities were original to the building, and after 25 years of wear and tear, needed refurbishment. Additionally, the painted walls in the winery continually peeled in the harsh environment and had been repainted several times in an attempt to remedy the situation. The condition of Biltmore's floors and walls not only troubled Biltmore management, but also presented aesthetic concerns, since many parts of the facility are open to public tours, welcoming thousands of wine enthusiasts each year. Biltmore management knew the positive benefits that new floors and walls would bring to the facilities and selected several resinous systems that could address all their needs. These systems helped transform both production facilities and improve work conditions.

In 2008, the flooring manufacturer began by conducting a careful analysis of Biltmore's needs and designed a multi-phase plan that included floor, wall and lining systems that would perform well in the production environment. When Biltmore planners were skeptical whether a wall coating could stand up to the conditions in their facilities, the manufacturer installed onsite samples to demonstrate the durability of the product. Convinced, Biltmore installed more than 8,800 square feet of flooring and 7,500 square feet of wall coatings between 2008 and 2010.

A troweled polyurethane textured mortar system was installed in the tank room and grape processing areas. The highly resistant polyurethane mortar floor system provided a durable floor surface that could withstand heavy wear, impact, abrasion, thermal shock, and thermal cycling. These areas also received an application of epoxy wall glaze, which remedied all of the former wall problems by providing a smooth, easy-to-clean, chemical-resistant wall surface.

The manufacturer installed troweled epoxy mortar flooring in Biltmore's champagne bottling area and car exhibit space. The chemical and abrasion-resistant floors were sealed with a protective epoxy coating, which delivered a durable clean-line aesthetic with increased cleanability. The same troweled epoxy mortar was installed in a batching room and elevator lobby.

In addition, the manufacturer completed outdoor work at the Biltmore facility. A weatherproof and protective polyurea-polyurethane hybrid lining was applied to the outdoor welcome cabana and a rapid-installation polyurethane mortar system was used to complete an outdoor fountain basin.

Odor control during installation was imperative for Biltmore, as were the needs for crews to work around stationary equipment and to complete some of the work at night, to accommodate Biltmore's production and public tour schedules. "The floors look beautiful and I'm confident that they, along with the walls, will be there for many, many years," says Bill Lynch, production manager.


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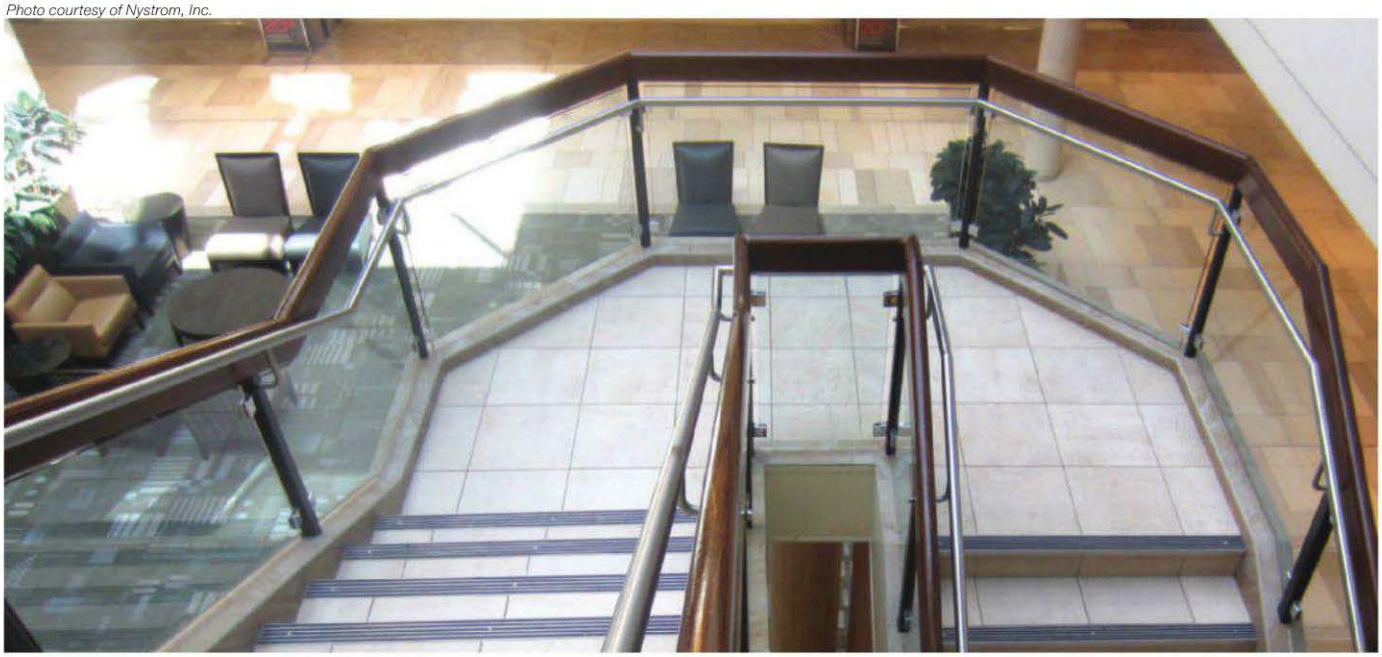

Ridgedale Center Mall, Minnetonka, Minnesota

Stair Treads and Nosings

Specifying for safety, code compliance, and ease of maintenance

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

Steps and stairways are common to most buildings as a key element of circulation and movement of people through individual spaces and the entire building. They also serve as a means of egress in the event of fire or other emergencies and are regulated in great detail by building codes and standards as a result. From a safety standpoint, they are one of the most common locations for people to trip, fall, and be injured. The importance of designing safe and code-compliant stairs cannot be understated particularly since architects are sometimes held liable for damages to people injured on those stairs. Among the most significant safety details to be addressed are the proper design and specifications for treads and nosings installed in a variety of locations and construction types.

STAIR TREAD AND NOSING DESIGN PARAMETERS

Steps and stairways have been constructed out of many different materials and in many different construction assemblies. Historically, all of the stair parts and components were typically made of whatever material was consistent with the rest of the building such as stone, wood, or masonry. Not all of these materials or stair assemblies held up well as the building was used over time with surfaces becoming worn, damaged, or as assemblies settled or became loose. In the late 1800s, cast metal was introduced into stair design to help address some of these issues by providing stronger and more durable components, particularly on stair treads, making them less susceptible to problems. During the 1900s stair design in commercial and institutional buildings became fairly standardized, falling into several familiar material categories: wood, solid concrete, solid metal, and metal pans with concrete fill. At the same time, manufactured treads and nosings emerged as a popular way to treat the walking surface of stairs for increased durability, safety, code compliance, and slip resistance.

