ARCHITECT

Snarkitecture
Soane's Museum
Glass Partitions

How Developers Think
Job Prospects in Cuba
On Top of One World Trade
Rybczynski on Brutalism

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The Journal of the American Institute of Architects

R+D Awards

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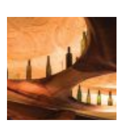

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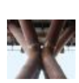
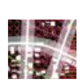


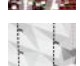

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Volume 104, number 7. July 2015. On the cover: Pulp Pavilion, en route to the Coachella Valley Music and Arts Festival; photo by Omar Garza.

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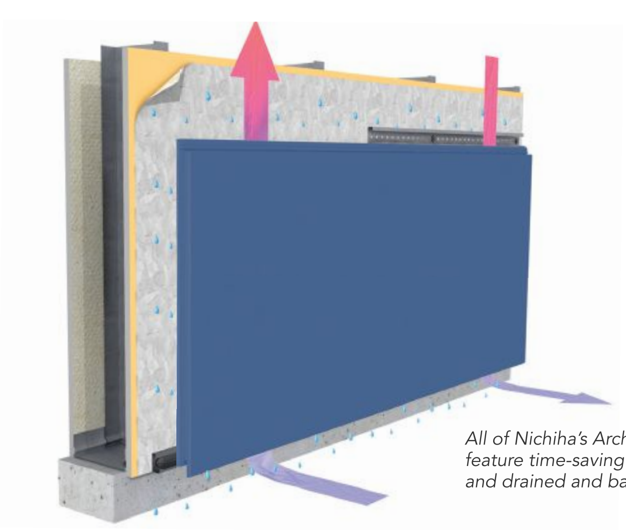
Ford Ice Center—Antioch, TN



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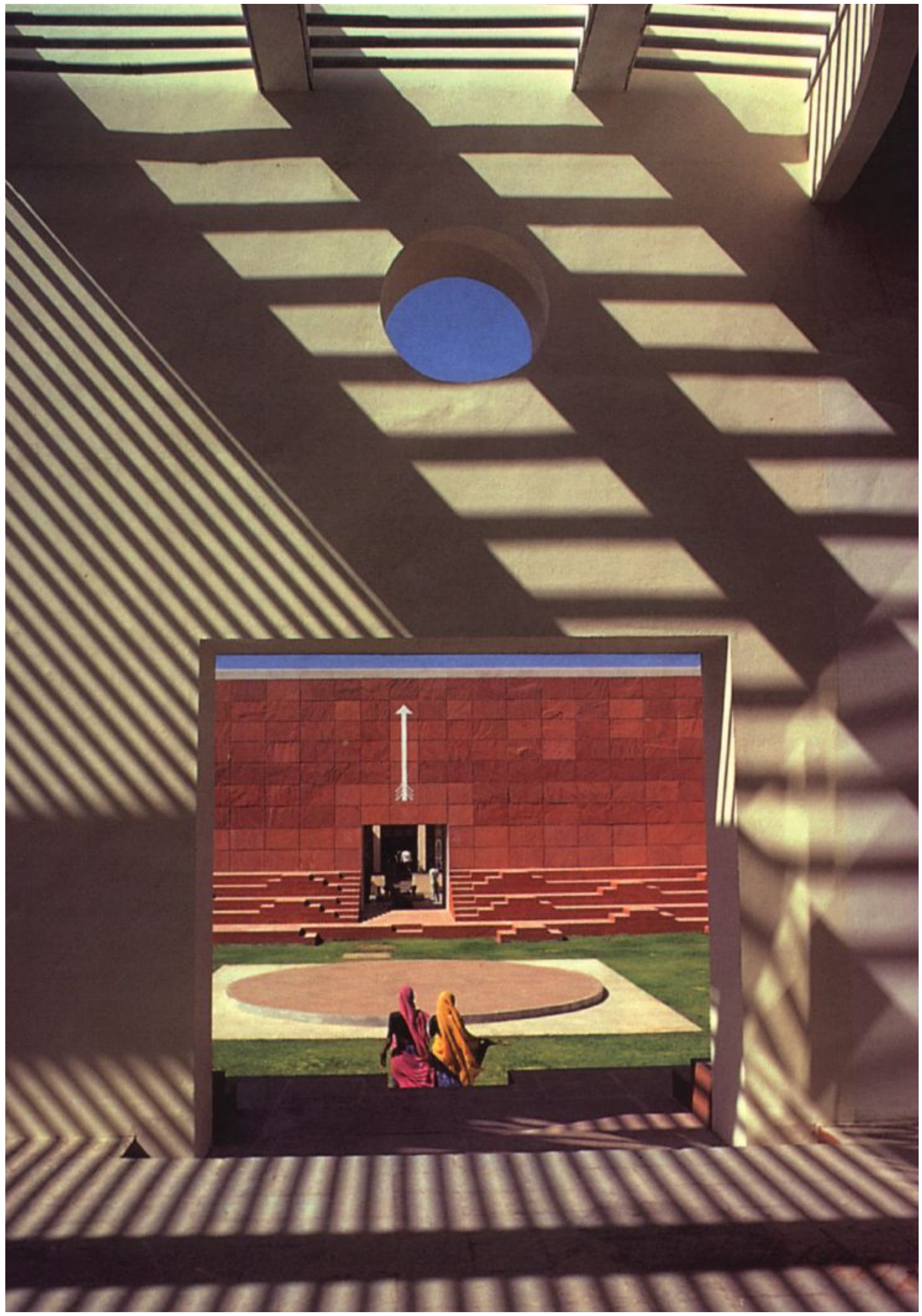


India's Modern Master

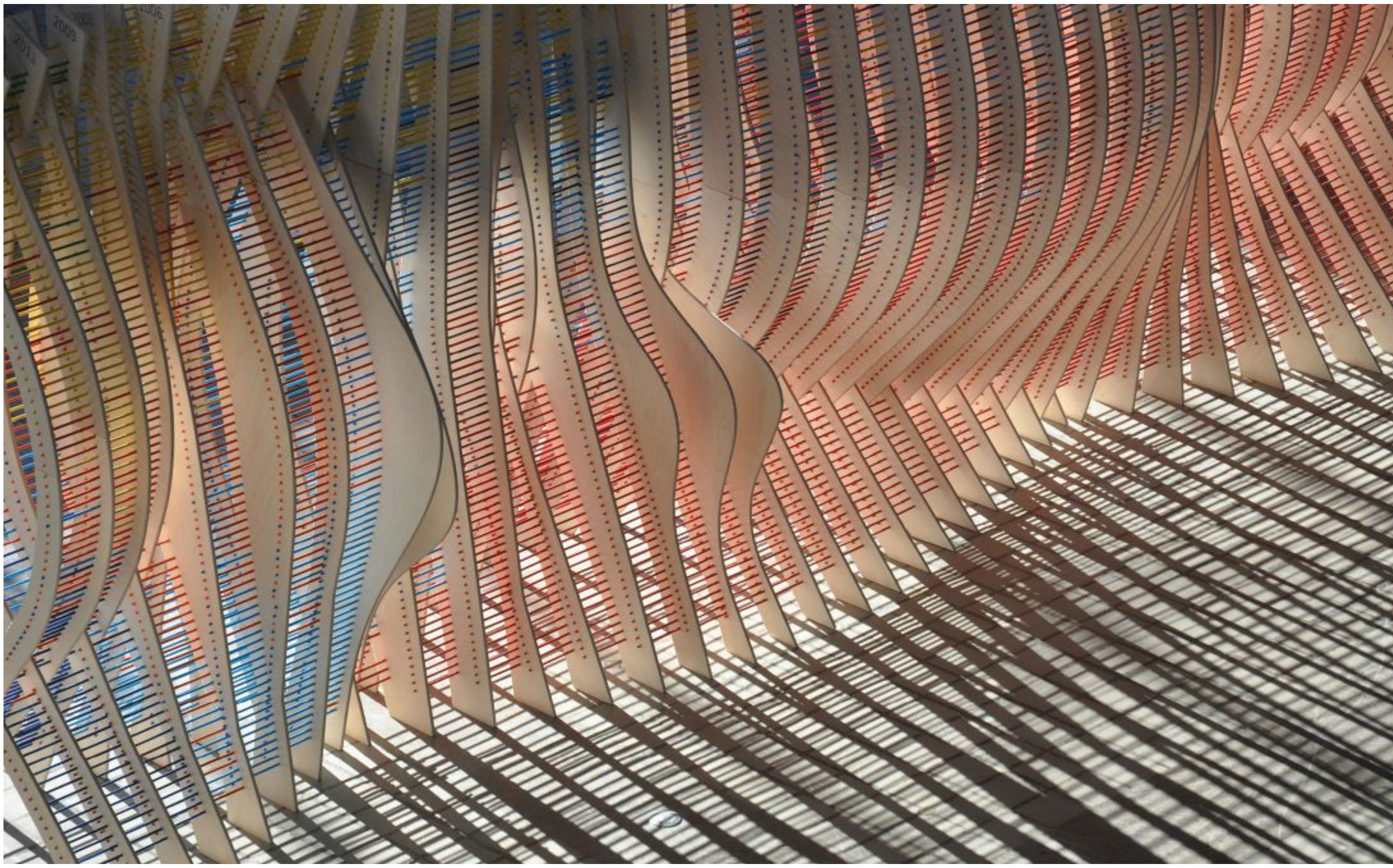
Architect, planner, and activist Charles Correa died on June 16 at age 84. The founder of Mumbai, India–based Charles Correa Associates is most well-known for reconciling modern architecture with the vernacular of his native India, as exemplified by such projects as his 1993 Jawahar Kala Kendra art center in Jaipur, India (pictured). The Royal Institute of British Architects awarded Correa the 1984 Royal Gold Medal and named him "India's greatest architect" in 2013. He also received the International Union of Architects' Gold Medal in 1990, and Japan's Praemium Imperiale in 1994. —CAROLINE MASSIE

> To see images of one of Correa's last projects, the Champalimaud Centre for the Unknown in Lisbon, Portugal, visit bit.ly/ChampalimaudCentre.

MAD-ness in Beverly Hills

One of China's hottest architecture firms, MAD Architects, is designing its first residential project in the United States, 86oo Wilshire in Beverly Hills, Calif. The 48,ooo-square-foot, 18-unit complex, which includes three townhouses and two studios, will sit atop a three-story commercial base with ground-floor retail and a living wall of native succulents and other plants. The units will open onto a central rooftop courtyard. MAD, which has an office in L.A., is collaborating on 86oo Wilshire with executive architect Gruen Associates and interior designer Rottet Studio.

> To see more images of 86oo Wilshire, visit bit.ly/86ooWilshire.



Big Praise for Small Projects

In June, the AIA announced the winners of the 2015 Small Project Awards: Bloom, a thermobimetal pavilion in Los Angeles, by Do|Su Studio Architecture; Centennial Chromagraph (pictured), Variable Projects' 3D history of the University of Minnesota architecture school; a house in Door County, Wis., by Johnsen Schmaling Architects; the Principal Riverwalk Pavilion in Des Moines, Iowa, by Substance Architecture; the Lawn on D, a Watertown, Mass., public space by Sasaki Associates; a house in Quonochontaug, R.I., by Bernheimer Architecture; and, at the old Bethlehem Steel Mill in Bethlehem, Pa., the Levitt Pavilion by WRT. —DEANE MADSEN

> *For images and information on all seven winning small projects, visit bit.ly/2015AIASmallProjects.*

A Home for Chicago Architecture

Move over, Tribune Tower. The Chicago Architecture Foundation is organizing an ideas competition for a 241,000-square-foot Center for Architecture, Design, and Education, on a prominent downtown site near Millennium Park (pictured). David Adjaye, HON. FAIA, Monica Ponce de Leon, AIA, Stanley Tigerman, FAIA, Billie Tsien, AIA, and ARCHITECT editor-in-chief Ned Cramer, ASSOC. AIA, will serve as jurors. The top prize is $10,000, and Chicago Public Schools students will award a special $1,000 prize. During the Chicago Architecture Biennial, the foundation will exhibit as many as 100 shortlisted entries at its current facility on Michigan Avenue.

RYAN DALY

> *Visit chidesigncompetition.org for a detailed brief, deadlines, and other information.*

DAVID X PRUTTING / BFA

Art for the Masses

Last month, following the May opening of Rem Koolhaas, HON. FAIA's Prada Foundation in Milan, the architect and his firm OMA unveiled the Garage Museum of Contemporary Art (pictured) in Moscow's Gorky Park. Both galleries are renovations of existing buildings, funded by fashion-designing women. The Garage's patron is Dasha Zhukova, the Russian-born, American-raised founder of the Kova & T label and wife of oligarch Roman Abramovich. Despite its new name, the Soviet-era structure was built as a restaurant; the institution formerly occupied a 1926 bus depot designed by Konstantin Melnikov and Vladimir Shukhov.

> *For more images of the Garage, visit bit.ly/GarageMuseum, and for more on the Prada Foundation, visit bit.ly/FondazionePradaOMA.*


Clearly Evolving

Fifteen Hundred Easy Pieces

This summer, for his first solo show in his native China, dissident artist Ai Weiwei offers the unusual spectacle of a Ming Dynasty ancestral temple split in two. The wood structure, originally located in Jiangxi Province, honors a sixth-century prince. After being disassembled into 1,500 pieces, the temple was rebuilt in Beijing in adjacent venues: Galleria Continua and Tang Contemporary Art. Ai has placed small objects around the galleries as well, including hundreds of broken teapot spouts, a ladder, traditional lanterns, and replicas of a Ming Dynasty cup bought at auction last year by collector Liu Yiqian, a former taxi driver, for $36.3 million.

> *For more images of the installation, visit bit.ly/1500Pieces.*

Next Progressives: Snarkitecture

TEXT BY ZACH MORTICE

PORTRAIT BY NOAH KALINA

The well-trodden intersection of art and architecture is where Snarkitecture practices, but the New York–based studio's uncanny spaces exist in a place "adjacent to real life." Firm founders Alex Mustonen, who studied architecture at the Cooper Union, and Daniel Arsham, an artist, have developed a portfolio of high-end retail installations, furniture, and products that relentlessly subvert visual and material expectations. An encounter with Snarkitecture goes like this: Surprise, recognition, then self-satisfaction at solving the riddle, and maybe buy a custom key chain.

Just about all of Snarkitecture's projects are meditations on sharp, digital replication or messy, organic excavation and subtraction. The firm's "Drift" pavilion at Design Miami in 2012 created a reverse-topographical ceiling made out of hundreds of white inflatable tubes. Their "Dig" installation at New York's Storefront for Art and Architecture bored a series of holes with hammers and chisels through walls made of expanded polystyrene (EPS) foam.

With its latest and largest installation, Snarkitecture looks to combine its sharp digital and messy organic approaches

Daniel Arsham

into a single installation at the National Building Museum this month. "The Beach" will see Snarkitecture assemble a 10,000-square-foot beachside stage set that will fill the museum's Great Hall with a shifting ocean of 1 million translucent plastic balls. Here, Mustonen discusses the firm's philosophy and upcoming work.

Minimalist Repetition

We're very interested in the idea of reduction—of taking a concept, space, or program and really distilling it down to the bare minimum. Oftentimes, that means taking out color. It's a level of abstraction that brings you into a space that doesn't have all the things normally around us in our everyday environment.

Snarkitecture, Starting at $15

Our first object was a pingpong table. From that we started getting interested in smaller-scale products. What's interesting for us is giving a much wider audience the possibility to have our work be a part of their daily life. If you're interested in Snarkitecture but you're not going to commission an installation, but maybe you need a candle for your home, you can have that.

Hand-Drawn Intuition

We do use digital modeling and drafting programs, but at the end of the day, we use a more analog sort of approach. We start every project by drawing by hand.

We just did this project in Milan with [fashion brand] COS that was a kind

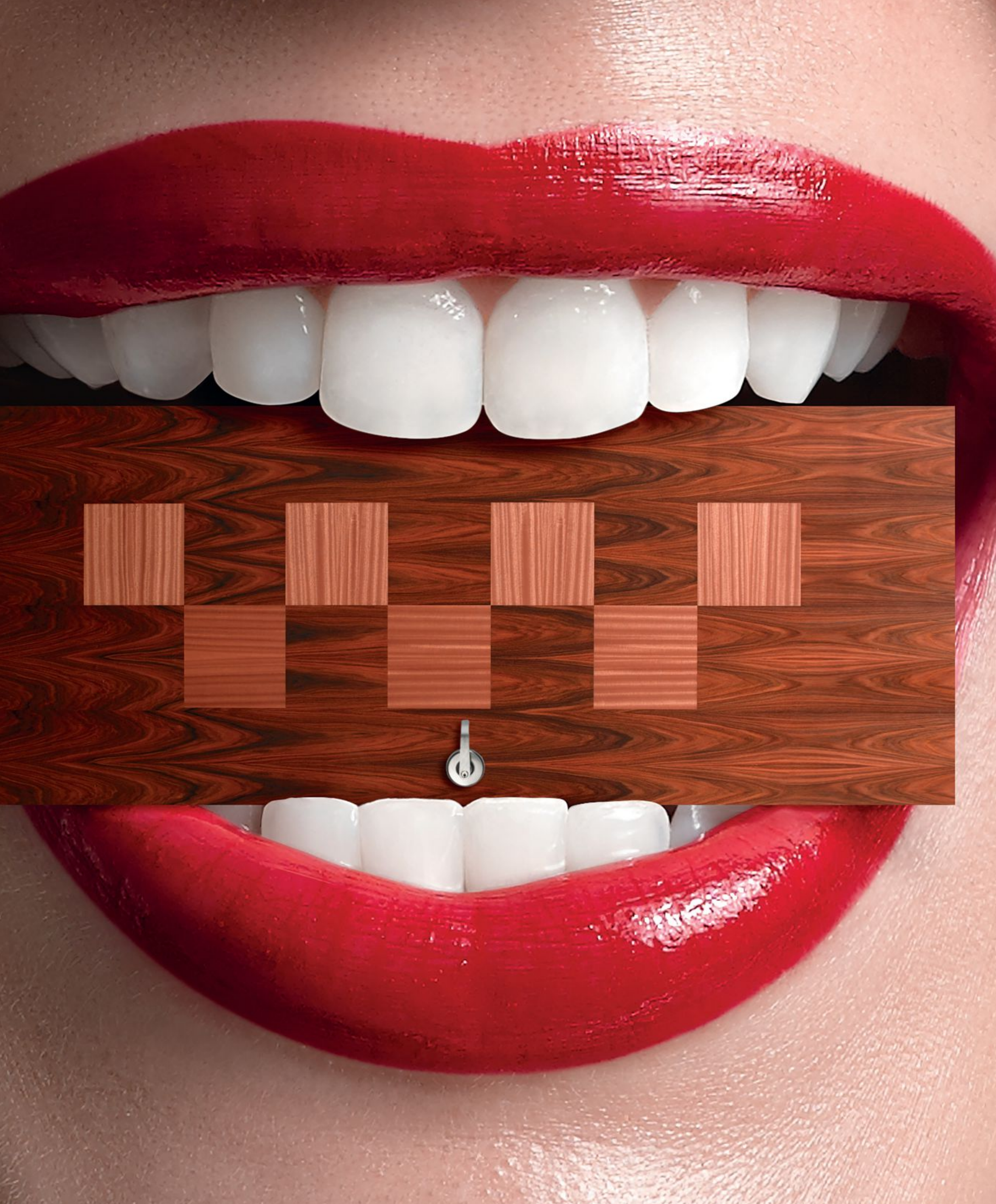
Alex Mustonen

of fabric cavern. We had a computer model of the entire project. We used that model as a guide, but physically sculpted the space by literally cutting fabric ribbons. It was really more about this sort of intuitive process of physically being in the space and feeling it around you, and altering it accordingly. At the end of the day, it could have been pretty easy to build with a pencil, paper, and scissors.

For "Dig," the space was made up of a grid, so you could track your progress within it. But it was like going into a snowstorm, operating blindly, so you would use these grid lines as demarcations to figure out where you were.

The Hunt Continues

Obviously, there've been tons of precedents for one-off artist-architect collaborations, but [we wanted] to see what would happen over a sustained period. When we started this, we were interested in creating something that could discover what this conversation [between art and architecture] could be on a long-term basis. I don't think we have the answer to that just yet.



Next Progressives:
Snarkitecture

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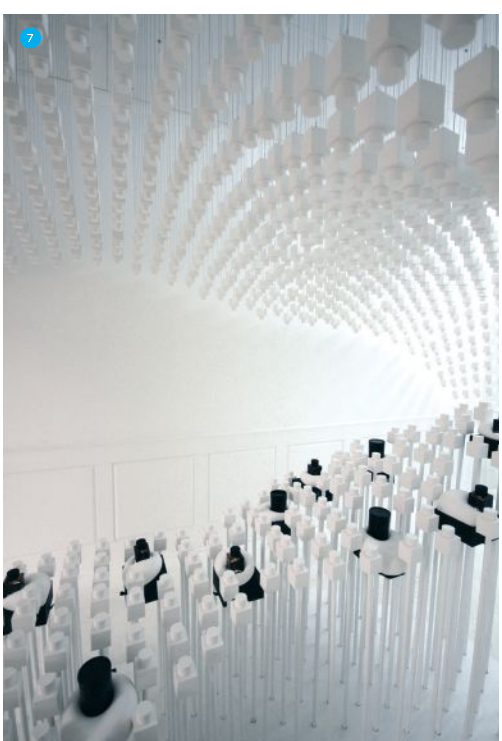

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1,3. For "The Beach" at the National Building Museum in Washington, D.C., Snarkitecture has envisioned a sandbox-like ball pit that can be manipulated by visitors. **2.** Daniel Arsham camped out in and carved through solid masses of EPS foam at New York's Storefront for Art and Architecture during the firm's month-long residency there in 2011. **4.** Inflatable tubes created a soft-stalactite effect for Snarkitecture's 2012 "Drift" pavilion at Design Miami. **5.** To mark the 10th anniversary of its 1994 Bourgie lamp, Kartell invited designers to reimagine the product. Snarkitecture's interpretation is an "invisible" lamp wrapped in a white shroud made of rigid fiberglass, such that the shroud stands on its own, absent the lamp it would be concealing. **6.** Snarkitecture cast white concrete in the form of a pillow as a bedside resting place for a mobile phone. **7.** For fragrance company Odin New York, the duo created an undulating ceiling of suspended perfume-bottle casts within a Manhattan pop-up shop. **8.** Snarkitecture collaborated with Print All Over Me to develop an apparel collection dubbed Architectural Camouflage that includes white marble, subway tile, and hex tile (pictured) to encourage moments of architectural confusion.