Building codes commonly define a stair as "a change in elevation, consisting of one or more risers" with a riser being the vertical portion of the individual steps. They go on to define a stairway as "one or more flights of stairs" and also include "the necessary landings and platforms connecting them, to form a continuous and uninterrupted passage from one level to another." Hence a stairway is the total assembly connecting levels within a building. When it comes to individual components of stairs and stairways, codes don't typically provide a

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Learning Objectives

After reading this article, you should be able to:

1. Differentiate and distinguish the elements of stair treads and nosings that make them safe and compliant with applicable codes and standards.
2. Identify the types of manufactured stair treads and nosings that are available including options to specify for best performance in particular applications.
3. Investigate and compare proper installation strategies on different types of new and existing stair construction.
4. Explore successful cleaning and maintenance methods required for ongoing safe and slip-resistant stair treads and walkways.

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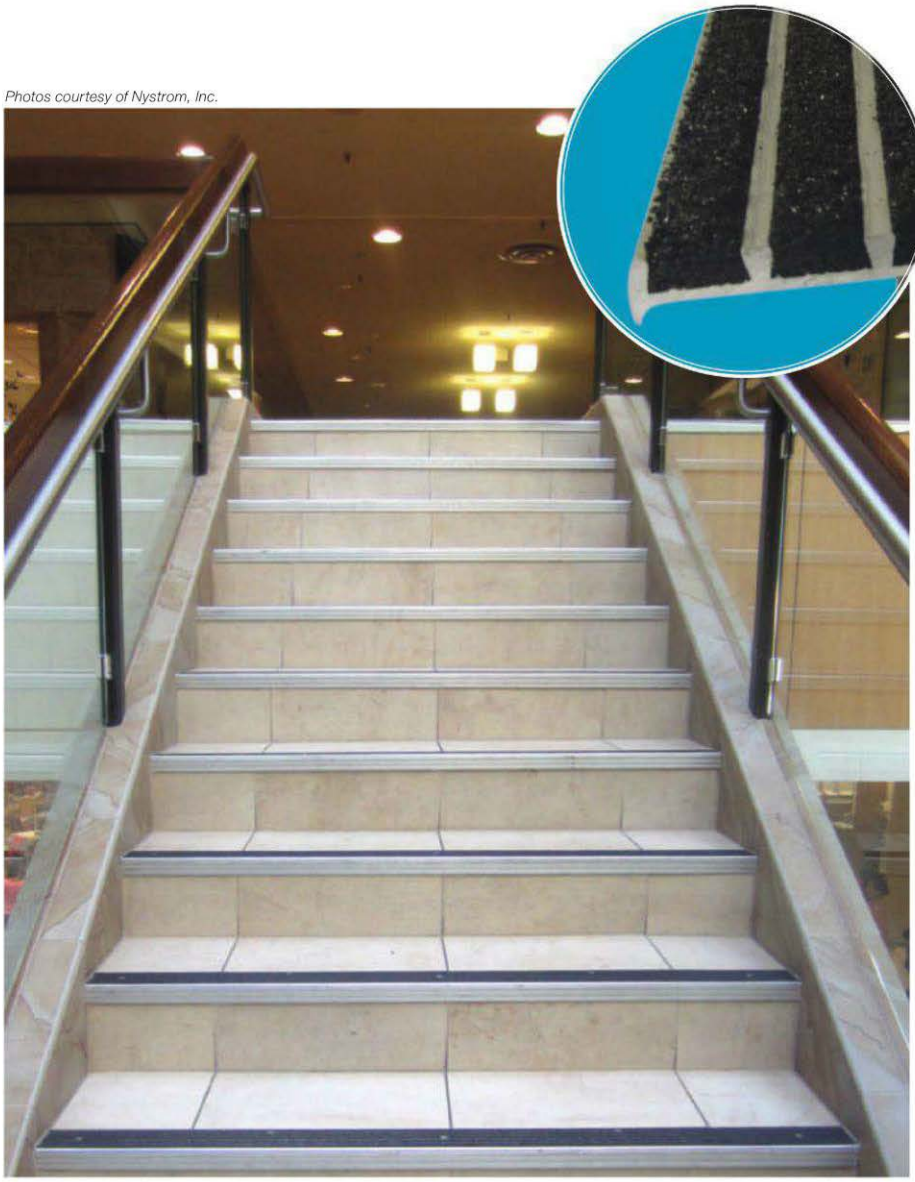
Photos courtesy of Nystrom, Inc.



Stair treads are the full horizontal surface that a person steps upon while the nosing is the leading edge of the tread.

definition of a stair tread, but it is commonly defined as simply the flat, horizontal portion of a stair that a person places their foot upon (as in stepping upon or treading upon it). Codes typically require a minimum depth of stair treads on the order of 11 inches and mandate consistency in their dimensions along a run or flight of stairs. Stair nosings are a distinct part of a tread that building codes define as "the leading edge of stair treads." Nosings also apply to the leading edge of landings at the top of stairway flights. The codes address the size and depth of the nosing for different stair profiles and call for them to provide a degree of slip resistance along their surface. For purposes of this article, all of these elements of defining stairs, stairways, and treads and nosings apply. However, we will generally differentiate a tread from a nosing based on the stair industry standard—a nosing is defined as 4 inches or less in depth and a tread is defined as greater than 4 inches in depth (i.e. commonly the full depth of the stair tread).

In light of all of the above, it is common current practice to design and specify stair treads and nosings as distinct elements of the overall stair design. As distinct elements, they can be added to the supporting material of wood, concrete, or steel that the stairs are made from. Further, they can be specified for both new and retrofit/renovation installations. For commercial and institutional buildings with moderate to high levels of foot traffic, extruded aluminum nosings and treads are often selected for both interior and exterior locations. The aluminum extrusions are typically filled with abrasive material running from side to side along the width of the tread or nosing. When using this approach in stair treads, the abrasive material is typically installed in channels in the extrusion, thus forming alternating strips of exposed aluminum and abrasive running across the stair tread. It is also possible to use "full abrasive" treads and nosings which have the abrasive material covering over the top of the extrusions so that only the abrasive material is seen.

In industrial or very heavy foot traffic conditions, full cast aluminum treads and nosings can be used. This approach is also applicable for both new construction and renovation/retrofit applications. These are solid aluminum products on the order of 5/16-inch thickness that are manufactured through a sand casting process instead of an extrusion process. Their profiles are often made specifically to fit onto either new or existing poured concrete or concrete filled steel pan stairs. In cases where only the nosing is desired to be added, they are available in different widths and styles. Where full cast aluminum treads are desired, the nosing is typically integral to the product along the leading edge. In either case, they are finished with an abrasive silicon carbide covering over the top of the cast aluminum. They may also include a diamond or crosshatch safety pattern in the aluminum for greater slip resistance. The cast aluminum will take the brunt of the traffic and any abuse, thus protecting and preserving the concrete beneath it and helping to ensure a well-maintained stair that remains intact and safe over time.

APPLICABLE CODES AND STANDARDS

The family of codes published by the International Code Council (ICC) includes the building code and fire code which address in detail the requirements for safety and slip resistance in stairs and means of egress as already discussed. It is important to note, however, that while these codes apply in the majority of states in the U.S., some states have adopted either revised editions of these codes or still use their own independent codes. Hence, it is always appropriate to review the prevailing and current code requirements in any given area related to stair and egress design. While this is the appropriate starting point, there are also a number of other applicable standards that come into play and need to be addressed whenever specifying and designing with manufactured treads and nosings:

Handicapped Accessibility

The Americans with Disabilities Act (ADA) sets out specific requirements for barrier-free environments including stairways. Some of this has been codified in American National Standard ICC A117.1 (the Standard) which is appended to most building codes as the prescriptive require-

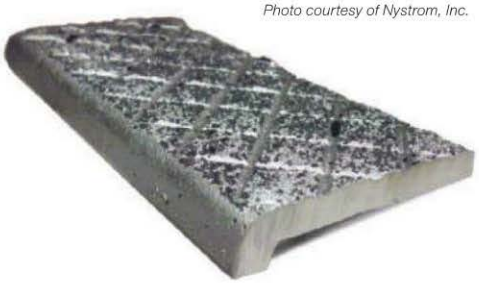


Photo courtesy of Nystrom, Inc.

Cast aluminum treads and nosings

ments to achieve such barrier-free environments. Section 504 of this standard specifically addresses stairways indicating more stringent requirements on treads and risers. It states that the vertical risers shall be at least 4 inches and no more than 7 inches tall while the horizontal treads shall be at least 11 inches deep, which is all consistent with the International Building Code requirements for stairs. In Section 504.4 this Standard goes on to state that the surface of a tread must comply with the provisions of a floor surface as described in Section 302. These include being stable, firm, and slip resistant. The Standard and codes do not quantify slip resistance, but the ADA does recommend a coefficient of friction level of .60 or above for walkways and .80 for ramps. It is common for manufactured treads and nosings to achieve coefficient of friction levels on the order of 0.98 – 1.02 or well above the minimum called for. Other requirements in the Standard for floor surfaces include being level within a slope of 1:48 and any openings in the surface must not allow passage of a ½-inch diameter sphere. If these openings are elongated, then they must be perpendicular to the direction of travel. It is worth noting that all these same floor surface requirements also apply to ramps as cited in 405.4 of the Standard.

Nosings receive a fair bit of detailed attention in Section 504.5. First the leading edge of the tread shall have a maximum radius of ½ inch where it aligns with the riser below. If the nosing projects past the riser it is first limited to 1-1/2 inches maximum past the riser but it must also have the underside of the nosing curved or beveled. The riser below can be angled back from the nosing provided that angle is no more than 30 degrees and the projection remains within the 1-1/2-inch maximum. In terms of specifying a manufactured nosing, all of these details must be provided for to assure both compliance with the standard and that there is no protruding lip that could be a tripping hazard.

Beyond the functional walking aspects of treads and risers, the Standard adds a visual requirement in Section 504.5.1. It requires that the leading 2 inches of the tread is differentiated with a contrasting color from the rest of the tread. This can be either a dark edge on a light-colored tread (e.g., black nosing on a gray concrete tread) or a light-colored edge on a darker-colored tread (e.g., yellow safety nosing on a black stair tread). Clearly, this is meant to help visually impaired people as well as improve the general safety of everyone.

California Title 24

The state of California is known for supplementing national standards with additional state-specific requirements and that is true in the case of stair treads and nosings too. Specifically Title 24 addresses the visually impaired aspect of nosings with a variation on the Standard A117.1 requirements. It calls for the same 2-inch-wide contrasting color strip but specifies that it must be within an inch of the front of the nose of the stair. Some have interpreted this in different ways, but the stair industry has responded by providing a 3-inch nosing that can have all or any 2-inch part of it treated with a contrasting color.

Occupational Safety and Health Administration (OSHA)

Consistent with this federal agency's mission of protecting workers, they have identified requirements for stairs. Specifically in Section 1910.24f of their standards, it states, "All treads shall be reasonably slip-resistant and the nosings shall be of nonslip finish. Welded bar grating treads without nosings are acceptable providing the leading edge can be readily identified by personnel descending the stairway and provided the tread is serrated or is of definite nonslip design. Rise height and tread width shall be uniform throughout any flight of stairs including any foundation structure used as one or more treads of the stairs." This language addresses the same concerns as the building codes and the handicapped accessibility requirements for stairs, but without the same level of detail. Therefore, by complying with the previous codes and standards referenced, OSHA compliance would seem to be met as well.

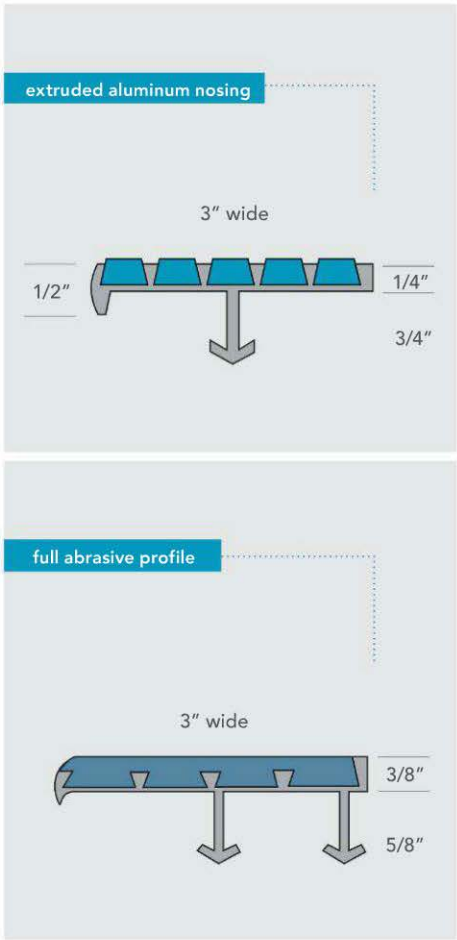
ASTM F1637 Standard Practice for Safe Walking Surfaces

The American Society of Testing Materials produces many standard specifications for many things related to design and construction. In the case of walking surfaces ASTM F1637 is the published standard available. It addresses indoor and outdoor walking surfaces indicating that walkway surfaces shall be slip resistant under expected environmental conditions and use. It goes on to state that when wet conditions are reasonably foreseeable, then an abrasive additive, grooving, texturing, or other appropriate means shall be incorporated to render the surface slip resistant. This would apply to the treads as walking surfaces on exterior stairways and they should be treated accordingly.