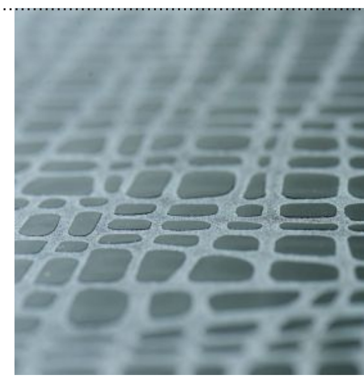
TOP: MARKUS HAUGG

Products: Translucent Panels

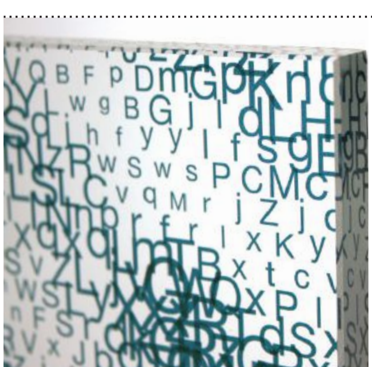
TEXT BY HALLIE BUSTA

Ultra-White Fade, Bendheim
The clear-to-white gradient on this laminated glass partition adds privacy while allowing daylight to permeate interiors. In ¼" and ½" thicknesses. *bendheim.com*

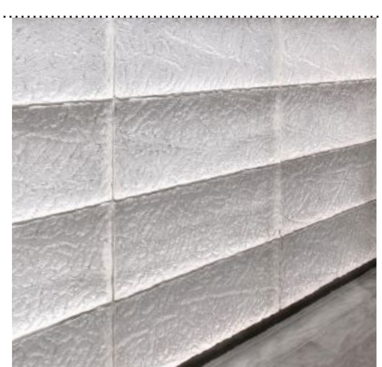
Mesh, Nathan Allan Glass Studios
A pocked surface puts a fresh spin on the metal-mesh aesthetic in this architectural glass, which can be used for partitions, flooring, counters, and stair treads. From 6mm to 19mm thick. *nathanallan.com*



C1 Collection, Carvart
This series of architectural glass comes in 12 etched, geometric patterns named after neighborhoods in Brooklyn, N.Y.—where Carvart launched in 1996. Offered in thicknesses of up to 1". *carvart.com*



Make, Skyline Design
The etched, back-painted, and printed geometries and typography in this glass series can be modified by density, weight, and scale. Up to ¾" thick. *skydesign.com*



Alight, Pulp Studio
Brooklyn studio Amses Cosma teamed up with Pulp Studio to turn textured glass into a wall system with a steel frame. For indoor and outdoor use. *pulpstudio.com*

Woods, 3form
Wood-grain patterns printed in high-resolution top the latest addition of resin panels to 3form's Woods collection. Four designs are offered. *3-form.com*

> *For more technology and products news, visit architectmagazine.com/technology.*

Schwartz and Architecture • **CROOK CUP BOW TWIST**

Q+A:
Peter Hendee Brown

TEXT BY CAROLINE MASSIE

Peter Hendee Brown, AIA, has held many job titles in the building industry: architect, city planner, and now urban development consultant. In his latest book, *How Real Estate Developers Think: Design, Profits, and Community* (University of Pennsylvania Press, 2015), the Minneapolis-based polymath discusses how public perception of real estate developers has changed over time, why current stereotypes about developers should change, and why architects should care. ARCHITECT caught up with Brown to learn more.

How does this book seek to change stereotypes about developers?
I'm trying to debunk three common myths: Developers are only in it for the money; they don't understand or care what good design is; and they don't care much about community because they're only in it for the money. I try to humanize developers by letting them talk about what they do and why.

At the same time, I provide historical context for development. As I say: Show me a historic district and I'll show you a 200-year-old real estate development. One example in my book, Beacon Hill [in Boston], was a big bunch of land that some folks bought, regraded, and started building houses on. Today, the word "developer" often has a derogatory connotation. We used to call developers our town founders and place their statues in our town squares.

I try to put developers into the context of making products we need and want. We grow up in homes, shop in stores, and work in office buildings that have been envisioned by developers. They do a great job of envisioning what we might want next as people's tastes change. Everybody's got their own view of what development is, but the developer has to knit together all those views and then succeed by producing something he or she can sell for more than what it cost to build.

How can architects and developers collaborate to create buildings that are architecturally interesting but also economically viable in the marketplace?
One developer I know defines a good architect as someone who is sensitive to design time and cost on the front end before the deal is real. Developers want an architect to design something that'll stand out in the marketplace. You can't do 10 big design moves on every building, you have to figure out one or two [to make the building] stand out. Then, get the nuts and bolts right and do a good job on the details.

Architects have a vision for a building. Developers have a vision for a larger service, a product, or experience, of which the building is one part.

How can architects make clients and the general public understand and appreciate what they do?
Architects should try to understand what their client is trying to achieve. Similarly, when architects are presenting their projects in public, they benefit from explaining in clear language what they're doing and why their project achieves greater goals—how it's helping the city complete an undeveloped area, raising the tax base, creating jobs, or helping to move development in a certain direction.

Growth, development, and density are all coming. We can't stick our heads in the sand, pull up the drawbridge and try to oppose everything. Developers do want to learn from the community, because they want to improve their product as much as they can before they build it.

> *To read the full interview, visit bit.ly/PeterHendeeBrown.*

Detail: Pancho Arena

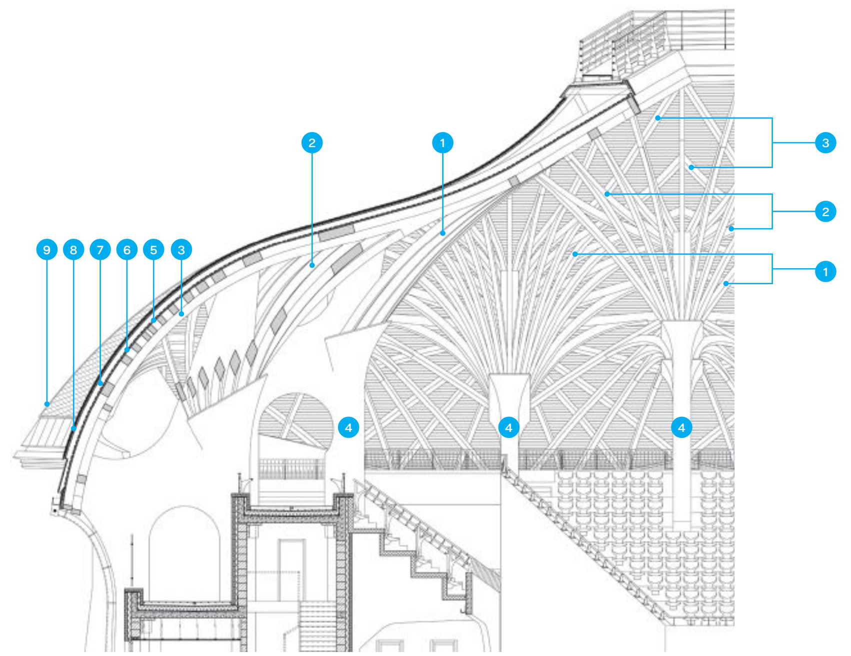
TEXT BY EMILY HOOPER

Located just outside of Budapest, Hungary, the 3,400-seat Pancho Arena at the Puskás Academy exemplifies the look of the campus, which was master planned by Imre Makovecz, a proponent of organic architecture. Local firm Doparum Architects designed the 130,000-square-foot soccer arena to harmonize with the natural environment, from the fan vaults that spread like tree branches to its prominent use of timber.

Cantilevering 43 feet over spectators, the roof is supported by glulam beams rooted into concrete piers every 20 feet. As the supports extend farther from the piers, their depths increase to accommodate the accumulating cantilevered load. Secondary beams connect to the primary beams via radial glulam crutches. The result is a hybrid timber and fan-vault structure based on gridshell principles, built from nearly 1,000 tons of wood.

In Doparum's first design iteration, modeled in ArchiCAD, nearly every support had a unique radius, which was cost-prohibitive to manufacture. In their second pass, the firm grouped members of a similar bending radius for more efficient milling, says principal Tamás Dobrosi. For example, every member that initially had a 33- to 43-foot-tall radius was revised to a 38-foot radius.

Dobrosi is proud that the Pancho Arena was designed and constructed by local firms. "Smaller firms may not have much big-project experience," he says, "but we have lots of diligence and enthusiasm."



1. Primary glulam beam, 9½", 25", or 41" deep
2. Glulam crutch, 9½" or 17" deep
3. Secondary glulam beam, 7" to 25" deep
4. Reinforced concrete pier (20' o.c.)
5. Wood decking
6. Waterproofing membrane
7. Air cavity and pressure-treated purlins
8. Pressure-treated sheathing
9. Slate roof

IMRE CSÁNY DAPH

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WOOD: HARSH CLIMATE COMFORT & FUNCTION

In a sun-seared corner of California familiar to triple-digit temperatures and seismic tremors, this 12,000 square-foot regional headquarters of the **USDA Forest Service** elegantly demonstrates what building design can achieve under extreme environmental conditions.

Located at the western edge of the Mojave Desert, the Mojave Rivers Ranger Station is subject to extreme seismic and high temperature stress. Daily July daytime temperatures average 95 degrees Fahrenheit and the area's earthquake activity is 733 percent greater than the U.S. average. Wood plays an "essential" role in managing the extreme conditions.

Wood factors prominently in the Ranger Station's aesthetic, from furnishings and accents to structural design.

Inverted king-post trusses with laminated wood beams offer a high strength-to-weight ratio and exceptional ductility for improved structural performance during times of strong desert winds or seismic events.

Extended wooden trellises form a shaded outside perimeter, helping manage solar gain and limiting interior cooling and lighting expenses.

What does a thoughtful architect do when nature deals a punishing hand? She bows to the conditions and delivers a design that makes the most of the land and environment.

Such was the challenge before the design team at Marcy Wong Donn Logan Architects of Berkeley, Calf. They were asked by the USDA Forest Service to create a regional headquarters for the Mojave Rivers Ranger District in Acton, Calf. After carefully investigating the environmental challenges and owner requirements, the design team specified wood to anchor the design aesthetic.

"Wood is one of our favorite materials due to its beauty, versatility, and sustainability," co-designer and firm principal Marcy Wong, AIA, explains.

"The wood structural system achieved an aesthetic, sustainability, and engineering objectives within the project budget. The wood nonstructural elements provided visual warmth to the workplace."

One of the chief structural requirements was seismic resilience. Wood played a vital role. "The roof structure is a system of king- post trusses with laminated wood beams spanning the building width. The beams support a wood roof diaphragm which is essential to the building's seismic resistance."

Wong cites other reasons for specifying wood. "Wood products are used to create outdoor shade elements that create cooler micro-climates outdoors, minimizing heat gain indoors. Among building materials, wood—renewable and carbon-storing—is unsurpassed as a sustainable resource.

"Wood is especially apropos for the ranger station," Wong observes. "It's for the USDA Forest Service, which is the nation's lead agency in natural conservation."

Wong and her team incorporated an assortment of design strategies, including:

- Deep roof overhangs shelter the interior from direct sunlight.
- A narrow 40-foot floor plate provides bi-directional daylighting and cross-ventilation.
- Inverted king-post trusses support the interior office space in an aesthetically-pleased manner.
- A low, horizontal building profile complements the expansive desert.

The project has earned many distinctions, including LEED Gold certification. But perhaps there is no finer tribute than this from a USDA Forest Service Ranger: "This is a fantastic ranger building, better than any I've worked in or visited across dozens of National Forests."

Owner: USDA Forest Service

Architect: Marcy Wong Donn Logan Architects

Structural Engineer: Gregory P. Luth & Associates

General Contractor: Swinerton Builders

Photographer: John Edward Linden Photography

Awards

Woodworks—Wood in Government Buildings Design Award

American Institute of Architects, East Bay Chapter—Citation Award

Museum of Architecture + Design—American Architecture Award

EDC Excellence in Design Awards—Government Category Winner

Best Practices: How to Retain Emerging Professionals

TEXT BY ALICE LIAO

Success in any field requires taking ownership of one's own career. Firms can help; many invest in the enrichment of emerging talent, which is vital to sustaining the architectural profession. Here are a few ways firms are encouraging nascent designers to stay and thrive.

Assist in the Licensure Process

Recognizing that time and cost are obstacles to achieving licensure, firms are creating opportunities to help designers fulfill Intern Development Program requirements, assist with exam preparation, and provide financial incentives. At New Orleans–based Eskew+Dumez+Ripple, employees have access to a library of resources, are supported by a licensing adviser, and receive reimbursements for each exam division they pass and a bonus once they're licensed.

Share Knowledge

Educational programs allow budding architects to enhance their skill set. Each quarter, Milwaukee-based Eppstein Uhen Architects' eponymous EUA University administers 15 to 18 courses taught on-site by internal staff and external trainers on topics from Revit to project management to presentation techniques. The firm budgets 40 to 50 hours of training per employee per year. "The training hours are not mandatory, but highly encouraged for growth and development," said Bob Norman, EUA associate and human resources director.

At Payette, in Boston, the Young Designer's Core (YDC) hosts events ranging from licensure workshops to construction tours. Operating autonomously from firm leadership, YDC has an open platform model that adapts to the changing needs of emerging architects, say current co-chairs Jenny Ratner and Hilary Barlow. Initially focused on education and licensure, YDC now organizes activities intended to boost morale, advance individuals in the firm, and encourage mentorship. Leadership lunches, for example, encourage budding designers to talk with associate principals about career development.

Offer Research Opportunities

Emerging professionals who believe in the transformative power of architecture can become disillusioned by the reality of the business. "When [designers] first get into the profession, they're a bit shell-shocked by the very fast pace [with which] projects are turned over," says Colin Booth, an associate with Watertown, Mass.–based Sasaki Associates. Research allows them to "feel good about what they're doing."

Aspiring architects may find career satisfaction in research projects. For those whose primary responsibilities consist of CAD work, the opportunity to delve into an issue of interest can be a welcome change.

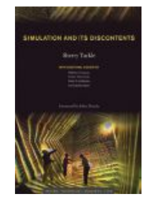
This also fosters mentorship, says Andrea Love, AIA, associate principal and director of building science at Payette, where nearly a third of the firm is involved in internal research projects. Senior staff team up with junior designers, who work on the projects in their downtime. The size of the project teams varies with scope, and findings are shared across the firm and the industry. Dissemination is critical, Love says, "because it doesn't help if the research projects happen in isolation."

> "The training hours are not mandatory, but highly encouraged for growth and development."
>
> —Bob Norman, Eppstein Uhen Architects, associate and human resources director

Be Clear About Firm Operations

Transparency about finances, goals, and career development helps designers feel more invested in their work, says Steve Ramos, AIA, a senior associate and project architect at LS3P in Charleston, S.C., who writes about his experiences as a young architect on his blog Buildings Are Cool. An open work culture provides direction, sets expectations, and exposes emerging architects to the complexity of running a practice. EUA's Norman says his firm shares the financial status of all projects with all employees "so they're fully aware of how what they do impacts the success of the project and the firm."

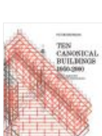
Architects' Choice: Books



BY ALI MORRIS

Architectural education introduces students to a trove of reference materials that aim to influence how they think about design. But which ones are worth a coveted spot on the bookshelf? We asked six architects to share the texts they've held onto and why.

David Salmela, FAIA
Principal, Salmela Architect, Duluth, Minn.
The Language of Wood: Wood in Finnish Sculpture, Design, and Architecture, the Museum of Finnish Architecture
"The visual communication of Finnish design reflects the essence of Finnish culture by saying so little, and proving that a picture is worth a thousand words. The beautiful graphics, the meaningful photo selection, and the timeless order of the book makes it hard for me not to go back to it for visual inspiration."



Sarah Whiting, Assoc. AIA
Partner, WW Architecture, Houston, and Dean and Professor, Rice University School of Architecture
The Woman Destroyed, Simone de Beauvoir; Willliam Cronon's chapter on grain, "Pricing the Future," in his book *Nature's Metropolis: Chicago and the Great West*; Neil Denari, FAIA's, interview in Issue 3 of *Project Journal*; and Peter Eisenman, FAIA's, introduction to his book *Ten Canonical Buildings: 1950–2000*
"Architecture today needs the nimble but sustained form of the essay to advance, both as a discipline and as a field. So it's to essayists that I turn. These writers provoke, with words that are as carefully composed as the arcs of their arguments."

Blaine Brownell, AIA
Director of Graduate Studies, University of Minnesota School of Architecture
Designing Design, Kenya Hara
"Hara's critical writings and design projects exemplify refined thinking," Brownell says. An architecture professor specializing in technology, sustainability, and Japanese architecture, he turns to this pure white, cloth-bound tome by the Japanese designer and art director for home-goods maker Muji for inspiration.

Daniel Davis
Senior Researcher, Case, New York
Simulation and Its Discontents, Sherry Turkle
"If a book's worth can be measured by how many times you've cited it, or how many people you've recommend read it, then *Simulation and Its Discontents* may be the most valuable book I've ever read—and reread, sentence for sentence. Turkle is an incredible writer but it is the larger story she tells, of architects and scientists being introduced to computers in the 1980s, that sustains my interest years later. She is able to articulate the politics and emotions of technology adoption in a way that helps explain our industry's continued unease with technology."

José Alvarez, AIA
Principal, Eskew+Dumez+Ripple, New Orleans
101 Things I Learned in Architecture School, Matthew Frederick
"This fantastic, pocket-sized book is my professional companion. Its clarity and simplicity always help me focus back to the basic lessons in design and the creative process."

Ronald Rael
Co-founder, Rael San Fratello Architects, Oakland, Calif.
Lequeu: An Architectural Enigma, Philippe Duboy
"Lequeu and his contemporaries—Boullée, Ledoux, and Cointeraux—are very influential to my work, but his work stood out to me as completely original in conception, especially for the time. The plates that focus on the figure and the body (human and animal), have taught me about the relationship between object and meaning in architecture and have helped me formulate attitudes about conveying politics and humor through architectural form."

> *Find out what other architecture reference materials we can't live without at bit.ly/architectschoicebooks.*

AIA Architect

AIAVoices


PHOTOGRAPHY: JOSE MANDOJANA

The Contextualist

Engaging a principled approach to site.

Allyn Stellmacher, AIA, is the project architect for ZGF Architects' Federal Center South Building 1202 in Seattle, a building that received the 2015 AIA COTE Top Ten Plus Award. Widely considered an expert in employing sustainable materials, building systems, and technologies in complex projects, Stellmacher says that it comes down to one basic principle: "There are so many opportunities that a physical site presents—outside of sustainability checklists," he says, "and if you want to make a positive impact, you have to listen to the site."

The Federal Center South Building in Seattle was a complex problem—and we approached it as a large design/build team with highly skilled architects, engineers, planners, landscape architects, and consultants who created an environment where we could holistically evaluate the design problem and find solutions.

"High performance" can be a shorthand term—and it's often used that way—but the design team had an opportunity to work across the spectrum of research and practice, and we started thinking about high-performance as an energy question. Pretty quickly, the term also became about accommodating the needs of different users. In other words, a space has to be optimized to work for people—so that's another aspect of performance that I think is lost when we use it as a shorthand term. Even though the form of Federal Center South is a lyrical oxbow shape, how we could accommodate program, unifying the experience, and how we could speak to individual needs were all essential qualities of that high-performing building.

And I think there are some precedents for this idea of high-performance building. If you look at Palladian villas, for instance, it's always interesting to me how they still have a useful footprint, still have an efficient plan, and still take advantage of daylight. These are all simple but important things that remain when you strip away terms and definitions.

I've been at ZGF since 1989, and there's always been an interesting mix of diverse approaches within the firm. The larger team has always been set up around a collective vision about how a building will resonate with its context. We avoid a cookie-cutter design culture within the office, and it comes back to the notion that if buildings should contribute to their environments, then those environments should shape our thinking.

When I was at the University of Oregon, I had an instructor—a really quixotic guy—who was fond of posing a premise to us in conversation. I remember him saying that people become architects because they are interested in everything, not just buildings. And that's the one thing I've carried with me throughout all these years. **AIA**

As told to William Richards

AIANow

What We're Reading Now

By William Richards
Art Direction by Jelena Schulz

Count your cash on Friday nights, avoid borrowing against future receivables, fire jerks, and hire winners—all hard-won observations offered by Arthur Gensler, FAIA, in **Art's Principles** (Wilson Lafferty, 2015). Some of the 62 principles are very basic indeed. Others seem basic, but are too often ignored at one's financial peril. Gensler, who started his eponymous firm in 1965 (with $200 in the bank), has been a force in architecture for three generations, and the explicit point of the book is to tell us exactly why that's been the case. For that reason, it will appeal to ambitious professionals of all stripes. But, if there's an implicit point of the book, it's that architects often need a little help in business. And for that reason it's worth browsing—whether you're taking your AREs or celebrating the 50th anniversary of the firm you started with a little money and a Mayline straightedge.

Could there possibly be 80 "practical ideas for a sustainable world," as promised by **Designed for the Future** (Princeton Architectural Press, 2015)? Surely, there are some redundancies in there. The book, edited by Jared Green—a D.C.-based blogger and writer—is really a compendium of 80 voices within architecture, history, landscape architecture, and urbanism. They range from Christian Gabriel's puckish prescription to "overlap land uses, enjoy the curious wrinkles" to Jonsara Ruth's altruistic plea to "eliminate trash and chemicals." In between: Marion Weiss, FAIA, on the virtues of river walks, photographer Christoph Gielen on roadways composed of solar panels, and Columbia University's Barry Bergdoll on a new kindergarten in Bogotá that opens itself to the surrounding neighborhood. They're 80 voices worth listening to and 80 ways to see the current landscape.