Clearly, then, there are numerous sources of requirements and safety standards that can be consulted on stair design and on treads and nosings in particular. It is incumbent upon the architect as designer and specifier to address these as part of the stair design and it is incumbent on the construction contractor and manufacturers of treads and nosings to follow through and provide the safe conditions called for.

AVAILABLE TREAD AND NOSING PRODUCTS

In writing the specifications for treads and nosings, there are numerous points to consider and understand so that the correct products are called for. First is the material used in the manu-



These examples of extruded aluminum nosings show a ribbed profile (top) and a full abrasive profile (bottom).

Photos courtesy of Nystrom, Inc.

Left: Concrete stairs show their deteriorated condition before using renovation treads. Right: The stairs—with new renovation treads installed—have been restored to a safe condition.

facturing process. For moderate-duty treads and risers, extruded products are most commonly made from an aluminum alloy referred to as Alloy 6063 / T5. This alloy contains about 97 percent aluminum mixed with small amounts of other metals including chromium, copper, iron, magnesium, manganese, silicon, titanium, and zinc. Each of these added metals provide added characteristics either to enhance the strength and durability of the aluminum or to make it easier to extrude and machine into shape. For heavy-duty stair treads and nosings, either cast aluminum or cast iron can be specified. The common casting aluminum is referred to as Alloy 319 preferred because of its good sand casting characteristics and machining capabilities. It contains fewer added metals in the alloying process, which are limited to tiny amounts of iron, copper, and zinc for strength and durability. In some interior locations an alternative to cast aluminum is high-quality gray cast iron that complies with ASTM A-48-70. Gray iron has unique properties in the distribution of stress, corrosion resistance, unlimited design, abrasion resistance, vibration absorption, and economy. Ductile iron is available but is generally not selected for stairs since it is better suited to other uses and is notably higher in cost. All of these metal options include the ability to specify recycled content since they are very common building materials.

Once the fundamental decision is made about the metal and type of manufacturing process, the next item is the abrasive material that is added. In extruded shapes, this abrasive material is commonly a combination of aluminum oxide and a two-part epoxy which provides a durable slip-resistant surface for walking on. The aluminum is extruded with ribs running along the surface and the abrasive is placed in between. This creates the common ribbed look and is used extensively. An alternative is to specify a full abrasive product, most common for nosings, where the ribs are shorter and the abrasive material covers over the top of them across the width of the product. For cast products, a continuous coating of silicon carbide at least 1/32 inch thick is used.

Properly specifying treads and risers is directly linked to the type of stairs that they are being installed on. There are four basic choices available:

Poured concrete stair installation. Nosings are typically set along the edge of the concrete treads immediately after the concrete is poured and is intended to be flush with the surfaces of the treads and risers.

Steel pan installation. Nosings or treads are set into the concrete supported by the steel pan. Typically, this means a slightly different edge condition to assure that there is no lip protruding past the metal riser that might cause a tripping hazard.

Wood stair installation. Commonly this is a full tread application that sets into or over the wood.

Retrofit installation. This is also a full tread installation that is designed to cover over de-teriorated concrete or wood stairs and restore them to a safe condition.

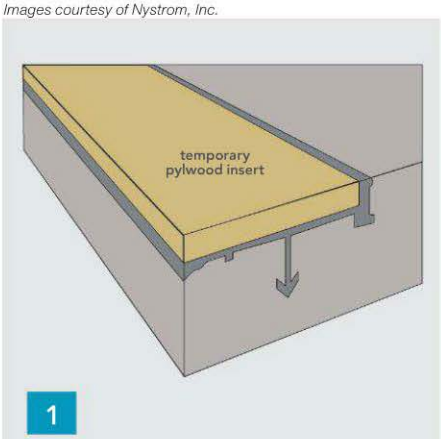
Of course, in selecting treads or nosings for any of these applications, the size needs to be identified. Three- and four-inch nosing widths are standard since 3-inch or larger nosings will satisfy the requirements of virtually all codes and standards. Nonetheless, sizes ranging from 2 to 12 inches are commonly available for nosings and treads and need to be selected according to the size of the stairs and their construction accordingly.

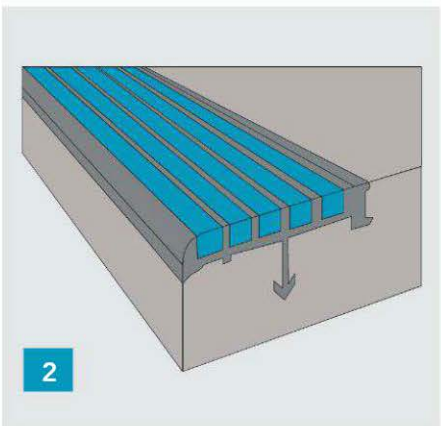
Cast products typically don't offer many other choices beyond size, but extruded products offer numerous other options including the following:

Single-part products. These are the most commonly used tread and nosing products. They are installed as one piece into poured concrete stairs, onto steel pan concrete filled stairs, or onto wood stairs. In addition to choosing the width, the specific product nosing profile can be selected. For example, the front edge of the nosing will typically be aluminum that can be a short or long piece as appropriate to the installation. If long, then it can be made to suit a 90-degree riser or one that is sloped back. These products are also available as flat pieces without any nosing for use in ramps to provide the needed slip resistance for handicapped accessible and other sloped walking surface situations.

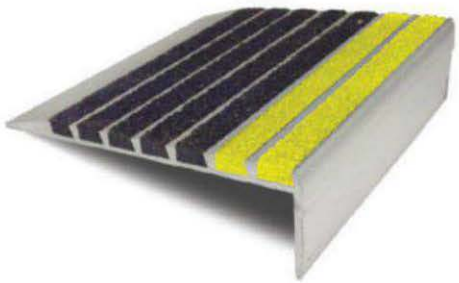
Two-part products. These are popular in steel pan concrete stair applications where concern about protecting the tread and nosing during construction is important. These work particularly well when the stairs need to be done early on a project and there are months of construction foot and equipment traffic going up and down the stairs. As the name implies, there are two pieces installed separately. First, a base plate unit is installed in the concrete fill as with the single part products. However they are shipped with a piece of plywood installed in place of the nominal 3-inch nosing. Later, after construction is nearly complete, the plywood is removed and the finished nosing is installed. Either ribbed or full abrasive nosings are available for this type of product.

Images courtesy of Nystrom, Inc.





Two-stage nosing used in metal pan concrete filled stairs



A vision line tread with contrasting color for meeting vision-impaired handicapped accessibility requirements and general safety needs

Vision line. A contrasting color can be applied to the leading edge of ribbed treads in any color combination. This is particularly important in meeting vision-impaired handicapped accessibility requirements.

Range of colors. The abrasive aluminum oxide in treads and nosings can be specified in as many as nine common colors including black, safety yellow, brown, gray, red, burgundy, orange, green, and blue. Luminescent strips that glow in the dark when first exposed to light are also available in response to some recent code revisions calling for luminescent markings in stairways, particularly in the northeastern United States.

Taped tops. For protection during the initial pour, single-stage products can be shipped in some cases with protective tape covering the top or exposed part of the product. Tape must be removed immediately after the stair tread is set, however, so it only offers very short-term protection.

Painted undersides. To prevent a possible reaction between the concrete and the aluminum, the undersides of the treads and nosings can be specified to be coated with a protective paint to separate them from the concrete.

End miter cuts. In design situations where traffic direction changes or stairs turn a corner, it is possible to have the manufacturer or fabricator provide miter cut corners and edges for treads and nosings. The nature of extrusion manufacturing, however, does not lend itself to a curved stair tread with a radius shape.

Hardware. A range of anchor options are typically available including wood screws for wood stair applications, wing anchors with machine screws for concrete or steel pan applications, and nylon expansion shields with screws for renovation treads installed into existing concrete.

Adhesive. In some cases, construction adhesive may be the most appropriate means to secure renovation treads and is available as an option if anchoring is not possible or practical.

BUILDING INFORMATION MODELING (BIM) FOR TREADS AND NOSINGS

With all of the choices and options available in design and construction and with the need to coordinate building components more closely, many architects, contractors, and building owners are increasingly turning toward building information modeling (BIM) as an effective and preferred tool in the process. BIM helps the entire project team investigate the options and visualize alternative conditions quickly and easily. It also reveals in three dimensions places that are in conflict so they can be resolved during design rather than the more costly resolution during construction.

Because there are many manufactured products that are documented and available in BIM format, it is more straightforward than ever to use this available library to make a final selection and actually customize products to suit a project's needs. In particular, it is increasingly common that manufacturers will offer tread and nosing computer files in a BIM format so they can be coordinated with the rest of the stair construction. Using the manufacturer's BIM files in the overall computer model will allow for full visualization of the appearance and functionality on different stair surfaces and allow the designers to make the best informed decisions on product selection.

Continues at ce.architecturalrecord.com

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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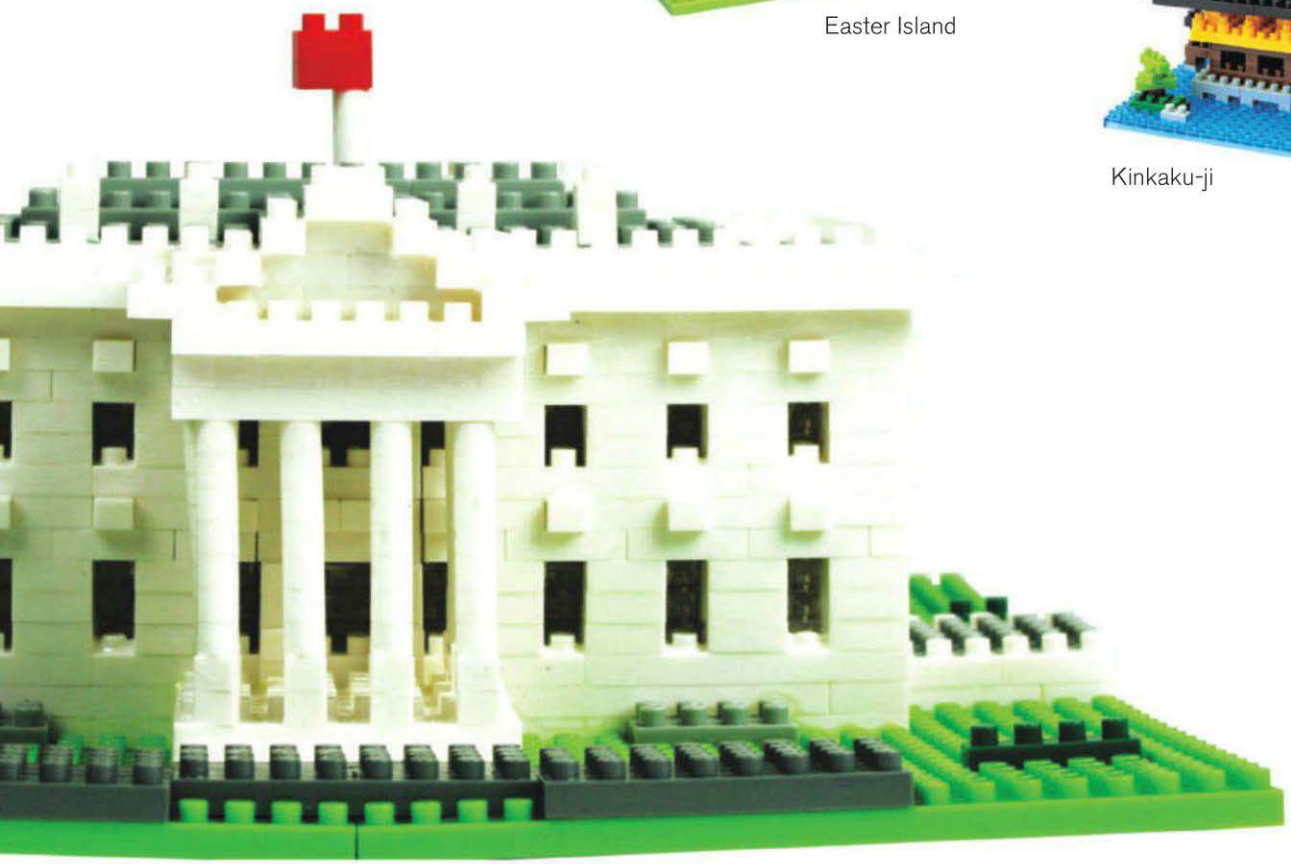