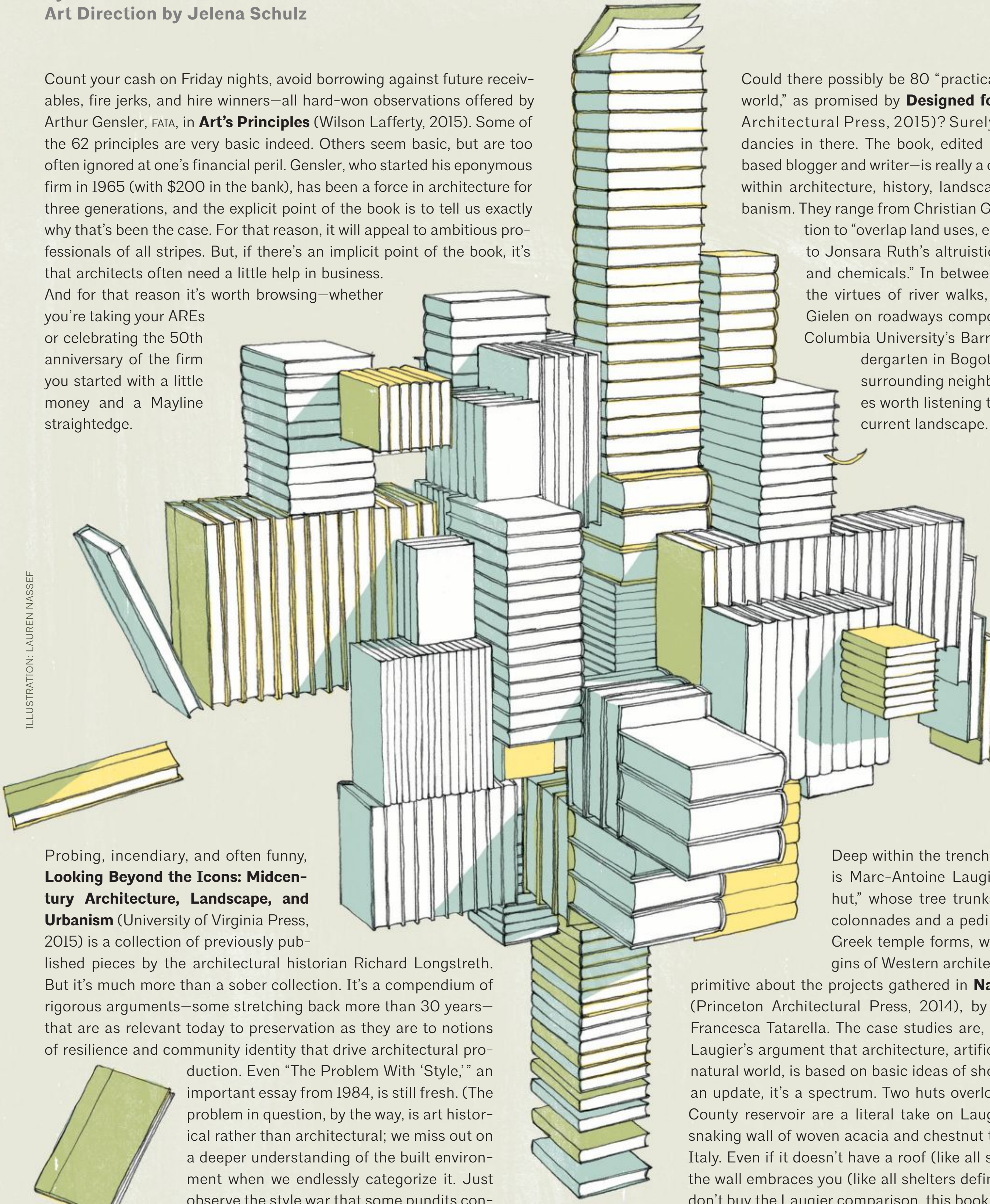


ILLUSTRATION: LAUREN NASSEF

Probing, incendiary, and often funny, **Looking Beyond the Icons: Midcentury Architecture, Landscape, and Urbanism** (University of Virginia Press, 2015) is a collection of previously published pieces by the architectural historian Richard Longstreth. But it's much more than a sober collection. It's a compendium of rigorous arguments—some stretching back more than 30 years—that are as relevant today to preservation as they are to notions of resilience and community identity that drive architectural production. Even "The Problem With 'Style,'" an important essay from 1984, is still fresh. (The problem in question, by the way, is art historical rather than architectural; we miss out on a deeper understanding of the built environment when we endlessly categorize it. Just observe the style war that some pundits continue to wage and you'll see the relevance of that 30-year-old essay today.)

Deep within the trenches of architectural theory is Marc-Antoine Laugier's idea for a "primitive hut," whose tree trunks and branches (forming colonnades and a pediment) were the origins of Greek temple forms, which are, in turn, the origins of Western architecture. But there's nothing primitive about the projects gathered in **Natural Architecture Now** (Princeton Architectural Press, 2014), by the landscape architect Francesca Tatarella. The case studies are, collectively, an update to Laugier's argument that architecture, artificial as it may seem to the natural world, is based on basic ideas of shelter and function. But, as an update, it's a spectrum. Two huts overlooking a Northumberland County reservoir are a literal take on Laugier. Less literal is single snaking wall of woven acacia and chestnut tree branches in Trentino, Italy. Even if it doesn't have a roof (like all shelters probably should), the wall embraces you (like all shelters definitely should). Even if you don't buy the Laugier comparison, this book is a showcase of material possibilities. Who knew you could shape Hawaii's reedy strawberry guava plant into such supple forms?

AIA Advocacy

ILLUSTRATION: VIKTOR KOEN

Design Is Not Enough

Going to the barricades in the AIA's Year of the Advocate is a collective effort and an individual responsibility.

For young architects and architects-to-be, the numbers are daunting. A 2012 survey conducted by the American Institute of Architecture Students (AIAS) found that the average architecture school graduate holds nearly $40,000 in federal loan debt. That figure doesn't even include the averages for private loans ($15,000), loans from family members ($8,100), or credit card balances ($2,000). [See "Loan Me A Dime (x 250,000)" in the September 2013 issue of ARCHITECT] The millstone of debt, coupled with the arduous path to licensure and elusive job prospects, have many wondering if the profession should brace itself for a dearth of talent.

Andrew Goldberg, ASSOC. AIA, the AIA's managing director of government relations and outreach, can relate. He's a member of what he calls one of the "lost generations of architects" that finished school in the early 1990s, couldn't find work at architecture firms, and followed alternate career paths. Today, Goldberg and his colleagues on the AIA's advocacy team are working to make sure that those who want to become licensed, registered architects can do so by reducing the debt barrier with the National Design Services Act (NDSA).

NDSA is a 2013 amendment to the 1974 Housing and Community Development Act originally presented by Representitive Ed Perlmutter (D-Colo.) to the particularly unproductive 113th Congress that would allow the secretary of the U.S. Department of Housing and Urban Development (HUD) to establish a loan forgiveness program for architects that provides volunteer services through community design centers in high-need areas.

Translation: Architects can work off their debt, freeing up capital to reinvest in their practices or simply to live. While Perlmutter and the advocacy team are tweaking the original bill before its reintroduction this summer, the crux remains the same. Young architects who volunteer their services for a specified length of time—the original bill called for one year—can have some of their debt forgiven, much in the way other licensed professionals are able to do.

"The important thing is that we have the concept," Goldberg says. "There are worthy programs for doctors, lawyers, and veterinarians, but architects are just as important in communities, and we need to help those students as well."

The marriage of service and young architects is a comfortable one, says Stephen Parker, ASSOC. AIA, the former advocacy chair for the AIAS. While drumming up support for the NDSA among fellow young leaders, Parker saw tremendous engagement when students were empowered to speak to their representatives about their willingness to serve and the profound effect student debt has on their future. And, for over 10 years, the AIAS has facilitated Freedom by Design, a program that encourages students to serve low-income and disabled individuals by solving issues of accessibility in their homes.

"Many students would do a really incredible project through Freedom by Design and realize the idea of design as an advocacy effort. That's really what students want to do through community design centers as they work off their debt," Parker says. "I found it really powerful when students were able to get in front of the right people and make a passionate argument about how student debt is affecting their lives, and how they would make a positive impact on their community."

Cindy Schwartz, who has 25 years of experience as a legislative and political organizer with groups like the League of Conservation Voters, recently signed on as the AIA's senior director for advocacy. She's hoping to duplicate the energy and optimism seen in emerging professionals and cultivate it among the AIA's 86,000 members, equipping them with the proper tools to amplify their voice.

Advocacy efforts, like passing the NDSA, can protect the future talent of the profession. The AIA is constantly working on national, state, and local levels to ensure the profession itself remains healthy, Schwartz says. In tandem with the Institute's advertising and public relations campaign—the first phase of which, "Look Up," is seeking to disambiguate the concept of an architect to the world at large—the AIA has designated 2015 as the Year of the Advocate.

"It's about creating a richer, deeper program to empower architects to understand the power and importance of doing this kind of advocacy work, and why it matters to the profession, as well as the future of the profession," Schwartz says. "It's to get them to speak up for themselves."

Schwartz is looking to educate architects on everything from campaign development and the political process to proper messaging and access to tools to deliver those messages in the most effective way possible.

"Just like in writing," she says, "there are particular ways to say things. In the political world, there's messaging. The way that you phrase things, particularly to the public, makes an enormous difference. As it relates to getting others engaged, there is an entirely different way to thinking about how to craft those kinds of messages."

As some members of Congress are making progress in uncoiling the Gordian Knot of the U.S. tax code, it's doubly important for architects to make sure their messages are heard loud and clear. Countless firms rely on tax credits to function, most notably historic preservation incentives (enacted in 1976) and a tax deduction for energy efficient buildings called 179D (enacted in 2005), which offers a maximum deduction of $1.80 per square foot for the creation or renovation of energy-efficient buildings.

"Tax reform is a pretty dense subject, but the impact on every architect, every firm, and every community is potentially enormous because tax rates could change, affecting your cash flow and bottom line," Goldberg says. "The kind of incentives and financing available for different types of projects could either be increased or go away."

While the Institute's advocacy efforts were responsible for the extension of 179D through the end of 2014, the aged historic preservation incentives are of particular concern. "The Second Annual Report on the Economic Impact of the Federal Historic Tax Credit," a 2011 study released by Rutgers University, concluded that the Historic Tax Credit has leveraged $117 billion in private investment and created 1.5 million jobs, all while underscoring the idea that the most sustainable building is the one that's already built. To date, architects have rehabilitated more than 40,000 historic buildings in connection with this credit.

The issue to be most worried about is the credits' age. Most members of Congress today were not around in the early '80s and therefore may not be aware of its existence. "When they're looking for things to change in the tax code, if they don't hear from architects about why it's important, it could get thrown out," Goldberg says. "That's why we need to be there talking about it."

And, don't forget about legal changes at the state level, too. In every region of the country, architects have faced some level of encroachment by other professions seeking to carve out a piece of design business for themselves, says Mattia J. Flabiano III, AIA, a senior principal at Dallas-based Page, and a member of the AIA's Political Action Committee. Flabiano sees lobbying efforts as one of the major ways that architects can effectively assert themselves.

Looking at one example in the Keystone State, one can see why. In 2014, the Interior Design Licensing Coalition of Pennsylvania backed an amendment to AIA Pennsylvania's mandatory continuing education bill that would have codified interior design practice as a separate practice from architectural practice. Unlike the law on architectural practice, however, it lacked any thresholds, meaning retrofits and renovations of any building type, complexity, or size (publicly funded or otherwise) that didn't involve structural elements (as would purportedly be identified by the interior designer) would be swept into the new law.

This would have meant that building owners could still choose to hire an architect for their renovation projects, but they could instead choose to contract only with an interior designer without an architect's supervision and seal. Equally disconcerting—and a public safety issue, no less—to satisfy the minimum education and training requirements in the legislative proposal, a person could possess an associate's degree from an unaccredited college and have a mere four years of work experience. The bid was an attempt to overturn language in Pennsylvania's Uniform Construction Code that stated individuals could provide design services as long as they weren't compensated, notes Scott Compton, AIA, a principal at Entech Engineering who chairs AIA Pennsylvania's Government Affairs Committee.

So, what was intended as language to allow homeowners to make small alterations to their homes without requiring the services of an architect was misconstrued, Compton says, and nearly cost architects dearly. It was only through 11th-hour grassroots efforts to block the amendment that architects in the state were able to dodge this particular bullet.

And rather than wait for a last-minute phone call urging action on an issue, Flabiano sees advocacy arising organically when it is embedded in firm culture. With offices in the urban core of six major cities, he urges all young architects joining his firm to get involved in what he calls the "downtown issues" that concern them, whether it's homelessness or affordable housing, as examples. To foster that involvement, Page sets aside several days per year—typically Fridays—for employees to volunteer and get involved in such issues.

But regardless of when and how the seed is planted, Flabiano believes that architects are particularly well-suited to play the role of advocate. And it's time, he believes, for architects to boost their advocacy efforts.

"Advocacy has a huge impact on the business of architecture, but I don't think that all architects understand that," he says. "We're trained to be good listeners, we work collaboratively in groups, we look at all ideas, and we're problem-solvers. We have not been as loud in the communities because we're too busy practicing our trade, as opposed to advocating for our profession and what we do to enhance people's lives." AIA

Dominic Mercier

→ Learn more about AIA Advocacy and the initiatives, at www.aia.org/advocacy.

AIAFeature

Resilience to Adaptation

The crucible for an ethical practice in architecture.

Rachel Minnery, FAIA

ILLUSTRATION: MICHAEL KIRKHAM

Climate change may still be a political hot potato, but the scientific community is almost unanimously on the same page: It is real, and it is already impacting our planet. The 21st century has already seen 14 of the 15 hottest years since record-taking began in the U.S. in the mid-19th century. As President Obama stated in an April radio address, "Climate change can no longer be ignored [and] 2014 was the planet's warmest year on record."

We cannot ignore extreme temperatures any more than we can ignore precipitation that has intensified in recent years. We cannot deny imperiled air quality any more than we can deny the increased severity of hazardous weather-related events. However, it isn't just rhetoric, as the administration has implemented a wide range of regulations and policies which require federal agencies to include climate change risks and impacts in their deliberations. When the leader of the free world has made this a priority and matter of national security, we can be sure that the presidential directives and executive orders will have a ripple effect on the codes and regulations that architects will design.

While we may yet be unable to calculate with pinpoint accuracy the long-term effects of climate change, it is clear that, in the short-term, a paradigm shift among professionals designing for the built environment is necessary. Indeed, a swelling global population and rapid urbanization are placing greater pressures on an aging infrastructure in many quarters. By 2050, global demand for water is projected to increase by 55 percent. By 2035, global demand for energy will increase by 35 percent.

Climatologists have been Malthusian about pointing out that our natural resources—oil, freshwater, nutrient-rich soil—may be depleted to an unsustainable level for the global population. And food scarcity is not just about an immediate lack of food; it's also about the impossibility of growing more food in overworked soil—and that's assuming the required agricultural land has not been developed or otherwise taken over.

The Rockefeller Foundation's 100 Resilient Cities (RC100) initiative refers to these profound shifts—economic, social, and environmental—as acute "shocks" and chronic "stresses." Natural disasters are the shocks to a system, and the stresses are the daily pressures or barriers that prevent communities and individuals from thriving. In a natural disaster, these stresses can be the difference between those who recover and those who suffer.

Cities are systems, so it is important to view all issues, understand their interdependencies, and make decisions that do not harm the other components. RC100 recognizes that, to attract investment and development, cities have hidden or denied their vulnerabilities. So RC100 asks communities to name vulnerabilities and seek support to identify solutions that allow cities to respond and adapt. Resilient design strives for environmental, social, and economic sustainability with the ability to adapt to known and unknown risks and vulnerabilities. Community problems require community-based solutions. Applying creative system-thinking in design innovation can result in thriving and sustainable communities that allow both people and the planet to prosper.

If the sustainability movement of the last 45 years taught all of us to reduce/reuse/recycle—to tighten our belts, as it were—then resilience calls for a belt-and-suspenders approach. In our effort to be more resilient as individuals, families, businesses, and communities, architects will need to carefully plan buildings, select products, and design systems that are easily adaptable to changing needs, holistic in acknowledging adjacencies and regional impacts, and finally see the environment as their client inasmuch as they see their paying patron as their client.

What, then, does adaptability look like? Do we build structures that are temporary or permanent? Robust or whip-thin? Rigid or flexible? Are these structures to be designed based on historical data or future models?

Resilience: A Principled Approach

Before we can define adaptability, we have to look at the term "resilience" as an area of study

AIAFeature

CONTINUED

"Resilience is fundamentally about the elasticity of a building, a community, or, more generically, a host to revert to the full operations of the status quo."
—Jesse M. Keenan

that was born out of ecology and, at its core, holds the mandate for architects promoting it to solve problems without creating new ones. Indeed, its scientific definition is the ability of a substance or object to spring back into shape after suffering a trauma.

It's about elasticity, an innate quality of adaptability, and the connection to architecture is twofold. First, resilience means designing adaptable structures that can "learn" from their environments and sustain life, even in the face of disaster. Second, resilience means architects can learn from their buildings and deploy ever-more-refined designs. Third, resilience means involving people directly in the design and creation of strong and inclusive cities.

These two objectives are accomplished by talking to experts outside of architecture, by coordinating with dozens of agencies and partners, and by modeling and analyzing project performance—so that if there's any surprise at all down the line, it has to do with better-than-projected outcomes rather than worse-than-projected outcomes.

The development of the Toyota Prius (first available in Japan in 1997) is an example of this feedback loop. With successive models, Toyota managed to gradually increase the number of miles-per-gallon for its 1.5-liter engines, even after switching to a standard 1.8-liter engine. Overall, it was a positive evolution—with a twist: Hybrid cars like the Prius run so silently that they pose a risk for pedestrians. As reported by Paul Collins in Slate in 2012, some automakers are thinking of ways to make gas-sippers at least sound more like gas-guzzlers for that audible signal in an intersection. In this sense, an innovation can also be a new problem when created in isolation.

In other words, resilience and adaptation don't always unfold in a straight line. It is a process. Architecture relies on the capacity of architects to embody what Robert Venturi, FAIA, called "messy vitality." Messiness aside, architects need a set of principles for resilience and adaptation—prescriptive guidelines that address practice, business, and how the AIA may contribute to an emerging framework to not only define the concept for practitioners but also for the public. "Resilience is fundamentally about the elasticity of a building, a community, or, more generically, a host to revert to the full operations of the status quo," says Jesse M. Keenan, the research director for Columbia University's Center for Urban Real Estate. "Adaptation is about a transformation to alternative domains of operations, which in one application means we must design, produce, and consume the built environment differently than we do now as we flexibly respond to the uncertainty associated with climate change." Keenan argues that resilience is best thought to be a response to extreme weather events in maintaining the status quo through recovery and a reduction in vulnerability.

If architects can all start moving in the same direction, then a natural evolution of resilience and adaptation will occur in terms of technical specificity. And as our environment shifts and changes—for better or for worse—then that evolution in thinking will become more vital than ever. What follows are principles that may serve as the foundation for an emerging value system which imparts emerging professional ethical obligations.

Principles of Resilience

1. Discuss and incorporate resilience measures during predevelopment, programming, and planning phases so as to think across scales as to the passive ability of a building to operate in the face of extreme events. Mitigation planning includes six steps:
   - Identify hazards
   - Assess vulnerabilities
   - Analyze impacts
   - Modify programming with desired outcomes
   - Create performance targets
   - Design and implement; measure and evaluate

2. Think about how resilient interventions can create value in terms of the underwriting of building operations and in terms of mitigating harm to users and communities.

3. Balance first costs and long-term value over the intended service life in the decision-making process for total value. Position resilient interventions to provide co-benefits which might also serve sustainability and mitigation ends.

4. Pursue a multiscalar ecological systems approach through an integrated, multidisciplinary approach to problem-solving.

5. Communicate to clients and building users about climate and extreme weather events that fall outside of historical precedent and build social resiliency between owners, operators and users. Implement some redundancy in daily systems and supplies, and have your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Principles of Adaptation

1. Because current practices may not be effective in solving future problems, architecture should be designed to have the capacity to accommodate changing environmental and social conditions within a building's useful life. Utilize data and research on hazard and climate projections to perform risk and vulnerability assessments.

2. Develop systems of intelligence within buildings and owners to measure incremental changes in environmental and human conditions, which are often indirect to the impacts of climate change.

3. Strive for design that aligns life cycle design with potential periods of uncertainty. (Consider how buildings can facilitate regeneration of natural resources and improve air quality.)

4. Position resilient infrastructure and buildings to be able to become adaptive through incremental capital investment and accretive physical interventions.

5. Acknowledge that some standards and techniques may be obsolete with the advent of climate change.

Principles of Climate Change

1. Identify and discuss effective development and land use policies that protect individuals, build the economy, and enrich communities and the environment.

2. Advocate for the adoption of model building codes. In the permitting process, strive to streamline design review and approval processes so innovation is not synonymous with delay.

3. Identify and advocate for incentives for resilient design, construction, and operations.

4. Identify and develop public and professional networks which serve as resources for promoting social resiliency.

5. Promote small scalable prototypes and experiments which lead to scalable innovations which offset the costs of climate change. **AIA**

AIAPerspective

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An Urban Imperative

Taking direct action is a matter of focus.

In 1934, a major earthquake struck Nepal. The 8.4-magnitude event (stronger than this past April's 7.8) wreaked havoc throughout the region. The loss of life is estimated to have been between 10,000 and 12,000.