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20	3form *3-form.com*	37
21,22	AGC Flat Glass North America, Inc. *us.agc.com*	6,7
24	Alcoa Architectural Products *reynobond.com/DesignLine*	9
13	ALPOLIC / Mitsubishi Plastics Composites America, Inc. *alpolic-northamerica.com/naturalmetals-series*	58
25	American Hydrotech, Inc. *hydrotechusa.com*	36
23	American Institute of Steel Construction *aisc.org*	40
	AR Congratulates Massimo & Lella Vignelli	72
	Architectural Record Continuing Education App *archrecord.com*	152
	Architectural Record Editorial Excellence *archrecord.com*	75
	Architectural Record One Millionth CEU Test Taker Sweepstakes *archrecord.com*	5
	Architectural Record Show Us Your Record Sweepstakes *archrecord.com*	13
96	Architecture & Design Film Festival *adfilmfest.com*	71-72
26	Artemide, Inc. *artemide.net*	150
30	Audi of America	73
27	AZZ Galvanizing Services *azzgalvanizing.com*	195
28	Belden Brick *beldenbrick.com*	16
29	Bluebeam Software Inc. *bluebeam.com/setthebar*	48
92	Boomerang Systems, Inc. *boomerangsystems.com*	172-175
31	C.R. Laurence Co., Inc. *crlaurence.com*	199
32	Cascade Coil Drapery *cascadecoil.com*	34
33	CENTRIA Architectural Systems *CENTRIA.com*	21
34	CertainTeed Gypsum *AirRenew.com*	51
35	Collins *CollinsWood.com*	123
36	Construction Specialties, Inc. *c-sgroup.com*	19
38	Doug Mockett & Company, Inc. *mockett.com*	187
37	Dri-Design *dri-design.com*	30
39	Dryvit Systems, Inc. *dryvit.com*	44
40	DuPont Tyvek *fluidapplied.tyvek.com*	62
41	E. Dillon & Company *edillon.com*	63
42	Easi-Set Industries *slenderwall.com*	28
43	Ellison Bronze *ellisonbronze.com*	67
	ENR Sports Facilities of the 21st Century *enrsports.com*	122
44	Excel Dryer, Inc. *exceldryer.com*	187
45	Figueras Seating USA *figueras-usa.com*	118
46	Forms+Surfaces *forms-surfaces.com*	77
47	Glen Raven *glenraven.com/firesist*	27
64	Glen-Gery Brick *glengerybrick.com*	54
48	Guardian Industries Corp. *sunguardglass.com*	35
17	Hunter Douglas Contract *hunterdouglascontract.com/Techstyle*	158
89	Hunter Douglas Contract *hunterdouglascontract.com*	159-162
49	Hunza Lighting *hunzausa.com*	188
50	Inforesight Consumer Products, Inc. *solairaheaters.com*	50
51	International Code Council *iccsafe.org/planreview*	189
52	Invisible Structures, Inc. *invisiblestructures.com*	188
95	James, The *jameshotels.com*	74
53	Kawneer *kawneer.com*	39
54	Louis Poulsen *louispoulsen.com*	68
55	Lutron Electronics Co., Inc. *lutron.com*	cv4
14	Manning Lighting Inc. *manningltg.com*	8
57	Marvin Windows and Doors *marvin.com/inspired*	196
	McGraw-Hill Construction Outlook Executive Conference *outlook2013dc.com*	191
58	MechoShade Systems, Inc. *MechoShadeSystems.com*	cv3, 59
	Metl-Span LLC *metlspan.com*	41
	MHC Meet The Green Experts *construction.com*	15
60	modularArts® *modulararts.com*	198
91	Mortar Net® USA, Ltd. *mortarnet.com*	168-171
61	MP Lighting *mplighting.com*	61
62	NanaWall Systems, Inc. *NanaWallSystems.com*	43
	National Building Museum *nbm.org*	142,186, 190
63	Nedlaw Living Walls *NedlawLivingWalls.ca*	14
93	Nystrom, Inc. *nystrom.com*	181-185
65	Oldcastle Architectural, Inc. *oldcastleapg.com/ceubim.html*	49
66	Oldcastle BuildingEnvelope™ *oldcastlebe.com*	2-3
67	Parex *parex.com*	141
69	Pella Corporation *pella.com*	29
70	Petersen Aluminum *pac-clad.com*	12
71	Phaidon *phaidon.com*	149
72	PPG Industries, Inc. *ppgideascapes.com/SBr100*	10-11
	Regenerative Network *regen-net.com*	143
77,87	reThink Wood *rethinkwood.com*	4, 153-157
73	Rocky Mountain Hardware *rockymountainhardware.com*	25
74	SAFTI *FIRST* Fire Rated Glazing Solutions *safti.com*	33
75	SCHOTT North America, Inc. *us.schott.com/pyran*	121
94	Sciame *sciame.com*	70
16	Selux *selux.com/usa*	119
15	Sherwin-Williams Co. *sherwin-williams.com*	78
	Skyscraper Museum, The *skyscraper.org*	188
76	Sloan Valve Company *sloanvalve.com*	197
78	Sound Solutions *soundsolutions.ca*	24
90	Stonhard *stonhard.com*	176-179
	Sweets *sweets.com*	180
	Sweets Mobile App *sweets.com*	163
18,79	Technical Glass Products *tgpamerica.com*	cv2-1, 198
80	ThyssenKrupp Elevator *thyssenkruppelevator.com*	52
81,88	Tile of Spain *tileofspainusa.com*	164-167, 196
82	TRC Solutions *NJCleanEnergy.com/ssb*	76
83	Vetrotech Saint-Gobain North America *vetrotechUSA.com*	64
84	VT Industries, Inc. *vtindustries.com*	57
85	Western Red Cedar Lumber Association *wrcla.org*	124
	XXIV Pan American Congress of Architects *xxivcpa.com.br/en/*	189
86	YKK AP America Inc. *ykkap.com/inspire*	26

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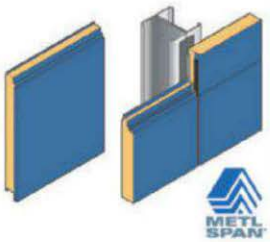

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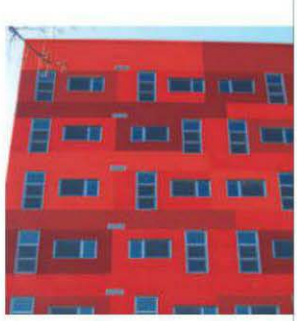

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New and Upcoming Exhibitions

Massimo Scolari: The Representation of Architecture, 1967–2012
New York City
October 2–November 21, 2012
A comprehensive retrospective of the work of visionary architect and artist Massimo Scolari, this exhibition marks the first U.S. display of Scolari's work since 1986. The show, which originated at the Yale School of Architecture in spring 2012, was curated and designed by Scolari himself and features over 160 original drawings, paintings, watercolors, and other works completed between 1967 and 2012. At the Cooper Union. For more information, visit cooper.edu.