Among the differences between the disasters, two stand out. Eighty years ago, the people of Nepal were isolated and news of the event did not reach the wider world very quickly at all; and relief from the outside world took months. Contrast that with the news cycle a few months ago when, within minutes, images of the damage and first-person accounts were flashed around the world, even while the ground was still shaking. In a matter of hours, relief agencies sprang into action.

This is the borderless world in which we live, and the events that affect the fewest number of individuals can get the attention of the greatest number of people.

Which brings me to another important difference, one that speaks directly to our role as architects: The earthquake in Nepal is a reminder that structures—more than restless tectonic plates—kill people. Whereas our ability to predict when these plates are about to slide is still in its infancy, our knowledge about how to design resiliency is nuanced, varied, and quite mature. As architects, we have a responsibility and a desire to share that knowledge.

As we urbanize, it is imperative to learn from each other, with the goal of developing up-to-date codes and standards. But how we share this knowledge is as important as the knowledge itself. We cannot simply barge in, uninvited. We have to be mindful of local customs and protocols; we are guests, not superheroes. Moreover, even though natural disasters do not respect borders, we still need to work with and through international bodies that represent the world's architects.

What will effective action look like? First and foremost, it will be our role in designing temporary shelters that speak to human dignity. While this need is being met, we must work in partnership with affiliated and allied design organizations, both on the ground and internationally, to press for and participate in the research that will lead to greater resiliency in both new and existing, often historic, structures. These steps suggest that a commitment to resiliency as a priority must be long-term. Headlines are fleeting but rebuilding takes years. As disasters move out of a week's or month's news cycle, we must remain focused. **AIA**

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“An architect, no less than an artist, should be willing to fly in the face of what is established, and to create not what is acceptable but what will become accepted.”

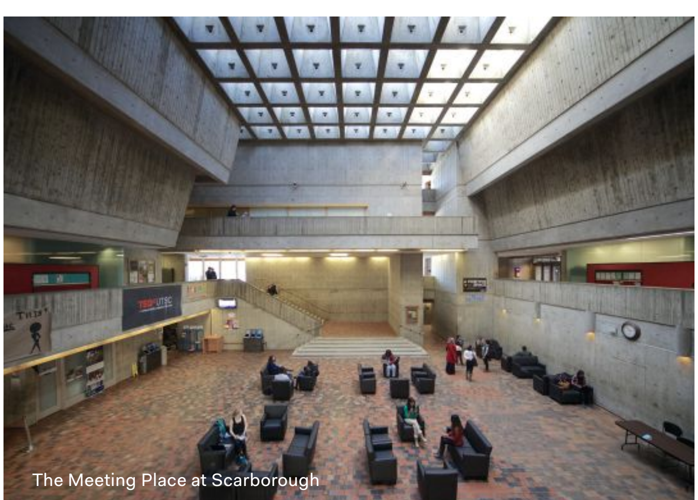
A Tale of Two Colleges by Witold Rybczynski, HON. FAIA

Buildings don't only weather physically, they also weather architecturally. Ideas age as surely as materials; what once seemed exciting and adventurous can appear strained and shallow in hindsight. Conversely, some ideas—like wine—take time to mature.

I recently revisited Scarborough College and Massey College. These two buildings were completed within a few years of each other, in the mid 1960s. While both were part of the University of Toronto, their design approaches were light-years apart; the first was a flagship project of what would become known as Brutalism, while the second was an exercise in Arts & Crafts, with more than a nod to Frank Lloyd Wright. When I saw them as an architecture student, the former struck me as exciting and original, and the latter as rather tame. Almost a half-century later, I was curious to see how these two projects have worn over the years, and to see if my initial impressions had changed.

An Architect's Architecture

When Scarborough College (now known as the University of Toronto at Scarborough) opened in 1966, it was the first building of the university's new suburban commuter campus. An internal pedestrian "street" forms the spine of this 1,200-foot-long structure. Roughly at the center is a dramatic four-story space, overlooked by galleries and lit by a giant eggcrate skylight. It's called the Meeting Place. In my experience, college students tend to gather in classrooms, dining halls, and at social events, but an



The Meeting Place at Scarborough

academic town square is nevertheless an attractive concept. The square, like the rest of the college, is all concrete; the eggcrate is concrete, the walls are concrete, the balustrades are concrete, even the wall sconces are concrete. This is not the warm, plastered concrete of Frank Lloyd Wright, or the silky smooth concrete of Tadao Ando, HON. FAIA, just ordinary poured-in-place concrete, replete with air cavities, flaws, and pour marks. The concrete also shows the impression of its formwork, sometimes simply joint lines, sometimes a variety of vertical ribs, a technique pioneered by Le Corbusier in the Unité d'Habitation at Marseille and widely used by architects in the 1960s.

Scarborough was designed by John Andrews. He got the job almost by accident. An Australian, he attended the Harvard Graduate School of Design (GSD), and while still a student he and three classmates entered the international competition for Toronto City Hall, and were one of the finalists. (I. M. Pei, FAIA, was another; the winner was a Finn, Viljo Revell.) This success led to a job offer from John B. Parkin, a leading Toronto practitioner. Andrews accepted and eventually opened his own office. Like many struggling young architects, he took a teaching job—at the University of Toronto. Andrews happened to be available when the university was exploring the feasibility of a satellite campus. The enterprising 30-year-old turned a master planning study into his first major commission.

The completion of Scarborough propelled Andrews into the limelight (two years later he was hand-picked by his old teacher, Josep Lluís Sert, to design the new GSD building). Scarborough was covered widely by the American and British architectural press. It's easy to see the appeal. This was an architect's architecture: spare, spatially inventive, determinedly functionalist, a frank expression of structure and construction. It was also self-consciously "new," a campus without the usual trappings of academe: no distinguishable departments—no arts building or chemistry building—no lawns, no formal entrance. This was clearly no ivory tower; the iconic vertical feature was not a spire or a belfry but the chimney of the heating plant.

The New Brutalism

Scarborough exhibits all the characteristics that Reyner Banham described in his seminal 1955 essay, "The New Brutalism": a powerful image that communicates the functions of the building; an approach to design that he called "*je-m'en-foutisme*," which roughly translates as "I don't give damn," or, "what-you-see-is-what-you-get"; underdesigned details; and the use of building materials "as found"—that is, in their raw state—which in practice usually meant exposed concrete. As I observed during my recent visit, concrete does not age gracefully: exterior surfaces are discolored and stained by rust

THOMAS GUIGNARD

> *For more pictures of Scarborough and Massey, visit bit.ly/ScarboroughAndMassey.*

streaks, corners are chipped, ugly patches abound. Retrofitted electrical conduits are surface-mounted on the solid concrete walls. Nor does concrete react well to human use. A brass handrail gets attractively burnished over time, wood become smoothly polished where it is handled, but the well-used concrete balustrades I saw merely acquired a greasy patina.

Scarborough is a very early example of the use of form-tie holes as a kind of architectural ornament. "Ornament" may be too strong a word. My chief impression of this building was of a no-nonsense work of engineering, like a dam or a highway overpass: scaleless, implacable, mute. Well, not entirely mute. Andrews did not splurge on materials or workmanship, but he was liberal when it came to space. Above the pedestrian street, the space rises the full height of the four-story building providing vertiginous, Piranesi-like views of overlapping balconies, galleries, and skylights. More than one contemporary reviewer compared the college to a Baroque stage set. In practice, Brutalism developed a strong romantic streak that was at odds with Banham's *je-m'en-foutisme*—just think of Paul Rudolph's concrete architecture or Boston City Hall. At Scarborough, the building zigs and zags picturesquely along a heavily wooded ridge, and the chiseled forms of the protruding lecture halls look like mouldering World War II bunkers, especially covered in ivy, as they are today.

Two wings extend from the Meeting Place. One houses the humanities, the other, the sciences—6,000 students under one roof. Scarborough is one of the first—and largest—built examples of a megastructure, wherein functions previously housed in separate buildings are combined in a single structure. In a 1966 *Architectural Forum* review, Oscar Newman called Scarborough "an important milestone in urban design in North America," reflecting the common view that megastructures represented the future of urban planning. Indeed, he referred to the building as "a beginning rather than a culmination."

In fact, it proved to be the latter. Andrews' building was phase one of a projected linear scheme designed to be twice as long, but phase two never materialized. Scarborough grew vigorously—there are now 10,000 students—yet the university turned its back on the megastructure concept, perhaps because it proved ill-adapted to change and much less flexible than its maker promised, more a straitjacket than a liberating tool. Or perhaps it was a search for academic identity that caused new departments such as computer science, business administration, and social sciences to be housed in their own freestanding buildings. Their architecture is resolutely modernist in a low-key Canadian way—but precision, transparency, and lightness, not *je-m'en-foutisme*, are the order of the day. The cladding is copper, glass, brick, and limestone—anything except concrete.

Several prominent Brutalist buildings—unloved and underperforming—have succumbed to the wrecking ball in recent years. Although the concrete bunker looms over the Scarborough campus like some elephantine survivor of an alien civilization, the university appears committed to what it calls the Andrews Building. The name feels right. This monolith is, above all, a monument to an architect's idea. I can still admire Andrews' single-mindedness, and the consistency that he brought to his design, but his ideas have not worn well. He was focused intently on the future, but it turned out to be a future that was stillborn, which makes this iconoclastic building oddly quaint, the architectural equivalent of a Sixties psychedelic poster.

Massey's Wrightian Echo

Massey College was designed as a conscious attempt to create a small, close community of graduate students from different disciplines. The difference with Scarborough is not merely one of scale, however. Instead of advancing a new planning concept, Massey is modeled on an Oxbridge quadrangle; instead of concrete it uses traditional materials; instead of industrialized construction it celebrates craft; instead of form-tie holes there is ornament. And instead of a smokestack it has an actual bell tower.

Massey College stands at a busy intersection on the downtown campus of the university. From the street, the brick exterior, which steps back and forth and is interrupted by vertical slots, appears intriguing rather than forbidding. The entrance is marked by the college's coat of arms carved in limestone. Beyond the porter's gate, a grassy quadrangle is enclosed on three sides by three floors of student rooms. The fourth side comprises a common room, a library, and the dining hall, whose tall, glazed volume is plainly visible.

What is most striking, other than the Edenic atmosphere of the leafy quad, is the architecture. The vertical rhythms of the residential façades vaguely suggests Gothic, despite the modernist flat roofs and lack of medieval detail. The horizontal canopies and the geometric finials of the dining hall explicitly mimic Frank Lloyd Wright circa 1915—think Midway Gardens in Chicago and the Imperial Hotel in Tokyo. The bell tower, an abstract composition of overlapping planes, recalls the Wrightian Dutch modernist Willem Dudok. On the other hand, sculptural forms capping the limestone mullions resemble Haida Indian totems,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and window spandrels are decorated with sun-burst motifs that reminds me of Marimekko fabric patterns. It is a puzzling mix.

Massey College opened the same year as Paul Rudolph's Yale Art and Architecture Building. In the early 1960s, modern architects were expected to use concrete and to design abstract forms that expressed a building's function, craft was frowned upon, and ornament was forbidden. The brick quad broke all these unspoken rules. Perhaps that's why I couldn't find a single reference to the project in the American architectural press. The reception in Canada was mixed. One critic considered that the building set architecture back 50 years, referring to the resurrection of Wrightian motifs. The contrarian historian Peter Collins took a different view. He wrote in the *RAIC Journal*: "If one considers that Frank Lloyd Wright was one of the pioneers of modern architecture, and that he had already reached maturity by, say, 1903, then it is difficult to see why the forms he was using in 1913 should cease to be valid in certain circumstances today." I doubt that most architects at the time would have agreed.

An Absence of Formal Training

The designer of this unorthodox building was Ron Thom. Born in British Columbia in 1923, he graduated from art school and joined a Vancouver architectural firm as an apprentice. His lack of a formal architectural education influenced his approach to design. Architecture schools did not encourage reproducing the past, even the recent past, but in his early houses, Thom drew directly on the work of Wright, as well as Southern California modernists such as Richard Neutra, Rudolph Schindler, and Harwell Hamilton Harris. He was not a historicist, but his willingness to appropriate elements from other architects flew in the face of the conventional architectural wisdom that condemned "copying" and privileged originality.

Thom's approach did appeal to his client. Vincent Massey (whose family owned the agricultural equipment giant, Massey Ferguson) had been a diplomat and the governor general of Canada. As a young man, he had conceived and financed Hart House, the university's Gothic Revival student center. Massey College was one of his last philanthropic projects. His son and nephew—both architects—had helped to organize a limited architectural competition. Massey, who had attended Balliol College at the University of Oxford, had a very definite idea of what he wanted; the final competition brief stipulated that the new building "should be in the form of a quadrangle—that it should be turned inwards, not outwards." The three other competitors (John B.

Massey College's dining hall

Parkin, Arthur Erickson, and Carmen Corneil) did not follow this requirement. Thom did, and produced a private, fully enclosed court. Massey likely supported the neo-Gothic compositional approach and Thom's ornamental touches.

At the time he designed Massey College, Thom was 35, a partner in the Vancouver firm of Thompson, Berwick & Pratt, and an experienced designer with more than 40 houses under his belt. According to my classmate Ralph Bergman, who worked for Thom in the 1970s, "Ron didn't necessarily believe in the things we were taught in school—truth to materials, clarity of structure, and so on. He had in mind to create spaces and environments, so anything necessary to achieve this was okay with him—and he was very good at it." This pragmatism is visible in Thom's treatment of structure. Like Scarborough, Massey College is constructed of poured-in-place concrete, but the material is largely concealed. The dropped ceiling of the dining hall is wood and the columns are clad in limestone; the bearing walls in the residential section are clad in brick. The brick-clad structural walls are indistinguishable from the partitions and the non-load-bearing exterior walls which are also brick. The heavy window mullions are limestone, whereas the similar-looking spandrels and finials are cast stone. In Thom's work, form and function lead separate lives.

Massey College accommodates about 60 graduate students, as well as visiting scholars. The rooms, instead of being organized along a continuous corridor or around individual staircases, are grouped in five separate "houses," each with its own entrance. All the rooms look into the quad. The distinctly un-institutional atmosphere is heightened by the

BOB GUNDU

labyrinthine circulation (which, being one-sided, benefits from natural light), and the variety of room plans—most include a small bedroom as well as a study, and many have fireplaces. The 45-degree geometry of the fireplace in the common room recalls Wright, as do that room's ceiling coves and concealed lighting. The walls throughout the building, as in so many of Wright's houses, are brick, a warm ocher blend. The ironspot brick, dense and nonporous, is also used on the exterior where it has aged exceptionally well; after 50 years it looks as good as new.

The inscription on the bell in the college tower—the Bell of St. Catharine, patron saint of learning—is "I summon the living: I mourn the dead: I rouse the sluggards: I calm the turbulent." And in my case, "I toll for lunch." The dining hall of Massey College is both imposing and surprisingly intimate. It is a double-cube lit by high windows, an arrangement that recalls a medieval hall. Thom played down the resemblance—there are no hammer beams or stained glass—but he did include fabric-shrouded suspended light fixtures that resemble banners. He also designed the wooden tables and chairs, which remind me of the Arts & Crafts movement, as well as the decorative cast-iron grilles that cover the air vents. The massive brick fireplace is pure Prairie Style. A frieze below the windows carries a long quote from George Santayana rendered in medieval calligraphy. The quote ends: "To be happy you must be wise."

The Human Experience of a Place

Scarborough is emblematic of its time; Massey College, an outlier, is different. What seems to have guided Thom were not abstract ideas, but something more down-to-earth: the human experience of a place. *You come into the room and you see this. You turn, go up a few steps, and you touch that. A fire crackles in the corner.* Human experience endures. So does human memory. Thom alluded to the past—to several pasts—which provides his building with richness and a depth of meaning that can still be appreciated. He was no functionalist. "The architect in proposing a building makes a choice—an imaginative choice which outstrips the facts," he wrote in a 1962 *Canadian Architect* essay. "The creativity of architecture lies here; it imagines more than there is grounds for and creates relations which at bottom can never be verified." He added, somewhat defensively: "An architect, no less than an artist, should be willing to fly in the face of what is established, and to create not what is acceptable but what will become accepted." Thom didn't need to be defensive; after a half-century, the masterful quad resoundingly bears him out.

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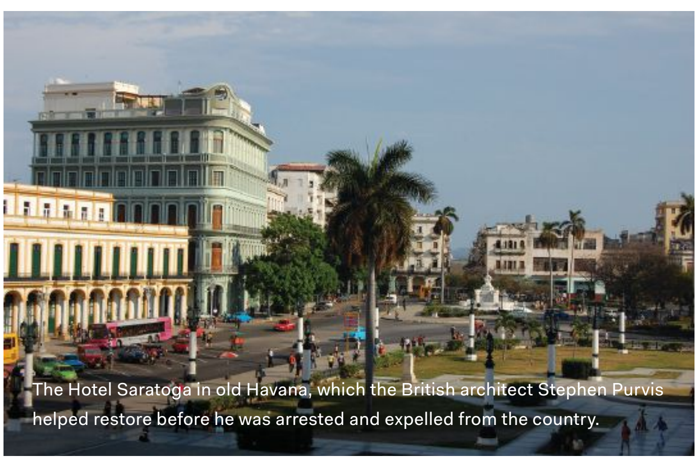
“I’m getting calls. ‘What are we doing in Cuba? Are we positioning ourselves to do something in Cuba?’ My answer to all of them is: There is an embargo in place.”

The Emerging Cuban Market by Amanda Kolson Hurley

When Abby Gordon, a designer at Shepley Bulfinch in Boston, entered the competition to win her firm's travel fellowship, she had only one destination in mind: Cuba. "I knew I had to go," says Gordon, who has traveled extensively in Latin America and visited Mexico as part of a class at the Boston Architectural College (BAC) on Luis Barragán. Gordon's BAC professors had previously taken students to Cuba, and she was enthralled by their photos of the island, as well as by *Unfinished Spaces*, a 2011 documentary about the National Art Schools outside of Havana, their astonishing brick vaults begun in the first flush of the Cuban Revolution and never finished.

Gordon won the fellowship, and in late June, she left Boston on a 30-day journey. She planned to trace the course of the revolution through the island and, of course, tour the capital of Havana. With its collection of Neoclassical, Baroque, Art Deco, and modernist



The Hotel Saratoga in old Havana, which the British architect Stephen Purvis helped restore before he was arrested and expelled from the country.

architecture, Havana, founded in 1519, has "the most impressive historical city centre in the Caribbean and one of the most notable in the American continent as a whole," according to UNESCO. The organization has named Old Havana a World Heritage site, along with the centers of three other Cuban cities: Trinidad, Cienfuegos, and Camagüey.

Gordon's timing couldn't be better. In January, the U.S. government relaxed restrictions for Americans wishing to travel to Cuba, just a month after President Barack Obama restored diplomatic ties with the island nation. Between January and May, the number of Americans who visited the country surged by 36 percent, a Cuban economist told the Associated Press.

The ramifications go beyond the prospect of direct flights and weekend mojito breaks. Only 90 miles from Florida, with endless beaches and the still-unpolished jewel of Havana, the island beckons to real-estate developers and architects. With the easing of diplomatic relations, will Cuba soon become the next big emerging market for American firms?

Whither the Embargo

The U.S. embargo, which prohibits Americans from spending money or doing business on the island, remains in place and has staunch defenders, like Florida's Sen. Marco Rubio (R) and New Jersey's Sen. Robert Menendez (D). Opinions differ as to its staying power. New York architect Belmont Freeman, FAIA, who is half Cuban and has spent considerable time on the island, thinks the fall of the embargo is inevitable. But, given the ill-will between Congress and the president, he says, "I have a feeling it won't happen until the next presidential administration."

On the other hand, Joseph Scarpaci, a geographer and professor emeritus at Virginia Tech who has written extensively about Cuba, says that hardliners in Congress will ensure that the embargo survives for the foreseeable future. "Obama's announcement, it's wishful thinking," he says. He also points out that foreign investment in Cuba is nothing new; it began in the 1970s and gained steam in the '90s. "Americans are late to the beach party, if you will," he says. Spanish, French, and Canadian companies have long been building beach resorts and swanky hotels in Havana through joint ventures with the Cuban government. And much of the island's waterfront access has already been sewn up, particularly on the northern shore. The beach town of Varadero, for instance, has numerous hotels operated by Spain's Iberostar and Melia chains, and Canada's Royalton brand runs resorts in both Varadero and Cayo Santa María.

A more promising opportunity for American firms may be medical tourism. José Gelabert-Navia, AIA, is the regional director for Latin America at Perkins+Will. He was born in Cuba, where his father, also an architect, held a prominent position in Fidel Castro's government before fleeing to the U.S. ("He was very much with the revolution until he was against the revolution," his son says.) Cuba has a lot of doctors, and they are renowned globally for their skill. "The level of education [in Cuba] is pretty high," Gelabert-Navia says. "When we combine the fact that you have a country that's only 90 miles away from the U.S., if you talk about doing hospitals, you know you can staff [them] with Cuban doctors." Maybe, in a decade, some Americans will be hopping a flight to Havana for Lasik surgery or a facelift.

But Gelabert-Navia also envisions a growing market for new hotels as well as mixed-use and institutional projects. There's hunger for it now, he says. "I'm getting calls, … 'What are we doing in Cuba? Are we

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positioning ourselves to do something in Cuba?' … My answer to all of them is: There is an embargo in place."

Would-be investors would face other obstacles even if the embargo were lifted. Over the past several years, Cuban President Raúl Castro has instituted a series of economic reforms (for instance, allowing banks to make loans to individuals and Cubans to purchase real estate) that encourage investment and entrepreneurship. But Cuba is still tightly controlled by its Communist government. Joint ventures are how foreign companies can enter the island, and the terms are less than ideal: a 51/49 split, with the Cuban government retaining the majority share.

Cuba has no independent judiciary, no free press, and a long track record of seizing private assets. As recently as 2012, the government jailed several prominent foreign businessmen, including a British architect, Stephen Purvis, whose investment group Coral Capital had worked on hotel and golf course projects on the island; some were charged with spying or corruption after spending months in prison, then expelled from the country. Gelabert-Navia says his own cousin had his dairy-production plant confiscated by the government. "If the embargo [is] lifted, it's going to be a complicated thing to give assurances that these investments are protected. That confidence has to be restored."

Ultimately, Cuba may emerge from communism as China and Vietnam did, with a form of state-run capitalism fueled by foreign investment. Even now, on joint-venture projects, foreign architects team up with their Cuban counterparts, not unlike the Chinese system that pairs overseas firms with local design institutes.

Untouched by Urban Renewal

In any case, most architectural work in Cuba today focuses on the restoration of Havana's immense historic building stock—two-thirds of which is in disrepair—and on bringing Havana into the 21st century without imperiling its heritage. That is the main worry expressed by many architects, including Freeman, who in a December 2014 essay in *Places* journal described Havana as "poised between two conditions of equal mortal peril": not having enough money or getting too much of it too fast.

Cuba is a poor country, with an average income of $20 a month. Building collapses are common. When the Soviet Union disintegrated, so did the government's main source of funding. Americans tend to romanticize scenes of Cuban life—vintage Buicks parked outside crumbling homes—and look past the deprivation they reflect. There is a clear need for capital. But development decisions need to be made with great care. "The urban fabric in Havana is intact," says Julio César Pérez-Hernández, a Cuban architect, planner, and educator. "Havana survived the urban renewal phase—it skipped that." After the revolution, Fidel Castro didn't foist any grand urban renewal schemes upon Havana because he was more interested in redirecting resources to the countryside. So the city, Pérez-Hernández says, "was saved by default."

Since the 1990s, Cubans have made great progress in restoring Old Havana's squares and landmarks. The official city historian, Eusebio Leal, is revered and surprisingly powerful, with a large budget and a staff of hundreds. Architects who have spent time in the country are encouraged by his leadership and Havanans' pride in their architectural inheritance. "It

> The scarcity of Internet access can make working in Cuba difficult, and there are other severe constraints on the practice of architecture there, first and foremost that private practice is not strictly legal.

is a very architecturally conscious city, sort of like Chicago," Freeman says. "Everybody's very proud of [its] beauty." Still, Pérez-Hernández is worried about overdevelopment. "In six years from now, if it looks like Hong Kong … that completely changes the image of Havana." His answer: an ambitious master plan that calls for revitalization of the waterfront (protecting the famous Malecón promenade against rising seas and pollution), a multimodal transit system, and more parks and public spaces. Pérez-Hernández began the project while a Loeb Fellow at Harvard University in 2001–02 and has refined parts of it with an international audience during a series of charrettes in Havana.

Pérez-Hernández spends most of his time in the U.S. The scarcity of Internet access can make working in Cuba difficult, and there are other severe constraints on the practice of architecture in the country, first and foremost that private practice is not strictly legal. In 2013, Raúl Castro expanded the list of private occupations that Cubans can hold to 201, including "dandy" (man dressed in colonial garb), taxi driver, restaurant owner, real-estate broker, and interior decorator—but not architect.

Most Cuban architecture graduates end up working for government ministries, where they earn abysmal pay and often find their creativity stifled. Under-the-table work is common, however, and enforcement of the rules is spotty. It's a fast-growing market. Foreign money—including remittances from

Cubans living abroad—is buoying a new generation of entrepreneurs, who are paying architects to refurbish their homes or fit out *paladares* (family-run restaurants). Building materials are still nearly impossible to find or prohibitively expensive, but a new container-ship port at Mariel should soon bring in a steadier flow of supplies, reducing their price. In addition, the U.S. government just approved a plan by the Boston-based Finca Vigia Foundation to ship nearly $900,000 in supplies to Cuba to help build a facility to preserve Ernest Hemingway's books, letters, and photos.

Still, many graduates of Cuban architecture schools are leaving the island in frustration. Pérez-Hernández reels off the places where his former students have moved: Florida, Virginia, New York, Mexico, Ecuador. If and when the private practice of architecture is recognized, more would stay, and some of those who have left would no doubt return.

The Rising Generation's Influence

As Gordon prepared to fly to Cuba in June, John Pilling, a Boston architect who taught her at the BAC, returned from leading a people-to-people tour of Havana. Pilling used to run a joint studio with Pérez-Hernández: students at the BAC and at Cuba's largest architecture school, the Instituto Superior Politécnico José Antonio Echeverría (or CUJAE), spent a semester working on a design problem in parallel, and then the Americans traveled to Cuba at the end of the semester. Pilling says graduates of CUJAE's five-year course have skills that are roughly comparable to their American counterparts, but with one major difference. The Cubans, he says, have "an inherent understanding of how to build in the tropics with limited budgets." (After the Bush administration set tighter restrictions on travel study, the studios stopped.)

But study-abroad programs are poised to grow again, especially because Americans now view Cuba more favorably than they have in 20 years, at least according to a recent Gallup poll. Nevertheless, many Cuban Americans—especially the older generation, and especially in Florida—remain strongly opposed to any engagement with the Castro regime. Cheryl Jacobs, the executive vice president of AIA Miami, plans to host a panel about American architects and Cuba's future, a topic, she admits, that evokes "a lot of strong feelings" among local architects. Miami is home to the National Association of Cuban Architects, a group that describes itself as continuing in exile the pre-revolutionary Colegio Nacional de Arquitectos de Cuba (CNAC); one of its goals is to promote the restoration of democracy on the island. (My attempts to contact several members of the association's board were unsuccessful.)

Younger Cuban Americans are more likely to support the new changes to U.S. policy, and in some cases, even their parents and grandparents have softened their stance. "For a lot of Cubans like my parents, that left because they were forced to ... they came to the States with no money. They had to rebuild completely," Gelabert-Navia says. "For that generation, the government in Cuba was evil personified." Although he has had plenty of opportunities to visit Cuba, Gelabert-Navia never has, on account of his parents. "I always felt a sense of betrayal to them."

Now, he says, his parents are older. They "feel they only have so much time left." And they have asked to go back to Cuba, one last time.


0.0"
0.8"
1.7"
2.5"
3.3"
4.2"
5.0"
5.8"
6.7"
7.5"
8.3"
9.2"
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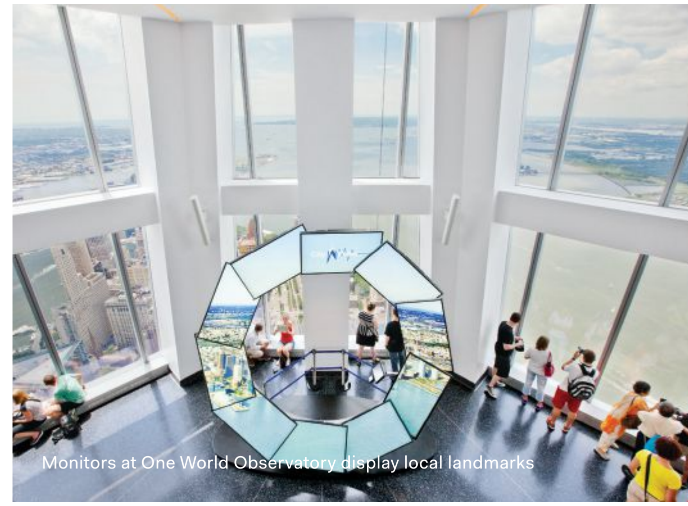
3.3"
10.0"
100%

“The prevailing theory in deck management is that there’s a little Philippe Petit in all of us, a latent desire to test the awesomeness of these supertall buildings.”

The Observation Deck Achieves New Heights by Karrie Jacobs



Monitors at One World Observatory display local landmarks

The motto of One World Observatory, which opened in late May atop One World Trade Center, is "See Forever." It's a lovely sentiment. The view from the public viewing area that occupies floors 100 through 102 (admission price $32, or $90 if you want "expedited" entry on a weekend) is as expansive as you might imagine. But seeing isn't exactly the point, not to the operator of the observation deck, Legends Hospitality, a concessionaire owned in part by the New York Yankees and the Dallas Cowboys.

The business of observation decks has lately embraced the contrived concept of "experience." One World Observatory, according to a case study issued by the project team—which includes the New York–based architecture firm Montroy Andersen DeMarco Group Inc. (MADGI), known for its work on "rooftop amenities," and the Hettema Group, theme-park experts based in Pasadena, Calif.—follows an "experience pathway." MADGI principal Richard DeMarco, AIA, describes it this way: "It's a machine. You come in. You experience. You go through it. You come out."

A visit to the observatory goes like this: You work your way through a dense tangle of lines. You eventually enter through a glowing portal in one of the tower's basements, go through security, wend your way past a video montage of workers describing the thrill of constructing the tower, commune briefly with bedrock, and enter the elevators, which are the complex's most remarkable feature: As you rocket up you are immersed in a computer-generated fantasia of New York City's development from the arrival of the Dutch to the present. (On the trip back down, you're treated to a CGI tour of the new World Trade Center complex. It's an oddly disorienting experience, because as you're speeding toward the ground within an elevator shaft, you get stunning, simulated glimpses of the tower's exterior. It's a presto chango perspective that not even John Portman, FAIA, with his craziest glass elevators could conjure.)

Up top, the space is divided into three floors. You step off the elevator on the 102nd floor and are routed into a long narrow room, the "See Forever Theater," where you watch your basic welcome-to-New-York-City movie: fast cuts, bright lights. When the screen rises at the end, you get what MAGDI principal Daniel Montroy, AIA, calls the "reveal": a wall of glass. It's the first view (predominantly of Brooklyn) on the pathway. From there you can ride the escalators down to the restaurant and bar, on the 101st floor, and the main observation level, on the 100th floor. Skidmore, Owings & Merill, the tower's designer, had initially intended the 102nd floor to be the restaurant and the other two floors a double-height observatory. During the proposal phase, however, MADGI rejiggered that arrangement and crafted one triple-height space with the restaurant sort of hovering in the middle. Some areas of the deck have big, dramatic three-story windows, and some areas are squeezed above or below the dining. While the arrangement clearly maximizes the amount of rentable event space, it undercuts the architectural drama.

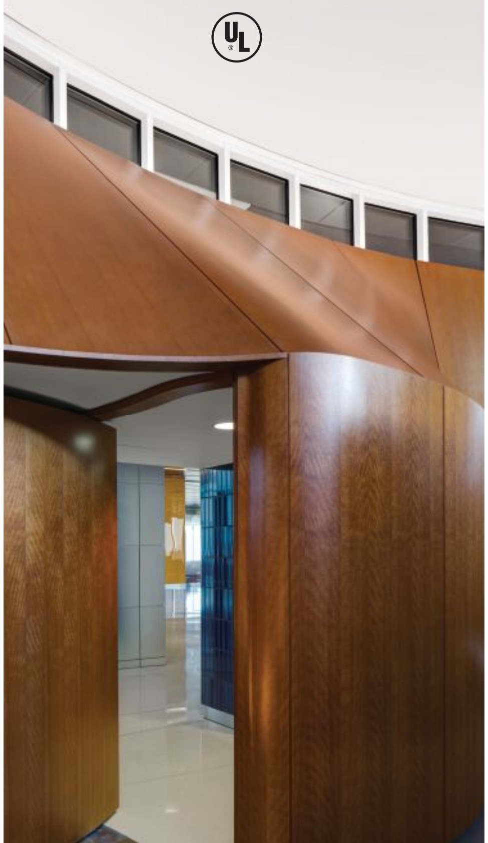
Conspicuously absent from the narrative at One World Observatory? The site's previous buildings. As Phil Hettema, president and creative director of the Hettema Group, explained in the case study: "The Observatory had to tell the right part of the story. … This project, particularly the Observatory experience, is about looking forward." But all I could think about as I walked around were the Twin Towers. The last time I visited Top of the World, as the former WTC's observation deck was known, I reviewed a 1997 renovation that turned it into a New York–themed attraction featuring a cafeteria with subway inspired décor and a ride that simulated a Manhattan helicopter tour. "You can go anywhere and see a lot of buildings," said one of the ex-Imagineers responsible for the renovation. "People are very sophisticated now. They've been to Disneyland, Universal Studios, and IMAX."

Observation Decks as Money Makers

Fortunately, the compulsion to turn observation decks into themed attractions has diminished since the 1990s. The procession and "experience" of the deck remains carefully choreographed, and electronic gadgetry de rigueur. (Get your picture taken against a virtual skyline!) But the prevailing theory right now in deck management is that there's a little Philippe Petit in all of us, a latent desire to test the awesomeness of these supertall buildings.

There's a fierce competition among developers to build the highest observation deck—currently Dubai's

CONNIE ZHOU

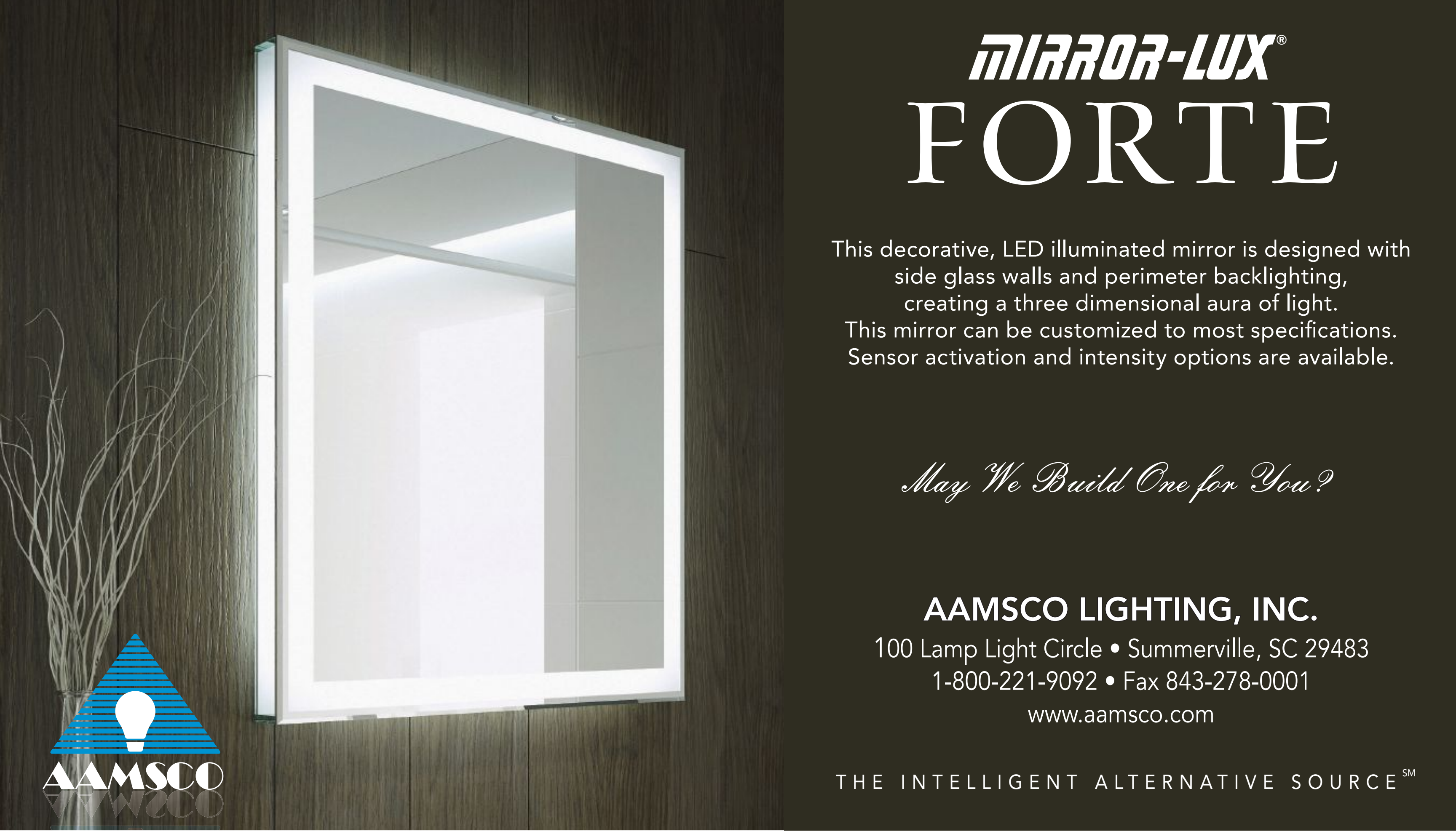


Burj Khalifa holds the title at 1,821 feet—and supply the most spine-tingling sensation. Some of this is simply because of the sheer number of skyscrapers that are being erected around the world, some of it is because of the profitability of decks. Charles V. Bagli, in a 2011 *New York Times* article, reported that the Empire State Building's deck complex earned $60 million in profits in 2010, while the building's office rentals "made little if any money." Similarly, when it was announced in March that the Blackstone Group would be buying Chicago's Willis (née Sears) Tower for $1.3 billion, the *Chicago Tribune* reported that one of the reasons was the Skydeck, which "reaped about $25 million in admissions revenue in 2014, an amount that has been climbing annually." At One World Observatory, the anticipated annual attendance is 3.8 million. Multiply by $32 and you've got revenues of roughly $121 million on admissions alone.

Carol Willis, director and curator of the Skyscraper Museum in Lower Manhattan, argues that what's happening today is a replay of what transpired at the dawn of the skyscraper age in New York, when each new building had a novel spire and a viewing platform available to an enthusiastic public. "It's far more prestigious to have a private space" atop a tall building," Willis says. Consider the 1,971-foot-tall Makkah Clock Royal Tower in Mecca, Saudi Arabia, which is topped by a crescent shaped prayer room available only to members of the Saudi royal family. But, she continues, "Buildings are businesses. They're planned to be rent producers. If the value is the greatest at the top, monetize the top by mass tourism." Willis does see a deeper value in allowing public access to such exalted space: "I think its best when everyone can go to the top. It's a democratizing experience."

David Malott, AIA, a principal architect at Kohn Pedersen Fox Associates (KPF) and chair of the Council on Tall Buildings and Urban Habitat, puts it this way: "If you're going to build the tallest, or one of the tallest buildings in a city, there is a social or civic responsibility that comes along with that."

For the sweet spot where contrived tourist magnet meets the sublime, consider Chicago's Ledge, which SOM added to the Skydeck at its Willis Tower in 2009. Designed by Ross Wimer, FAIA, now at AECOM, and the engineering firm Halcrow Yolles, the Ledge is a series of glass balconies that jut out from the 103rd floor of the tower and appear—through structural sleight of hand—to more or less float. More than anything I've done since I foolishly climbed construction rigging to the ceiling of Grand Central Terminal, standing on the glass floor 1,300 feet above Chicago frightened me. The Ledge made me sense, physically, the extreme scale of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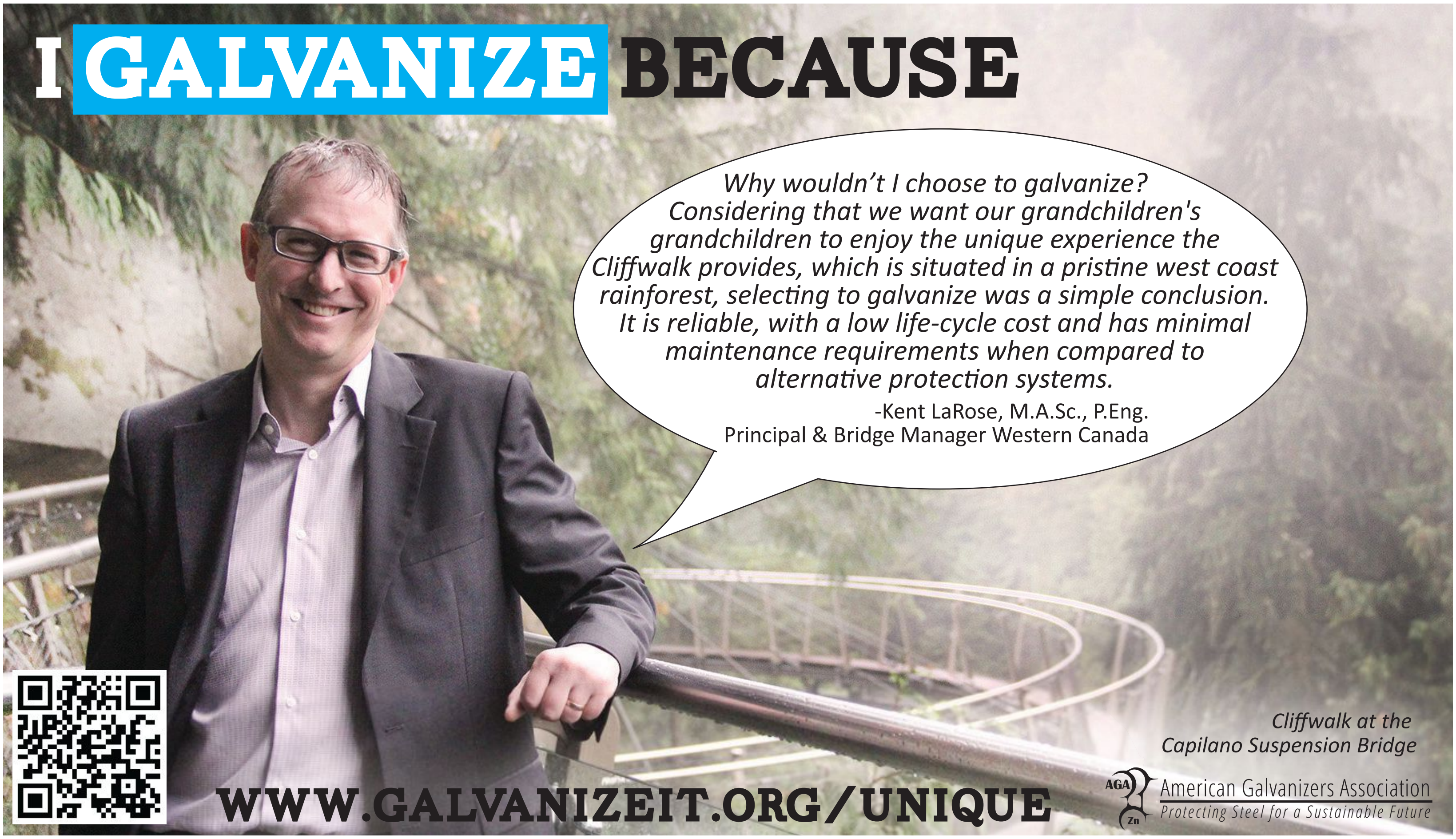
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-Kent LaRose, M.A.Sc., P.Eng.
Principal & Bridge Manager Western Canada
Cliffwalk at the Capilano Suspension Bridge
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the skyscraper. Or, as *Chicago Tribune* architecture critic Blair Kamin told me at the time, the Ledge is a source of "frisson," excitement commingled with pleasure. To step out onto the glass, he suggested, is "to dance with the possibility of structural failure."