The Lost Vanguard: Russian Modernist Architecture, 1922–32
Chicago
October 11, 2012–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.

Ongoing Exhibitions

New Nordic: Architecture & Identity
Humlebæk, Denmark
Through October 21, 2012
The first exhibition in a new series at the Louisiana Museum of Modern Art, *New Nordic* explores the relationship of architecture to culture and identity. The series deals with architecture as a field where collective memories and narratives are reflected materially and spatially, particularly how certain special "Nordic" features recur in architecture. For more information, visit louisiana.dk.

Palladio Virtuel
New Haven
Through October 27, 2012
This new analysis of the work of Renaissance architect Andrea Palladio, by architects Peter Eisenman and Charles Gwathmey and architecture critic Matthew Roman, is on view at the Yale School of Architecture Gallery. The exhibition examines 20 of Palladio's villas and represents the culmination of 10 years of study by Eisenman, adding an important contribution to the 16th-century master's already robust legacy. For more information, visit architecture.yale.edu.

Designed to Win
London
Through November 18, 2012
This exhibition at the Design Museum explores the ways in which design and sports combine, pushing the limits of human endeavor to achieve victories of increasing wonder. From the design of F1 cars to running shoes, bikes, and carbon-fiber javelins, the quest for enhanced function is endless. For more information, visit designmuseum.org.

Yung Ho Chang: Material-Ism
Beijing
Through December 2, 2012
Material-Ism is a comprehensive retrospective of the groundbreaking, cross-disciplinary work of China's first international architect, Yung Ho Chang. For this exhibition at the Ullens Center for Contemporary Art (UCCA), the center's Great Hall will be turned into an updated hutong neighborhood, containing six courtyard-like modules that each address a different aspect or focus of his practice, including inhabitation, construction methods, urbanism, tradition, perception, and culture. For more information, visit ucca.org.cn.

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Frames for Living: The Work of William Wurster
Cambridge, Massachusetts
Through December 28, 2012
William Wurster (1895–1973) was a pioneer of Modernist architecture and one of the most influential architectural educators of the 20th century. Appropriate to the California landscape and climate, his houses capture living space from the outdoors and feature high ceilings and overscaled windows that belie their small size. *Frames for Living* examines the innovative houses that are often regarded as Wurster's greatest accomplishment as a designer. At the Massachusetts Institute of Technology. For more information, visit mit.edu.

Anri Sala: Two Films
Detroit
Through December 30, 2012
Albanian-born artist Anri Sala's films *Dammi i Colori* and *Long Sorrow* are the focus of this new exhibition at the Museum of Contemporary Art Detroit. The films are portraits of communities in crisis and reflect on the human condition during periods of political unrest. Although the films are distinct artworks, both reveal the connective tissue between cities and people. Related programming includes artist talks, musical concerts, and lectures. For more information, visit mocadetroit.org.

Vision in a Cornfield
Detroit
Through December 30, 2012
Vision in a Cornfield is a multidisciplinary collaboration among various Detroit artists, musicians, and poets, including members of the band Destroy All Monsters and the artist collectives Ogun and Apetechnology. The exhibition brings Detroit's music, art, and automobiles together to celebrate urban creativity. At the Museum of Contemporary Art Detroit. For more information, visit mocadetroit.org.

California's Designing Women, 1896–1986
Los Angeles
Through January 6, 2013
Presented at the Autry National Center, this unprecedented exhibition honors 46 women designers and includes more than 200 examples of textiles, ceramics, furniture, lighting, jewelry, clothing, and graphics. These functional and decorative objects—from Arts and Crafts to Art Deco to Mid-Century Modern and beyond—exemplify California's national and international reputation for unrestrained creativity. For more information, visit theautry.org.

Field Conditions
San Francisco
Through January 6, 2013
This exhibition at the San Francisco Museum of Modern Art bends and blurs the boundaries between conceptual art and theoretical architecture, using the notion of the "field" to frame an investigation into the construction, representation, and experience of space. Nearly 30 works in various media by both contemporary artists and practicing architects will be on view, including pieces by Tauba Auerbach, Daniel Libeskind, Rafael Lozano-Hemmer, Sol LeWitt, and Lebbeus Woods. For more information, visit sfmoma.org.

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.

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 territory 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
Studio Gang Architects is a team of 40 architects, designers, and thinkers who have produced some of the most inventive and award-winning architecture today. Featured not as a survey or retrospective, Studio Gang Architects projects at this exhibition at the Art Institute of Chicago will be 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.

Skyline Adrift: Cuban Art and Architecture
Ghent, New York
Through May 2013
This politically and aesthetically ground-breaking 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

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October 1–31, 2012
Archtober presents special tours, lectures, films, and exhibitions that focus on the impor-

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tance of architecture and design in everyday life. The many participating organizations aim to raise awareness of the important role of design in the city and to build a lasting civic and international recognition of the richness of New York's built environment. For more information, visit archtober.org.

MADE Expo
Milan
October 17–20, 2012
Explore eco-friendliness and new technologies at this international building and design show at the Fiera Milano Rho. Ranging from the world of building sites to that of design and architecture, MADE offers an overview of products and technologies for living solutions. For more information, visit madeexpo.it.

2012 MAS Summit for New York City
New York City
October 18–19, 2012
This two-day event combines keynote addresses, panels, conversations, presentations, and special opportunities for attendees to network and exchange ideas. It will present innovative city-building ideas for New York and other cities around the themes of development, density, and diversity. At Jazz at Lincoln Center's Frederick P. Rose Hall. For more information, visit mas.org.

AIA Europe International Conference & Chapter Meeting
Hamburg
October 18–21, 2012
Attendees of this annual conference will study the HafenCity development taking shape at Hamburg's old harbor. As a redevelopment of former industrial land, it expands the city-center area by 40 percent. Attendees will be exposed to one of the largest concentrations of recent construction in Europe, including the centerpiece Elbphilharmonie and buildings by Herzog & de Meuron, Richard Meier & Partners, Behnisch Architekten, and others. For more information, visit aiaeurope.org/hamburg.

Ricardo Legorreta and Santa Fe
Santa Fe, New Mexico
October 19–20, 2012
This two-day event honoring the legacy of the late Mexican architect, whose inspired designs have helped shape the landscape of many residential, institutional, and corporate buildings in Santa Fe, will consist of a series of lectures, two films, and tours (both guided and self-guided) of the major Legorreta architecture in the city. At various locations in Santa Fe. For more information, visit sfai.org.