There is so much more frisson still to come. Indeed, Malott mentions one of his current projects, the Ping An Finance Centre, a 2,165-foot-tall insurance company headquarters in Shenzhen, China. "It's a private building," says Malott, "but we convinced them to put in observation decks. We cantilevered out triangular bay windows on each façade, with the glass-bottom floor." The idea is to offer the same, unsettling experience as


Requisite photography at One World Observatory

CONNIE ZHOU

the Willis Ledge, but given the sheer number of glass-floored alcoves, "the observation experience becomes quite personalized."

Meanwhile, the Shanghai Tower, by Gensler, is nearing completion and will have a deck 20 feet higher than the Burj Khalifa's. And rising in Jedda, Saudi Arabia, the Kingdom Tower, designed by Adrian Smith + Gordon Gill Architecture specifically to shatter records, has a 2,000-foot-high observation deck that cantilevers out from the insanely skinny tower like a giant serving tray. Closer to home, KPF's 30 Hudson Yards, on Manhattan's Far West Side, will have an observation deck on the 75th floor that, reportedly, incorporates a "thrill device." Says Malott, "I can't give too much detail on that, except that [developer] Steve Ross has said that it will be the most frightening experience one can imagine."

Coming Up with the "Bikini"

My most profound observation deck experience in recent years involved neither frisson nor a predetermined experience pathway. On the same trip to Chicago that took me to the Ledge, I decided that I also needed to visit another classic SOM tower, the 1,128-foot-tall John Hancock Center. The observatory

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The Sky Portal at One World Observatory

there was lovely, with stunning views of an azure Lake Michigan and a south-facing wall that was nothing but open mesh; the view over the Magnificent Mile was accompanied by a pleasant breeze. Unlike the Willis Skydeck, which was jam-packed, Big John's observatory was unexpectedly tranquil.

That changed, however. Gensler and a French observation deck specialist called the Montparnasse 56 Group have transformed the sleepy 94th floor into an attraction called 360 Chicago. Michael Gatti, AIA, a principal architect who runs Gensler's lifestyle studio in New York, explained his redesign using an analogy to Burberry, the raincoat maker that's lately begun to exploit its trademark plaids to sell things like swimsuits: "The view is the trench coat," says Gatti. "Then we had to come up with the bikini, if you will."

The "bikini" in this case is a moving glass box, engineered by Thornton Tomasetti, that allows eight people at a time to be gently angled toward the ground from the Hancock façade. It's a bit like BASE jumping … without the jump. Tilt, as it's called, has replaced one section of Hancock's open-air mesh wall. It's been such a success, Gatti tells me, that the Montparnasse 56 Group is considering installing a second Tilt and getting rid of the mesh altogether.

The sleepy, unmediated observation deck experience is, I'm sorry to say, a thing of the past. Or as Kamin wrote to me in a recent email: "You've got to be able to interact with the observation deck, to feel the danger associated with being more than 1,000 feet up."

This brings up an obvious problem for One World Observatory, given the tragic events that preceded it. Any hint of danger is unacceptable. The single oddest aspect of the deck seems like an attempt to tackle this dilemma. There's a round platform on the 100th floor called the Sky Portal. Basically, it's a Ledge manqué, a glass floor that purports to show you the city directly below your feet. Only what's directly below One World are the other 99 stories of the building. So the portal's view is of a video feed. There is not even the illusion of danger. The tourists, as you might expect, tend to ignore the thing and do what they came to do: peer out the windows. The lesson here—that a genuine view still tops an ersatz experience—is, I guess, a heartening one.

CONNIE ZHOU


YOUR VISION.
OUR EXPERIENCE.

PVC 101

THE BENEFITS AND USES OF CELLULAR PVC TRIM

Presented by:
VERSATEX TRIMBOARD
TRIM SMARTER.

Photo courtesy of VERSATEX Trimboard

LEARNING OBJECTIVES

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

1. List the properties of cellular PVC.
2. Identify common cellular PVC products and their uses in the building industry.
3. Describe best practices for preparation and installation.
4. List the "green attributes" of cellular PVC that make it an ideal exterior building trim.

CONTINUING EDUCATION

CREDIT: 1 LU/HSW

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By Paige Lozier

CELLULAR PVC TRIM—A GROWING MARKET

Let's first take a look at the exterior trim market from 1992 through 2013, and the forecasted breakdown between wood and non-wood products through 2018. It has been estimated that the trim market in the U.S. is roughly 3 billion board feet and growing. In 1992 wood was the dominant trim material, with wood being used for 98 percent of trim products; only 2 percent were manufactured from non-wood products, which include aluminum coil, vinyl, fiber cement and wood composites. Architects, builders and contractors were unfamiliar with other types of trim products, or they were not available in their markets.

By 2013, non-wood products commanded 65 percent of the exterior trim market and 35 percent were non-wood. New, low-maintenance products were being introduced; contractors were finding these products easier to work with and had fewer callbacks.

The projection for 2018 is that non-wood exterior trim will be the product of choice, representing 60 percent of the total exterior trim market. Although wood will still have a 40 percent market share, lumber quality, price-versus-benefit, maintenance, and it's susceptibly to rot and deterioration will continue to affect its acceptability as an exterior trim.

Cellular PVC trim features the real cedar look and woodworking characteristics a fine builder or craftsman desires. Photo courtesy of VERSATEX Trimboard

WHAT IS CELLULAR PVC TRIM?

You may be asking yourself, what is cellular PVC trim? It is solid white (typically) extruded plastic with the working characteristics of wood. It is moisture and insect resistant, yet features the real cedar look and woodworking characteristics a fine builder or craftsman desires. It is an ideal product for highly moisture sensitive areas, including those along coastal zones or regions affected by salt and high humidity. Most of the problems associated with wood trims, such as warping, cupping and splitting, are eliminated when using cellular PVC trim.

Cellular PVC trim is produced using an extrusion process. The material expands when it leaves the die creating a lightweight, rigid PVC or "cellular PVC" material with a density similar to that of pine board. All cellular PVC trim possesses characteristics and properties different from wood. These characteristics make it a perfect replacement for wood and wood composite trim materials.

Cellular PVC's properties are:

- Closed-cell structure
- Good resistance to weathering
- No splitting, rotting, warping, swelling or delamination
- Easy to paint, print, laminate, route, saw, rivet, screw and engrave
- Easy to fabricate
- Impervious to moisture
- Insect resistant
- Mold/mildew resistant
- Can be thermoformed
- Lightweight and high-strength

There are two basic methods for producing cellular PVC, the Celuka process and free-foam PVC. Photo courtesy of VERSATEX Trimboard

TWO MANUFACTURING METHODS

Not all PVC products are created equal. We will now look at how the method used to manufacture cellular PVC trim affects its physical as well as aesthetic properties. Manufacturing methods dictate the uniformity of the core, surface hardness, aesthetics and surface finish.

There are two basic methods for producing cellular PVC, the Celuka process and free-foam PVC. In the Celuka process two streams of foam enter the calibration chamber, coming in contact with cold metal plates. The foaming starts at the outer surface and expands inward, forcing the two pieces to fuse together at the midpoint of the overall thickness. A line at the center of Celuka boards shows where the two streams of foam meet.

Since the foaming starts on the outer edges and expands inward, the inner core cools at a different rate than the outside surface, The final product is cellular PVC with a hard, smooth and glossy exterior surface finish paired with a coarse, inconsistent cellular core that may contain voids because of the larger cell structure. The glossy shell is rarely seen since most Celuka products are sanded, as Celuka-based PVC products require painting.

In contrast, the free-foam process produces a finished product with a much tighter and more consistent cell structure. The foaming allows the PVC to expand outward in one piece. In a typical free-foam process, the PVC is extruded through a sheet die. Unlike Celuka, free-foam cellular PVC expands after exiting the sheet die. The thickness of the board is controlled through a series of cooled rolls that aid in slowing the foam process, while establishing the gloss and thickness of the finished trim. The product is cooled at room temperature, creating a smooth surface, a uniform cell structure throughout the core and a consistent overall density.

The typical properties of a free foam cellular PVC product are: a density similar to clear, white pine; a surface finish similar to white-primed lumber; a material that is easily milled or molded; and smooth cut edges with no "chip outs". Free-foam PVC products can either be painted or left as-is.

In an effort to compare Celuka to free-foam cellular PVC, a contractor used both products on a large home. His analysis can be found in the September 2004 edition of Fine Home Building, but we've compiled some of his comments here:

"Celuka's dense outer layer is more brittle than its inner core while free-foam is more uniform throughout."

"Fasteners mushroom when driven into Celuka."

"Celuka's core is less homogenous with small voids that leave the edges rough when routed."

"Celuka has a tendency to chip when cut."

"I've found free-foam PVC easier to work with than wood."

"Milled edges can be glass smooth."

"Free-foam has the identical density of pine."

"Each piece is exactly the same."

"Fastening is easier than wood and nails can be driven extremely close to the edge without splitting."

Some advantages of cellular PVC materials over wood trim are that it won't rot, it resists insect infestation, and it can be placed in direct contact with the ground, masonry or even direct moisture. Photo courtesy of VERSATEX Trimboard

FABRICATING CELLULAR PVC

Cellular PVC can be fabricated into a variety of sizes, shapes, and profiles. Trimboards, sheets and moldings are extruded, while beadboard and cornerboards are molded or milled into a final product. Its uses are limited only by the imagination of the designer.

Some advantages of cellular PVC materials over wood trim are that it won't rot, it resists insect infestation, and it can be placed in direct contact with the ground, masonry or even direct moisture. The product does not require flashing to divert moisture and is resistant to mold and mildew. It is different from wood in that it expands and contracts linearly with changes in temperature. Because of this, painting the trim dark colors presents some challenges.

The similarities to wood are that you can use standard tools for routing, cutting and drilling.

Short lengths, around windows for example, can and should be built with tight joints. Photo courtesy of VERSATEX Trimboard

The density of cellular PVC is similar to that of a premium grade lumber product, but it holds nails and screws better than wood. And, like wood, cellular PVC can be painted – but it is not a necessity.

Managing Expansion and Contraction

All materials move, but unlike wood and wood composites that shrink and swell with changes in moisture content, cellular PVC only expands or contracts along its length (linearly) with a change in temperature. How you treat the joints between boards on long runs will depend on the outside temperature and the temperature of the board during the time of installation. A good rule of thumb is to leave a 1/16-inch gap per 18 feet of board for every 20-degree temperature variance. Then fill remaining gaps with a recommended sealant.

On the other hand, wood composite trim requires a 1/8-inch gap at all butt or scarf joints plus double nails on both sides of the joints. With oriented strand board (OSB) you must leave a 3/16-inch gap where the trim butts over other materials and at butt joints. Fiber cement requires a 1/8-inch gap between the siding and trim, but actual siding gaps of ¼-inch have been reported.

Note that expansion and contraction is only an issue on longer runs, such as those of frieze, fascia and rake boards, comprised of three or more 18 foot boards. Short lengths, around windows for example, can and should be built with tight joints. The more the product is mechanically fastened or bonded on longer runs, the less likely it will move. Also, screws restrict movement more than nails. You can further restrict movement on longer runs by reducing on-center fastening to 12 rather than 16 inches.

Cellular PVC does not require painting for protection, but can be painted to achieve a custom appearance. Photo courtesy of VERSATEX Trimboard

Painting Cellular PVC Trim

Cellular PVC does not require painting for protection, but can be painted to achieve a custom appearance. Recommended paints include 100 percent latex acrylic or 100 percent latex acrylic with a urethane additive. Lacquers are not recommended because they are a more brittle coating and will not flex with any movement in the trim.

To ensure good adhesion, the surface of the product should be clean, dry and free of dirt, mildew, chalk, grease and any other surface contaminants before applying paint. Keep in mind that cellular PVC may have a static charge on the surface of the product which tends to attract dust. Cleaning can be accomplished using a cloth and a mixture of mild detergent and water. Other cleaning agents include mild household cleaners, or degreasers for more stubborn stains.

Prior to cleaning, it is a good practice to fill any nail holes and remove any marks or blemishes that appear during the installation process. Sanding the surface is an acceptable method of removing blemishes if painting, however sanding the original exterior surface will expose the micro cell structure.

The light reflective value (or LRV) of the paint should be greater than or equal to 55 units to avoid excessive heat buildup on the trim. For reference purposes an LRV equal to zero is black and an LRV equal to 100 is a pure white. Dark colors absorb the UV rays from the sun, causing heat to build up in the trim. Expansion and contraction is greater as the temperature rises. Excessive heat absorption could lead to heat distortion of the board or sheet, which occurs at or around 150 degrees Fahrenheit in cellular PVC trim products.

Paint applied to PVC requires a longer dry time due to the impervious nature of the product, but paints applied to PVC can last up to five times longer than paint applied to wood due to the absence of moisture in the substrate.

Sealant and Adhesive Guidelines

Specific sealant adhesives and tapes should be used with cellular PVC. Sealants should be either an elastomeric-polymer chemistry containing solvent, or polyurethane, as silicones are incompatible with cellular PVC trim.

To adhere PVC to PVC, methacrylates with UV inhibitors or standard PVC pipe glues with solvents and cyanoacrylates can be used.

To adhere PVC to wood, use a solvent or polymer-based adhesive. To adhere PVC to metal, use methacrylates with UV inhibitors. Double-faced tapes are excellent for use in conjunction with mechanical fastening and include polymer-based acrylic foam or adhesive transfer tapes.

Fastening Cellular PVC

When fastening cellular PVC use 2 ½-inch stainless steel 8d nails that are annular threaded or spiral type, thin shank, with blunt points and full round heads; the nail must penetrate a framing member at least 1 ¼ inches. Nails must be spaced 16-inches on-center along the board length and should be a maximum 2 inches from the end of the board, but ¾-inch is preferred. Use 2 ¼-inch long 7d trim screws if you prefer screws over nails to reduce expansion and contraction.

A stainless steel plain shank nail is a slender blunt pointed nail made from high tensile stainless steel to minimize bending and reduce the splitting of the material. Trifecta nails are less noticeable on the trim surface and offer a clean, finished look. They are also available in a trim head stainless steel screw. If using screws, consider headcoat stainless steel screws with white coated heads, which are designed to blend with PVC trim.

Highly visible joints should be glued, while other joints can act as an expansion joint with a backer rod and sealant. A common method used by some contractors is shiplapping the edges of the boards on long runs. This allows for product movement while never exposing the substrate or house wrap. It also increases the surface area of the joint should you decide to glue. You should use a combination of glue and mechanical fasteners, as glue alone will not insure a long term bond.

Cellular PVC trimboards can be heat formed into an assortment of shapes in a fraction of the time it takes to curve natural wood products using conventional techniques such as heat bending, pressure forming or vacuum forming. Photo courtesy of VERSATEX Trimboard

Thermoforming

Cellular PVC trimboards can be heat formed into an assortment of shapes in a fraction of the time it takes to curve natural wood products using conventional techniques such as heat bending, pressure forming or vacuum forming. Constructing the same shape in natural wood products requires sanding and finishing, and takes a longer period of time. Achieving a near perfect bend radius with cellular PVC trimboards can be accomplished by utilizing convectional air circulating ovens, strip heaters, heating blankets and radiant heaters. Heat guns can be used only on small areas where appearance and uniformity may be compromised.

Heating times and temperatures should be controlled to prevent the surface temperature of the product from exceeding 300°F for more than ten minutes. Heat should be applied on both sides of the product to assure uniform distribution of heat and to avoid distortion. The edges of the product are most susceptible to rapid heat loss, so edge heating is critical. Heating times are generally about three minutes per ¼-inch of product thickness. Heat should be applied evenly and consistently along the product's length until it has become flexible and easy to form.

Cellular PVC is a versatile product with infinite uses, limited only by one's creativity and imagination. Photo courtesy of VERSATEX Trimboard

QUIZ

1. By 2013, non-wood products commanded ____ percent of the exterior trim market.
   a. 50 b. 25
   c. 100 d. 65

2. Which of the following is an attribute of cellular PVC?
   a. Closed-cell structure b. Impervious to moisture
   c. Insect resistant d. Can be thermoformed
   e. Lightweight and high-strength f. All of the above

3. Which of the following manufacturing methods produces a product with a uniform cell structure throughout the core and a consistent overall density?
   a. Celuka Process b. Free-Foam Process

4. True or False: Cellular PVC does not have to be painted.

5. True or False: Expansion and contraction is only an issue on short runs.

6. The light reflective value of paint should be greater than or equal to _______ units to avoid excessive heat buildup on the trim.
   a. 15 b. 25
   c. 25 d. 55

7. True or False: Because cellular PVC is lighter than most other building products, it reduces the amount of fuel required for transportation, which in turn reduces fossil fuel use and carbon dioxide emissions.

8. True or False: Cellular PVC has a 60 percent greater R-value than wood.

9. In which case study was cellular PVC used to restore an ornate cupola built in 1897?
   a. Marting Hall b. Congregational & Presbyterian Church

10. True or False: According to industry sources, approximately 50 percent of the cellular PVC used in the U.S. building market today is domestically produced.

Once the board has reached a workable temperature, the heat can be removed from the board and the product can be bent or formed into the desired shape using any type of fixture. Overheating the product should be avoided, as it can cause a rough texture on the surface and discoloration or yellowing. Cellular PVC's textured appearance will fade away when thermoforming.

Special care should be taken when handling hot material. To prevent serious burns, special gloves and protective clothing should be worn. Cooling can be accomplished through normal air circulation or more rapidly by using fans or compressed air.

Visit http://go.hw.net/AR715Course1 to read more and complete the quiz for credit.

ADVANCEMENTS IN WINDOW GLAZING

Presented by:

SageGlass

Butler County Health Care Center, Photo courtesy SAGE Electrochromics; Copyright Paul Daubmann

LEARNING OBJECTIVES

Upon completion of the article the reader will be able to:

- Identify the basic components and properties of a high performance window
- Discuss how traditional mirror or tinted glazing functions and benefits occupants
- Describe the advancements in tinting and mirrored window coatings by today's manufacturers
- Explain how electrochromic coatings on windows function and the benefits of programmable tinted windows

CONTINUING EDUCATION

CREDIT: 1 LU

COURSE NUMBER: ARjuly2015.2

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By: Andrew Hunt

While the concept of smart phones is now well-accepted, the technology of smart windows is not well known in the public awareness. Windows and glazing options have made major advancements in the past decade. By all indications, the industry is poised to keep offering new and innovative options for architects in both commercial and residential settings. In order to take full advantage of these advancements, it is important to understand the anatomy of high performance windows and how new coating, tinting and programmable windows are best implemented.

WINDOW BASICS

The evolution of windows has held a slow and steady pace until recently. Before 1900, commercial and residential windows were mostly custom-built on site with wood frames and a simple single-pane design. At the turn of the 20th century, though, some companies started to manufacture pre-framed wooden windows. While this made it a bit easier and faster during construction, these mass-produced

windows were still crude in terms of energy efficiency, and installation was inconsistent with little attention to air sealing. As the century progressed, aluminum and steel frames were introduced, allowing for more interesting and unique designs, but by and large the windows were still basic frames with glass. These early windows were initially inexpensive to purchase. As technology evolved, they became more expensive to replace or upgrade. As a result, almost half of all commercial buildings still house single-pane, poorly installed windows.

However, in the 1960s, building scientists, engineers and progressive manufacturers looking for a competitive edge started to research and develop new fenestration designs and technologies. The first upgrade came when a second pane of glass was added to improve overall insulation. Then gas was added between panes to help keep them clear of humidity and also increase thermal properties. Tinting, glazing, coatings and additional panes soon followed. By the mid-1980s, there were hundreds of glass types, styles and features with varying benefits.

Most of the improvements in window design revolved around four measurable aspects of energy efficiency and comfort. Basic insulation, heat transfer, light transfer and air sealing were classified. Each area has been measured and improved on over the years. These attributes are commonly known as:

U-factor: Also called U-value, the U-factor measures the rate of heat transfer and indicates how well a window insulates. U-factors generally range from 0.25 to 1.25 and are measured in Btu/h•ft²•°F. The U-value of a window is similar to the r-value of an insulation material except it measures the heat transfer properties of the entire window as a unit rather than just the single components such as glazing and frame. Also, unlike an r-value where the higher the rating the better the insulation properties, the higher the U-factor the worse the thermal performance of a window. A typical single-pane window with a wooden frame may have a U-factor ranging from .9 to 1.1, whereas a high performance window will perform around .3 to .4 or better.

Solar Heat Gain Coefficient (SHGC): SHGC measures the fraction of solar energy transmitted and reveals how well a product blocks heat caused by sunlight. Simply put, this measurement indicates how much incidental solar gain, or heat transfer from sunshine, is passing through the window. Again a lower rating is better. SHGC is measured on a scale of 0 to 1, so an SHGC rating of 0 means that all heat is being reflected back out and away from the inside of the building, and a SHGC rating of 1 means all solar energy in heat form is passing through the glazing to the interior. Older single-pane windows generally have a SHGC above .75, while newer double-pane windows coated to improve performance may have ratings under .3.

Visible Transmittance (VT): VT measures the amount of light the window lets through. VT is measured on a scale of 0 to 1; values generally range from 0.20 to 0.80. The higher the VT, the more light you see. The glazing type, number of panes and glass coatings influence VT. This value decreases somewhat when a low-emittance (low-e) coating is added, and it decreases substantially when a tint is added. Including another layer of glass also decreases VT.

Air Leakage (AL): AL measures the rate at which air passes through joints in the window. AL is measured in cubic feet of air passing through one square foot of window per minute. The lower the AL value, the less air leaks through the window. Most industry standards and building codes require an AL of 0.3 cfm/ft².

CLEAR AS GLASS?

We may think of glass as a perfectly transparent material, but the truth is glass really isn't all that clear. Imagine breaking an older glass soda bottle. When you look at the glass directly, it appears clear, but from the side the glass looks green. This tint is caused by impurities, mostly iron, in the glass. So it is with commercial-grade glass used in windows—when looking at the edge of the pane, the glass appears green. Today manufacturers are finding ways to remove additional materials from the glass and have created ultra-clear panes to allow maximum visible transmittance.

There are several ways window manufacturers pursue the improvement of these measurable attributes. Of note are new tinted and mirrored glazing options that combine the conventional technologies of higher performing windows with coatings specifically designed to enhance and improve an occupant's comfort. New glazing options increase curb appeal in the urban setting and also reduce solar heat gain and help control energy costs.

Taking the advancements of reflective coated glass to the next level, programmable tinting options make it possible to manage daylight, glare, energy use and color rendering based on occupancy, light levels or integration with building management systems. Zoning of glass panels is also possible, enabling occupants to control the optimized balance of light quality, visual and thermal comfort, and energy performance in a space.

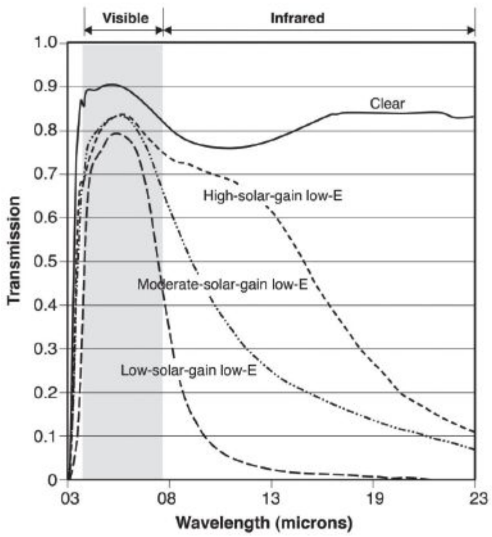
But before we get to the next generation of window technology, it is important to understand how current high performance windows address energy use and comfort concerns.

IMPROVING WINDOW PERFORMANCE

Single-pane windows do very little to reduce the amount of energy that passes between the outside environment and inside of the home. Glass alone is highly conductive, so to improve energy efficiency a second and third pane of glass were added to the window frame. The concept of creating space between panes as a thermal barrier is the same strategy used in basic fiberglass insulation; heat transfer is greatly reduced through air. To further slow the rate of heat gain, or loss, the gap between panes is filled with argon or krypton. Both gases are inert, nontoxic, nonreactive, clear and odorless. Krypton has better thermal performance than argon and is more expensive to produce. The optimal spacing for an argon-filled unit is the same as for air, about ½ inch. Krypton performs better than argon when the space between glazings is thinner than normally desired (eg: ¼ inch). A mixture of krypton and argon gases sometimes is used as a compromise of thermal performance and cost. Argon and krypton occur naturally in the atmosphere, and the gasses work to reduce heat transfer while also eliminating fog from humidity between panes. When compared to single-pane windows, double-glazing reduces heat loss by more than 50 percent (as measured by the U-factor). However, additional panes alone do little to improve solar heat gain or visibility ratings and can add significant weight to a window, making it more difficult and expensive to transport and install.

Arguably the greatest advance in window technology in the past few decades has been the use of low-e coatings. Emissivity is the ability of a material to radiate energy. All materials including windows emit (or radiate) heat in the form of long-wave, far-infrared energy depending on their temperature. When heat or light energy is absorbed by glass, it is either convected away by moving air or reradiated by the glass surface. Reducing the window's emittance can greatly improve its insulating properties.

A little understanding of basic science is helpful to appreciate how low-e coatings function to improve energy performance in windows. Visible light is a small fraction of the entire large spectrum of energy that surrounds us. Microwaves, radio waves, x-rays and ultraviolet are all forms of light we cannot see. Infrared is also on the spectrum of light, and though we cannot see it, we sense it in the form of heat energy. Different materials reflect, absorb or manipulate wave forms of light energy (like lead blocking x-ray waves) and low-e coatings have a high reflectance to long-wavelength infrared radiation. When applied to a pane of glass, the coating reduces long-wavelength radiative heat transfer between glazing layers by a factor



1. Spectral transmittance curves for glazings with low-e coatings. This graphic shows how different types of low-e coatings can reduce the amount of infrared solar radiation. Note that by choosing different types of low-e coatings, more or less heat energy is allowed to pass through the window. This is important when choosing window coatings in colder climates where additional solar heat gain may be advantageous. (image source: US DOE, EERE Building America Measure Guidelines Measuring Window Performance) http://apps1.eere.energy.gov/buildings/publications/pdfs/building_america/measure_guide_windows.pdf.

of 5–10, thereby reducing total heat transfer between two glazing layers. Coating a glass surface with a low-e material and facing that coating into the gap between the glazing layers blocks a significant amount of radiant heat transfer, lowering the total heat flow through the window. Low-e coatings may be applied directly to glass surfaces or to suspended films between the interior and exterior glazing layers.

There are many different types of low-e coatings but almost all are microscopically thin, virtually invisible metal or metallic oxide. Advantageously, low-e coating can lower the U-factor of the window without interfering with visibility. For example, uncoated glass has an emissivity of .84, while some advanced low-e coatings can reduce emissivity to .02.

Low-e coatings are broken down into three classifications: high, moderate and low solar gain. These have been designed to accommodate building needs. Low-e coatings can be custom-ordered to either encourage or halt solar gain, depending on a climate zone and other situational needs.

High solar gain low-e coatings typically have an SHGC value greater than 0.40 and are designed to reduce heat loss but admit solar gain. High solar gain products are best suited for buildings located in heating-dominated climates, and particularly for south-facing windows in passive solar designs. Unless properly shaded, high-solar-gain windows may result in overheating from excess solar gain in swing seasons, but the overall benefit of the additional heat during cold northern winters usually outweighs the additional cooling load during the relatively shorter summers.

Moderate solar gain low-e coatings typically have an SHGC value of 0.25–0.40. These coatings reduce heat loss, maintain high light transmittance, allow a reasonable amount of solar gain and are suitable for climates with heating and cooling concerns.

Low solar gain low-e coatings typically have an SHGC value less than 0.25. This type of low-e product, using a highly spectrally selective low-e glass, reduces heat loss in winter and reduces heat gain in summer. Compared to most tinted and reflective glazings, this low-e glass transmits visible light, but blocks a large fraction of the solar infrared energy, thus reducing cooling loads. Low solar gain low-e coatings are generally specified for hot sunny climates.

The location of a low-e coating application is also important. Placement of a low-e coating within the air gap of a double-glazed window does not affect the U-factor, but it does influence the SHGC. Thus in colder climates with higher heating demands, placing a low-e coating on the outside surface of the inner pane will maximize winter passive solar gain at the expense of a slight reduction in the ability to control summer heat gain. In cooling climates, applying a coating on the inside surface of the outer pane is generally best to reduce solar heat gain and maximize energy efficiency. Manufacturers sometimes place the coatings on surfaces for other reasons, such as minimizing the potential for thermal stress. Multiple low-e coatings also are placed on surfaces within a triple-glazed window assembly, or on the inner plastic glazing layers of multi-pane assemblies, which further improves the overall U-factor.

Some low-e coatings can be spectrally selective, filtering out 40% to 70% of the heat normally transmitted through insulated window glass or glazing while allowing the full amount of light transmission. Spectrally selective coatings are optically designed to reflect particular wavelengths, but remain transparent to others. Such coatings are commonly used to reflect the infrared (heat) portion of the solar spectrum while admitting more visible light. They help create a window with a low U-factor and SHGC, but a high VT.

A final consideration when evaluating low-e windows is the UV or ultraviolet protection the window coatings offer. Blocking UV light is important because it can protect furniture, art, carpet and décor from the fading effects of UV exposure. Low-e windows can block over 70 percent of the UV light coming through the window, but for projects such as galleries or in offices with extensive art collections, using a low-e coating with greater UV protection can be important.

Another category of window glazing that has developed in recent decades is tinting and reflective coatings. Unlike low-e coatings that generally are designed to be invisible, reflective and tinted windows are created to enhance the aesthetics of the project while also providing comfort and energy efficiency.

Reflective or mirrored coatings on window glazing or glass reduce the transmission of solar radiation, blocking more light than heat. While they improve the SGHC rating, they also greatly reduce the VT. Reflective coatings usually consist of thin, metallic layers, and come in a variety of colors including silver, gold and bronze. Because of the reduced solar heat gain, these coatings are most common in hot climates to control solar heat gain.

Tinting windows also can provide relief from solar gain, but again at the cost of visibility. Tints are added to the glass during the manufacturing process and come in a wide range of styles. Depending on the color of the tint, different wavelengths of light are manipulated to produce varying results. For instance, the most common gray- and bronze-tinted windows are not spectrally selective, so they reduce the penetration of both light and heat. Blue- and green-tinted windows offer greater penetration of visible light and slightly reduced heat transfer compared with other colors of tinted glass. In cold climates, black-tinted glass can absorb more light than heat—helping reduce energy costs in winter month. Tinted, heat-absorbing glass reflects only a small percentage of light, so it does not have the mirror-like appearance of reflective glass.

Thomas D. Culp, an energy consultant working with the Glass Association of North America and glazing industry since 1998, has witnessed considerable change in the industry as both tastes and technologies have changed. Culp has a PHD in engineering and began his career researching low-e coatings.

"Mirrored glass is pretty much gone. The trend has been to be less reflective, with Las Vegas and international places like Dubai as exceptions," he says. "If you go to Seattle and look at some of the new office buildings, they aren't the mirrored buildings of the '80s. … There's all the old tints like grays, bronzes, blues and green, and then there are new high performance tints that give more color choices but lower the solar gain. From the coating standpoint, there are hundreds of low-e coatings options from high visible transmittance, high reflective to low reflective—even new ultra-clear glass tints. Architects now can choose anything they want from daylighting to glare control to improving energy efficiency."

While many of the low-e, reflective and tinting options in glazing have been available for a number of years, Culp points out that like the rest of the building industry, updating window trends has taken a long time.

"Anything in the architectural world tends to move at slow pace, and in general the industry is pretty risk adverse," Culp says. "It's been interesting to see what is coming into popularity."

Chromogenic windows, called "smart" or "dynamic" windows, have grown in popularity in the past decade. Chromogenic windows have materials added to the glass that allow it to change tinting density depending upon the condition or stimulus. There are three main styles of chromogenic window technology available today—photochromic, thermochromic and electrochromic.

Visit http://go.hw.net/AR715Course2 to read more and complete the quiz for credit.

QUIZ

1. A window's U-Factor measures:
   a. The impact of solar panels on the building envelope
   b. The rate of heat transfer
   c. The rate of heat conduction through light beams
   d. The thermal rating of insulation

2. Which of these is not one of the measureable aspects of energy efficiency and comfort for windows?
   a. Clearness Rating (CR)
   b. Solar Heat Gain Coefficient (SHGC)
   c. Air Leakage (AL)
   d. Visible Transmittance (VT)

3. Low-e coatings reduce a window's heat:
   a. admittance
   b. omniscience
   c. emittance
   d. admissions

4. Which of the following features do reflective or tinted coatings NOT provide?
   a. Added noise protection
   b. Enhance the aesthetics of the space
   c. Provide comfort
   d. Help with energy efficiency

5. A second or third panel of glass was traditionally added to a window frame in order to do what?
   a. Added opening options
   b. Diminish mold and mildew buildup
   c. Prevent cracks
   d. Improve energy efficiency

6. Chromogenic windows are sometimes referred to as which of the following?
   a. 'Stylish' or 'Functional'
   b. 'Impressive' or 'Satisfying'
   c. 'Noteworthy or Inviting'
   d. 'Smart' or 'Dynamic'

7. Photochromic materials change their tint transparency in response to the amount of _____ they receive
   a. Care
   b. Light
   c. Titanium Dioxide (TiO2)
   d. Surface Area

8. With Electrochromic windows, the intensity of the tint is:
   a. Manually adjustable
   b. Automatic
   c. Fully calibrated
   d. Not available

9. Much like a household thermostat, Electrochomic windows are:
   a. Utilitarian
   b. Universal
   c. Dial operated
   d. Programmable

10. True or False: According to the U.S. Department of Energy, the window frame can account for over 80 percent of the energy loss through a window.
   a. True
   b. False

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IF YOU'D RATHER
DESIGN A BUILDING
AROUND YOUR VISION
INSTEAD OF AN
HVAC SYSTEM,
YOU'RE READY FOR
MITSUBISHI ELECTRIC.

BUILDING INNOVATION AND PERFORMANCE IN SCHOOLS

HIGH PERFORMANCE SYSTEMS IMPROVE THE LEARNING ENVIRONMENT

LEARNING OBJECTIVES

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

1. Define what constitutes a high performance building.
2. Describe how to integrate innovative and high performance design principles into schools to optimize the learning environment.
3. Examine systems that may contribute to the energy efficiency of high performance schools.
4. Review how high performance schools can serve as a teaching tool, specifically for STEM curriculum.

CONTINUING EDUCATION

CREDIT: 1 HSW/LU

COURSE NUMBER: ARjuly2015.4

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By Paige Lozier

WHAT DOES HIGH PERFORMANCE DESIGN MEAN FOR SCHOOLS?

Where is an occupant's safety and productivity more important than in schools, where the foundations of our children's futures are laid? There is a proven and strong correlation between a student's academic performance and a school's physical condition. Many children are often learning in sub-standard facilities that are riddled with deferred maintenance, causing health issues, discomfort and distractions for students. From mold issues to poor acoustics and lighting, as well as classrooms that are too hot or too cold, unsound conditions in the classroom environment can play a significant role in the health and productivity of students. Improving these environmental factors enhances learning, results in higher test scores and increases daily attendance, an important marker for school funding.

DEFINING A HIGH PERFORMANCE BUILDING

The Energy Policy Act of 2005 (EPACT) and the Energy Independence and Security Act of 2007 (EISA) seek to reduce building-related energy consumption and dependence on foreign energy sources.

Title IX, Subtitle A, Section 914 of EPACT directed the National Institute of Building Sciences to explore the development of consensus-based voluntary standards that set requirements for less resource-intensive, more energy-efficient, high-performance buildings.

EPACT defines a high performance building as one that integrates and optimizes all major high-performance building attributes, including energy efficiency, durability, life-cycle performance and occupant productivity. When EISA was passed in 2007 and the High Performance Building Council (HPBC) was formed, it established a new and aggressive plan for achieving energy independence in our nation's building stock by the year 2030. New and renovated federal buildings must reduce fossil fuel use by 80 percent (from 2003 levels) by 2020, and all new federal buildings must be carbon-neutral by 2030. The act also requires that sustainable design principles be applied to siting, design and construction.

The Act also promotes healthy, high-performance schools by providing grants to states, local governments and school systems to build energy efficient schools that utilize natural lighting and other energy features. It also dictates that the EPA is to study the effects energy efficient building features have on school aged children.

EISA's definition of high performance buildings expands to include those that integrate and optimize on a life cycle basis all major high performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality and operational considerations.

There are important technologies in the HVAC industry that can significantly increase performance, energy efficiency and occupant comfort and health, if implemented in school design.

HIGH PERFORMING HVAC SYSTEMS IMPROVE IAQ, ACOUSTICS AND THERMAL COMFORT

HVAC systems play a very large role in the performance of a building. Not only do they provide thermal comfort (or discomfort), but they impact acoustics and indoor air quality. There are important technologies in the HVAC industry that can significantly increase performance, energy efficiency and occupant comfort and health, if implemented in school design.

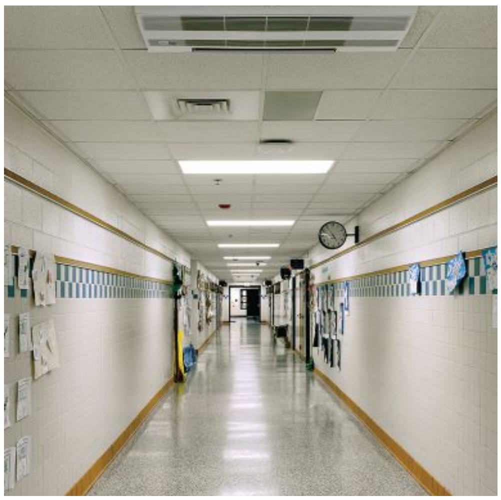
Indoor Air Quality

A high-performing HVAC system limits airborne toxins and humidity, which can lead to mold growth, a serious health concern. According to the EPA, asthma is a leading cause of school absenteeism and controlling exposure to indoor environmental factors such as mold, carbon monoxide, dust and pollen could prevent more than 65 percent of asthma cases among elementary school age children. A high performing air handling system can significantly improve air quality and ventilation rates, helping to maintain classrooms at optimal temperatures for comfort and focused learning.

Acoustics

Classroom acoustics and clear communication are an important, often neglected, aspect of the learning environment; up to 60 percent of classroom activities involve speech between teachers and students or between students. According to the Ceiling and Interior Systems Construction Association, classrooms in the United States typically have speech intelligibility ratings of 75 percent or less, meaning every fourth word is not understood.

HVAC systems often create distracting background noise in classrooms, which can inhibit reading and spelling ability, behavior, attention, concentration and academic performance. Noisy ventilation systems should be eliminated, minimizing the amount of disruptive outdoor and indoor noise affecting the classroom. Incorporating acoustical ceiling tiles, lined ductwork, and HVAC systems with vents placed appropriately are simple solutions to provide an environment where the student can hear well.



HVAC systems should use high efficiency equipment, be sized correctly to the estimated demands of the facility, and include controls that optimize system performance.

Thermal Comfort

Thermal comfort means that teachers, students and administrators are neither hot nor cold as they teach, learn and work. Comfortable indoor temperatures enhance productivity and keep students more alert. Good insulation techniques can help to keep a building in a desirable thermal state, as insulation reduces cooling and heating loads, improves occupant comfort, reduces noise transmittance and increases the building's overall durability.

Some ideas for improving insulation in a school building are to add insulation to the roof and ceiling, add or replace outdated insulation in wall cavities, and always insulate mechanical equipment, ducts and piping to decrease unwanted heat dissipation and improve the efficiency of the heating and cooling systems.

Energy Efficiency

A traditional HVAC system can consume up to two-thirds of the energy used in a school, but a system with high efficiency components substantially reduces energy costs. HVAC systems should use high efficiency equipment, be sized correctly to the estimated demands of the facility, the regional climate, and the age and structure of the school building, and include controls that optimize system performance. To further increase energy efficiency and minimize use of the HVAC system, the walls, floors, windows and roofs of the school should be as energy efficient as possible. The building envelope should integrate and optimize insulation levels, glazing, shading, thermal mass, air leakage and light-colored exterior surfaces.

To optimize energy savings, building systems should be simple to operate and maintain. Teachers should have control over the temperature, airflow, acoustics and lighting in their classrooms, and should be trained how to most effectively use them. In addition, regular maintenance inspections, performance monitoring and calibrations ensure that the systems continue to work effectively.

VRF systems are powerful, compact units that consume minimal energy, have a high coefficient of performance (COP) and contribute to maximum room comfort.

VRF HVAC TECHNOLOGY IMPROVES THE LEARNING ENVIRONMENT

The most up-to-date HVAC technologies should be employed for optimal performance, such as a system that uses variable refrigerant flow (VRF) technology. These systems take into account diversity of usage, occupancy, and solar gain parameters, and then deliver the right amount of refrigerant directly to the space to be conditioned, so that each zone in the system can have personalized comfort. The systems provide such precise indoor temperature control that desired temperatures can be maintained within 1 degree Fahrenheit.

VRF zoning technology can significantly improve energy efficiency, consistently producing 30 to 40 percent energy savings compared to conventional HVAC systems. With a zoned system, you only need to condition the spaces that are in use, which equates to virtual elimination of wasted energy. Inverter technology varies the compressor motor speed to match indoor space load requirements, delivering precise capacity to every zone in a building, ensuring total comfort and energy efficiency. This is compared to conventional HVAC systems with only two main states—ON and OFF; conventional systems are less efficient, less effective and less comfortable.

Zone Control

To effectively manage indoor conditions, space temperature can be measured at the indoor unit, within the space, or at the zone controller with remote sensing. The zone control is highly accurate, with indoor units and controllers that sense temperature, humidity, lighting and occupancy. A sensor scans the room and adjusts the airflow based on the temperature readings.

VRF zoning systems offer individual set point control to make it easy to meet each occupant's needs. Building managers or users can set and monitor operation, mode, temperature, fan speed and airflow direction, as well as create an operating schedule that's tailored to the needs of the occupants and the building. Intuitive controls monitor system functions and provide operation status information for easier diagnostics. This type of system could be very beneficial to schools, which must accommodate the needs of numerous occupants, as well as multiple classrooms and auxiliary spaces.

Noise Reduction

VRF systems are designed to provide the quietest possible operation for both indoor and outdoor environments. Because there is no noisy and bulky ductwork of a traditional HVAC system, the small and quiet system operations result in more comfortable occupants. Condensing units operate at decibels as low as 56 dB(A) and indoor units operate at decibels as low as 22 dB(A). The units are so quiet they can even be placed right under a window, in closets, on balconies or near rooftop amenities without worrying about noise interference. This is of great value in spaces that require minimal disruption like education facilities.