Cities Summit Tel Aviv
Tel Aviv, Israel
October 22–23, 2012
The mayor of Tel Aviv is hosting the city's first international summit on creativity in cities. From promoting technological and commercial innovation in the private sector to making city hall itself a center of excellence, this summit addresses the crucial issues facing urban administrators as they attempt to optimize the potential of their cities. At Tel Aviv-Yaffo Academic College. For more information, visit citiessummittelaviv.evolero.com.

2012 Curry Stone Design Prize Forum
Cambridge, Massachusetts
November 15–16, 2012
The Curry Stone Design Prize will announce its 2012 recipients during a two-day forum at the Harvard Graduate School of Design. The announcement of the winners will include an evening awards ceremony on November 15 followed by a full day of presentations. The annual prize celebrates social-design pioneers and the influence and reach of design as a critical force for improving lives and strengthening communities. For more information, visit currystonedesignprize.com.

Competitions

Tile of Spain Awards of Architecture and Interior Design
Registration Deadline: October 23, 2012
A total of nearly $50,000 will be awarded to winners across three categories in this new competition by Tile of Spain, the international brand representing 200 ceramic-tile manufacturers. Categories are: architecture, interior design, and degree projects of architecture students. Projects must make significant use of Spanish ceramic floor and/or wall tiles in order to be considered. The jury will also award two special mentions in each category. For more information, visit tileofspainawards.com.

Battery Conservancy Americas Design Competition: Draw Up a Chair
Submission Deadline: October 30, 2012
This open-call opportunity for designers across North, Central, and South America and the Caribbean welcomes designs for innovative portable outdoor seating for the Battery, the 25-acre green oasis at the southern tip of Manhattan overlooking New York Harbor. The Battery Conservancy will fabricate the winning design for use in its new Battery Green, scheduled to open to the public in 2014, adjacent to the park's Broadway entrance. For more information, visit thebattery.org.

Innatur_2 Competition
Registration Deadline: November 27, 2012
Organized by Opengap, the second edition of this open-ideas competition seeks innovative, cutting-edge, and contemporary proposals to address the challenges of implementing architecture in a protected natural environment. Participants are invited to find spaces that promote a deep understanding and assimilation of nature and promote synergies between nature and the building itself. The competition is open to all architects, designers, planners, architecture students, and others interested in the topic. For more information, visit opengap.net.

eVolo 2013 Skyscraper Competition
Late Registration Deadline: January 15, 2013
eVolo magazine invites architects, students, engineers, designers, and artists to redefine skyscraper design through the implementation of novel technologies, materials, programs, aesthetics, and spatial organizations. There are no restrictions in regards to site, program, or size. Participants must answer the question: What is a skyscraper in the 21st century? For more information, visit evolo.us.

E-mail information two months in advance to recordevents@mcgraw-hill.com. For more listings, visit architecturalrecord.com/news/events.

snapshot

PROJECT ARUM
LOCATION VENICE
DESIGNERS ZAHA HADID ARCHITECTS

GENERALLY, Iraqi-born British architect Zaha Hadid deals in organic forms more amoebic than botanic. But for the 13th Venice Architecture Biennale, Zaha Hadid Architects (ZHA) produced the bloomlike *Arum*, a 20-foot-tall installation of lightweight, pleated aluminum that takes its shape from the Northern European flower of the same name. The ZHA design team arrived at the floral form with the help of the office's Computation and Design Group (ZHA|CODE) and its research on shell structures—typically concrete forms that retain their shape and support loads without a steel frame. "The corrugation makes the whole thing stand," says ZHA staff architect Saman Saffarian, describing *Arum*'s origami-like folds. With help from U.K.-based engineering and professional-services consultancy Buro Happold, "we tried to push the boundaries of the structure's stability. The safest thing would have been to add external supports, but that would have been too easy," says Saffarian, jokingly. *Arum* is flanked by abstracted roof forms from ZHA's recent commissions (visible here in the background), including the Aquatics Centre at the 2012 London Olympics, and structural prototypes. With *Arum*, the firm is embracing its penchant for experimental forms and feats of engineering. The installation is on view at the Biennale until November 25. *Asad Syrkett*

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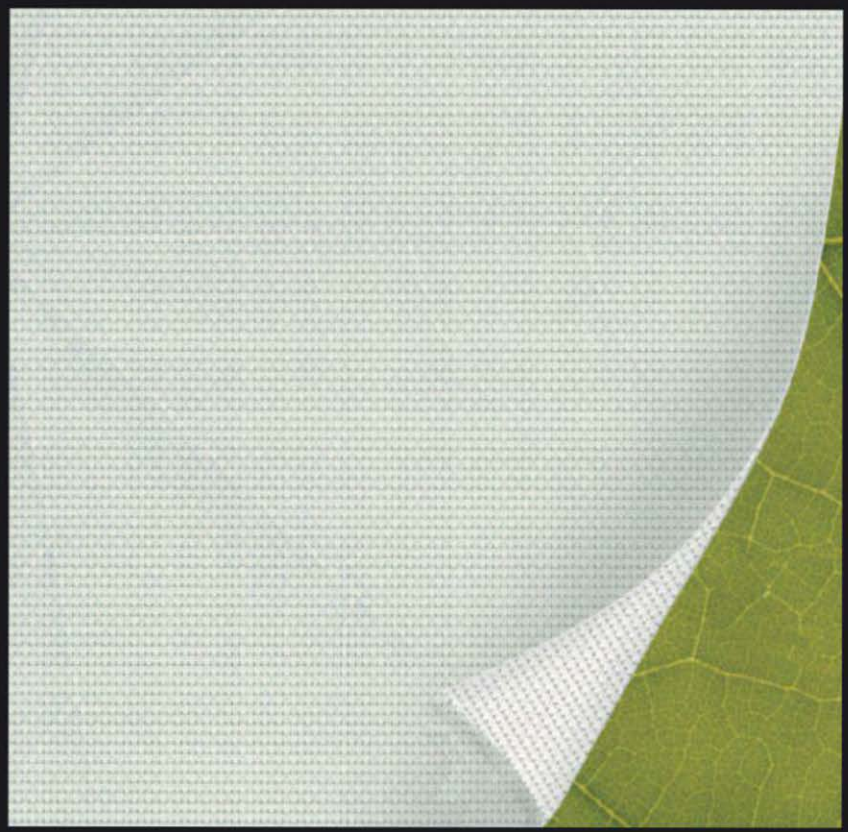

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