Condensing and Indoor Units

VRF zoning systems offer a variety of compact indoor and outdoor units. The condensing units are modular, allowing flexible placement and freeing up space. This modular system design eliminates the need for mechanical rooms and bulky equipment on the rooftop. Compact, indoor and outdoor units are also perfect for tighter, smaller spaces. Multiple options for indoor units meet varied room design and aesthetic needs, which is important for schools that have many different spaces for a variety of uses. Ductless units can be wall-mounted, ceiling recessed and suspended, and floor-standing. Concealed-ducted units include ceiling, vertical and floor-standing. Compared to large trunks of ductwork, the integrated return on ductless units saves a lot of valuable space.

A true comprehensive comparison of upfront HVAC costs includes more than equipment.

Reduced Installation and Maintenance Costs

A true comprehensive comparison of upfront HVAC costs includes more than equipment. There are potential hidden costs, such as consulting/engineering design costs; installation tooling, rigging and labor; potential electrical and/or structural modifications in a building; complexity of connecting outdoor and indoor equipment; and controls integration. VRF zoning systems effectively change the equation.

These types of systems take less time to install and require significantly less maintenance over time than conventional HVAC. VRFs come in two formats, two-pipe and three-pipe systems. In a heat pump two-pipe system all of the zones must either be all in cooling or all in heating. Heat Recovery (HR) systems have the ability to simultaneously heat certain zones while cooling others. This is usually done through a three-pipe design, with the exception of one manufacturer who only utilizes two pipes. In this case the heat extracted from zones requiring cooling is put to use in the zones requiring heating. This is made possible because the heating unit is functioning as a condenser, providing sub-cooled liquid back into the line that is being used for cooling. While the heat recovery system has a greater initial cost, it allows for better zoned thermal control of a building, as well as overall greater efficiencies.

Two-pipe VRF systems are engineered to be compact to simplify the installation process. They often fit in existing service spaces, eliminating the expensive tear-down and reconstruction often encountered with traditional options, thus saving the school money up front while delivering higher efficiency and ease of maintenance for years to come.

Two-pipe systems mean fewer piping and wiring connections which reduces labor and material costs. Labor costs are further reduced with VRF integrated controls. The lightweight/compact design of the outdoor units reduces the cost of rigging (cranes and lifts) and eliminates the need for structural roof reinforcement. By applying the VRF zoning principle of diversity, less outdoor capacity is needed, lowering equipment cost.

Finally, VRF systems have very efficient maintenance, which is of utmost importance to schools. Routine maintenance only involves simple, periodic filter changes or cleanings. Independent zoning in the modular systems means one zone can be serviced without taking the system offline or disrupting another zone. Intuitive controllers make operation and monitoring convenient with less time required for diagnosing comfort issues.

Independent zoning in the modular VRF systems means one zone can be serviced without taking the system offline or disrupting another zone.

SOLAR TECHNOLOGY

Other "outside of the box" renewable energy sources that could be incorporated into school design are photovoltaics (PV), ground source heat pump systems (GSHP), air source heat pump systems (ASHP) and wind turbines. Photovoltaic technology uses solar cells to convert sunlight directly into electricity. PV modules consist of thin layers of silicon, a semiconductor material that absorbs the sun's rays and turns them into electricity. When photons from the sun hit the photovoltaic cells in a solar panel, electrons in the solar cell are knocked loose from their atom, allowing the electrons to flow freely. Solar cells force these electrons to flow in a certain direction along a wire, creating a current, which is then drawn off the cell to create electricity that powers the school. A group of PV modules are typically combined in an array to generate electricity for a single structure; large numbers can be combined to form a power plant.

PV modules produce power anytime the sun is out. On cloudy days power output is considerably reduced. If fallen leaves, shadows or something similar cover a PV module, resistance increases at the affected area and overall power output decreases significantly. Some PV modules incorporate a bypass diode function that minimizes the effect of shadows on the unit's surface area.

QUIZ

1. Which act expanded the definition of high performance buildings to include those that integrate and optimize on a life cycle basis all major high performance attributes, including energy conservation, environment, safety, security, durability, accessibility, cost-benefit, productivity, sustainability, functionality, and operational considerations?
   a. Energy Policy Act of 2005 (EPACT)
   b. Energy Independence and Security Act of 2007 (EISA)

2. According to the Ceiling and Interior Systems Construction Association, classrooms in the United States typically have speech intelligibility ratings of _____ percent or less, meaning every fourth word is not understood.
   a. 25
   b. 50
   c. 75

3. True or False: A traditional HVAC system can consume up to two-thirds of the energy used in a school.
   a. True
   b. False

4. VRF zoning technology can significantly improve energy efficiency, consistently producing ______ percent energy savings compared to conventional HVAC systems.
   a. 10–20
   b. 20–30
   c. 30–40
   d. 40–50

5. True or False: Independent zoning in the modular VRF systems means one zone can be serviced without taking the system offline or disrupting another zone.
   a. True
   b. False

6. True or False: Photovoltaic technology uses thermal collectors to heat water and convert sunlight directly into electricity.
   a. True
   b. False

7. Which of the following operates by pumping water or refrigerants through underground pipes, where the ground remains at a relatively constant temperature of 50 to 60 degrees Fahrenheit?
   a. Ground source heat pump
   b. Air source heat pump

8. As of 2011, _____ percent of all jobs require a high level of knowledge in any one STEM field.
   a. 5
   b. 10
   c. 15
   d. 20

9. True or False: Knowledge of energy efficiency, alternative energy use, water conservation and sustainable building materials is important for occupations needing workers with STEM skills.
   a. True
   b. False

10. True or False: Hollis Montessori School is the First LEED Platinum Certified Independent School.
   a. True
   b. False

This article continues on http://go.hw.net/AR715Course4.
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MITSUBISHI ELECTRIC
COOLING & HEATING

Mitsubishi Electric Cooling & Heating is the leading brand of ductless mini-split and Variable Refrigerant Flow (VRF) technology in the United States. Our energy-efficient, award-winning M-Series, P-Series, and CITY MULTI® systems provide a wide variety of residential and commercial building solutions, including zone and whole building cooling and heating.

SUSTAINABLE EXTRUDED ALUMINUM TRIM PROFILES

DELIVER AESTHETICS AND DURABILITY

Presented by:

LEARNING OBJECTIVES

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

1. Identify the sustainability features of extruded aluminum architectural trim.
2. Summarize the aesthetic and environmental benefits of specifying extruded aluminum architectural trim.
3. Explore the profile and finish trim options that are available for use with fiber cement siding.
4. Discuss moisture management and the use of aluminum flashing when designing durable sustainable moisture-free structures.

CONTINUING EDUCATION

CREDIT: 1 LU

COURSE NUMBER: ARjuly2015.5

Use the learning objectives to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit http://go.hw.net/AR715Course5 and complete the quiz for free as you read this article. If you are new to Hanley Wood University, create a free learner account; returning users log in as usual.

By Karin Tetlow

"God is in the details," one of several iconic phrases attributed to Mies van der Rohe, continues to haunt architects. Whether the meaning is a disguised plea for creating ornamentation for buildings or adding a few more inches to a roof overhang, details are where architects can and do make a difference. With today's focus on green materials, detailing needs to meet both an architectural design aesthetic and sustainability requirements. Specifying trim for use with fiber cement siding is one instance where a knowledge of detailing can contribute to both.

DESIGN AESTHETIC

Manufactured to work as an integrated/complementary system with the major U.S. manufacturers of fiber cement siding, extruded aluminum profiles are available in a variety of choices. Their design, mostly driven by architects seeking cleaner details, adds a distinctive profile to interiors and exteriors of buildings. In addition, it breaks up the monotony of flat panel walls where the same siding products are used repeatedly. Installing aluminum trim rather than using wood trim or cutting and ripping fiber cement boards or panels is more convenient and saves time. "Using trim over panel joints becomes an architectural element and is a way of expressing the joints and defining their deliberate placement. It adds a level of architectural refinement," says Russell A. Hruska, AIA, principal and co-founder of Intexure Architects in Houston, Texas. In our climate, stucco often requires additional oversight to be correctly executed. Aluminum trim when used with fiber cement panels or lapped siding is more cost effective than stucco and provides long term durability while achieving our design aesthetic."

Constructed from 75 percent to 100 percent post industrial and post consumer scrap, extruded aluminum trim meets requirements for sustainability and can contribute to LEED® points. It may also be specified for interior or exterior use. Applications include an increasingly wide range of building types wherever fiber cement panels or lap siding is specified. In recent years extruded aluminum trim has begun to replace traditional wood 1x2 and 1x4 trim on single-family homes and is increasingly preferred for multi-family structures.

Extruded aluminum trim products are intended for design aesthetics. They do not necessarily include an exterior insulation and finishing system (EIFS), a type of building exterior wall cladding system that provides exterior walls with an insulated finished surface. Manufacturers usually state if their product does or does not include an insulation system. Since some extruded aluminum trim products on the market incorporate an EIFS, design professionals should note the exact description of each manufacturer's product and its performance expectations. As a general rule extruded aluminum trim products that are not part of an EIFS system are not designed or intended to be used in conjunction with an EIFS or similar system.

Nor do architectural trim profiles form a complete moisture management system. Always a critical feature of construction, a moisture management system is the province of the architect and builder who are responsible for designing and installing a code compliant building envelope. Again, manufacturers usually point out that extruded aluminum trim alone does not include a complete moisture management system, despite the fact that trim is designed with drain dams for vertical runs and shingle fashion for horizontal profiles. Some manufacturers do, however, supply moisture management products that complement their trim line and additionally help meet code requirements.

Design professionals are also advised to consult with the siding manufacturer for "best practice" applications of extruded aluminum trim product in order to ensure color, dimensional and thickness match.

Extruded aluminum adds durability and longevity to construction that other trim materials such as galvanized steel and polyvinyl chloride (PVC) lack.

PREFABRICATED TRIM MATERIALS

Extruded aluminum adds durability and longevity to construction that other trim materials such as galvanized steel and polyvinyl chloride (PVC) lack (see sidebar Benefits of Extruded Aluminum).

Galvanized steel

While initially less expensive than extruded aluminum, galvanized steel is less durable. The use of bare mill galvanized steel and aluminum flashing in direct contact with most claddings will increase chances of a chemical reaction, causing wear and break down on both products.

Polyvinyl chloride (PVC)

The third most widely produced and least expensive plastic also has limitations compared with extruded aluminum. One manufacturer of extruded aluminum trim profiles developed and manufactured PVC trim profiles to use with fiber cement siding and soffits, and still does. But through learned experiences and public demand, it began converting its profiles into more durable extruded aluminum. One hundred percent vinyl trim is susceptible to swelling and buckling when exposed to direct sunlight. Moreover, PVC trim painted dark colors, which is increasingly the choice of architects and developers, may cause the product to warp. This comes about because excess solar heat may be absorbed, particularly in hot climates, subjecting the PVC to distortion due to extremes of thermal expansion and contraction. Paint adhesion loss, blistering and peeling may also result.

Characteristics of extruded aluminum trim

Characteristics of extruded aluminum trim include:

- Adds a design aesthetic to a wide range of building types.
- Offers multiple profile choices.
- Typically fabricated from custom die-extruded heavy duty 6063 T-5 aluminum alloy with a coating that protects against harsh weather conditions and allows for paint adhesion.
- Typically designed to match color, metal thickness and dimensions of the country's major cementitious siding manufacturer.
- Available in anodized, standard color palette, or ready to paint finishes.
- Sustainable material, such as 75 percent to 100 percent post industrial and post consumer scrap, can contribute to LEED® points.
- Replaces time-consuming cutting and ripping of fiber cement panels or boards for trim use.
- Can be used for interior and exterior weather conditions.
- Highly durable and will long outlast caulk.
- Poses no health or physical hazard. (Aluminum trim products are defined as "articles," by the Occupational Safety and Health Administration's (OSHA) and are therefore exempt from the requirement of publishing material safety data sheets.)

CHARACTERISTICS OF EXTRUDED ALUMINUM

The most abundant mineral in the earth's crust, aluminum is derived from bauxite, which is mined from the earth. After processing, the resultant alumina undergoes a smelting and alloying process that produces solid logs of cast metal from which extruded aluminum shapes or profiles are made. Most extruded shapes for architectural use are fabricated from AA 6063, an aluminum alloy with magnesium and silicon as the alloying elements. Type 6063-T5 Aluminum, commonly referred to as the architectural alloy, has a very smooth surface and is the best alloy suited for anodizing applications. The T5 designation indicates it has been artificially aged and moderately heat-treated. Aluminum extrusion is a highly versatile metal-forming process that has a wide array of physical characteristics.

These include:

- Can be recycled and retains a high scrap value. It can be recycled indefinitely without losing any of its superior characteristics, making it especially appealing according to both environmental and economic criteria.
- Lightweight. Weighs about one-third of most other metals which makes it easier to handle and less expensive to ship.
- Strong. Profiles can be made as strong as needed for most applications. Having the strength of a rigid metal prevents swelling and buckling.
- Weather resistant. Cold-weather applications are particularly well served by aluminum because, as temperatures fall, aluminum actually becomes stronger.
- Fire resistant.
- Does not rust because aluminum is protected by its own naturally occurring oxide film.
- Resilient. Can spring back from the shock of impact.
- Not combustible. Even at extremely high temperatures, it does not produce toxic fumes.
- Different finishes available. Can be finished with liquid paint (including acrylics, alkyds, polyesters and others), powder coatings and anodizing.
- Seamless profiles. Complex shapes can be realized in one-piece extruded aluminum sections without having to employ mechanical joining methods. The resultant profile typically is stronger than a comparable assemblage and less likely to leak or loosen over time.
- Can be joined in many ways. Extruded aluminum sections can be joined by all major methods in use today.
- Economical. Relatively inexpensive and may not require long lead times. Even short-run prototypes can often be produced at moderate cost.
- Dimensional tolerance. Can be easily manufactured to accepted standard dimensional tolerances.

CASE STUDY 1: EXTRUDED ALUMINUM TRIM IN MULTIPLE FINISHES

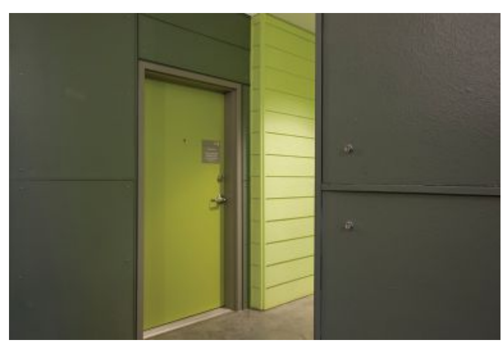
Peak Preparatory School, Dallas, TX

Extruded aluminum trim painted black accents the reveals in the façade to bring variation to the fiber cement panel.

Peak Preparatory School in Dallas, Texas, developed for Uplift Eduction, and designed by HKS, Inc, is a steel frame construction with a combination of brick and fiber cement panel and lap sidings. Pre-manufactured extruded aluminum trim in multiple finishes was used to accent corners in the lap siding and to create a varied and interesting façade with the fiber cement panel.

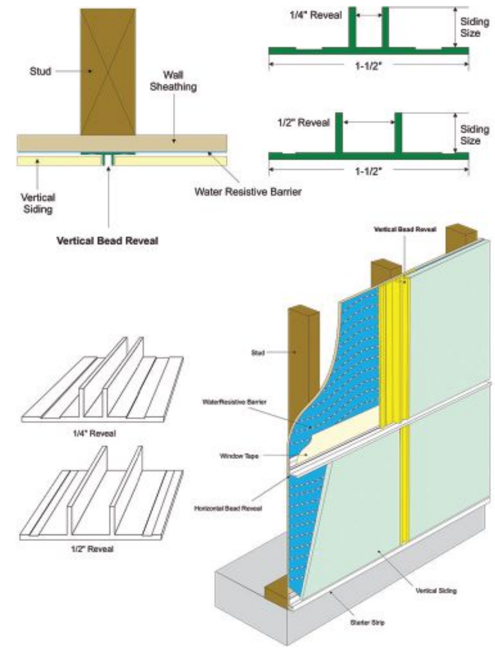
CASE STUDY 2: MANY USES OF ALUMINUM TRIM FOR NEW HOPE HOUSING, INC.

Multi-family housing has extruded aluminum trim above windows and doors, between fiber cement siding and brick, and on inside corners.

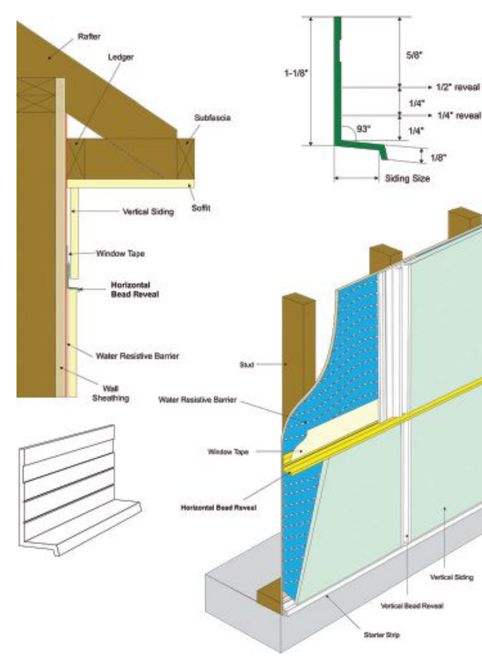


4415 Perry Street, Houston, TX

The new 4415 Perry Street affordable housing facility in Houston, Texas, developed by New Hope Housing, Inc, and designed by Val Glitsch, FAIA, LEED® AP, Houston, is three-story wood construction on a concrete foundation. The exterior is a mix of brick, fiber cement panels and lap siding. Pre-manufactured aluminum trim was placed above, below and between the different types of fiber cement siding, above windows and doors and below the siding over brick. It also was used for both inside and outside corners and where panels meet the siding boards. "What is the alternative to pre-manufactured trim? Wood trim gives a very different aesthetic. It is bulkier and, for water infiltration concerns, can only be used for vertical joints," says Glitsch. "We could have had a metal shop make up the trim pieces, but that's not always a good way to get a quality, consistent, cost-effective product. And the heavier-weight 'extreme trim' we used makes it easier to install the product properly."



Vertical bead trim with typical dimensions serves as an expansion joint between panels. Drawings provided by Tamlyn



Horizontal bead is designed to work with vertical bead trim for use with fiber cement or wood panels and not for use with EIFS systems or similar products. Drawings provided by Tamlyn.

TRIM PROFILES

Typically fabricated from custom die-extruded heavy duty 6063 T-5 aluminum alloy, trim profiles have a coating that protects against harsh weather conditions. Since siding panels will expand and contract due to changes in temperature, a 1/8-inch gap should be allowed between panels and trim.

Manufacturers typically warrant defective-free products for a period of 10 years for the original purchaser unless otherwise stated for the specific product ordered. They are further warranted as to adequacy of design, provided products are properly specified and installed.

Examples of trim profiles include:

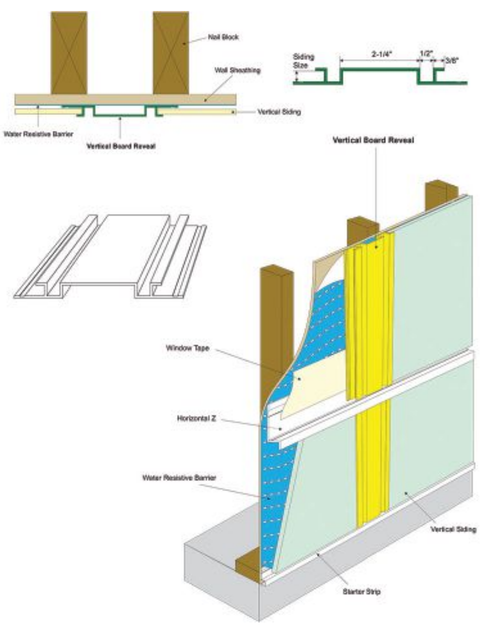
Vertical and horizontal bead trim

Vertical and horizontal bead trim each serve as an expansion joint between panels. Horizontal bead trim is designed to work as a system with vertical bead trim. Both work with all panel profiles and finishes.

These aluminum trim profiles are not part of an Exterior Insulation Finishing System (EIFS) and are not designed or intended to be used in an EIFS or similar system. They are designed for fiber cement or wood panels only.

Vertical board reveal

This profile provides a broad vertical accent between siding panels while not protruding beyond the plane of the façade. In addition, it serves as a rustproof flashing between the siding and the building sheathing. Typical standard length is 10 ft.



This profile provides a broad vertical accent between siding panels while not protruding beyond the plane of the façade. Drawings provided by Tamlyn.

This article continues on http://go.hw.net/AR715Course5. Go online to read the rest of the article and complete the corresponding quiz for credit.

QUIZ

1. Applications of extruded aluminum trim may be specified
   a. with fiber cement cladding
   b. in a variety of profiles
   c. to give buildings a distinctive design aesthetic
   d. all of the above

2. Installing aluminum trim compared with installing wood trim is
   a. more convenient but time consuming
   b. less convenient but saves time
   c. more convenient and saves time
   d. less costly but time consuming

3. Aluminum trim products always include an EIFS.
   a. True
   b. False

4. Extruded aluminum trim is typically fabricated from:
   a. custom die-extruded 6063 T-5 aluminum alloy
   b. 10%–20% post industrial and post consumer scrap
   c. recycled galvanized steel and aluminum alloy
   d an alloy containing copper and magnesium

5. Architectural aluminum
   a. has a very smooth surface suited for anodizing applications
   b. can be recycled
   c. is strong, lightweight and does not rust
   d. all of the above

6. Code requirements regarding the use of flashing are found in
   a. IRC Section R703.8 and ICC Section 1405.4
   b. ICC Section 703 and IRC 1405.4
   c. ICC Section 1403.2 and 1705.4
   d. IRC Sections 813 and 214

7. Aluminum flashing reduces moisture penetration by
   a. being nailed to the siding
   b. helping to hold a tighter seal against the siding
   c. reacting with the fiber cement of the siding
   d. never being used where two planks butt together

8. Using housewrap that provides drainage space between the housewrap and exterior sheathing
   a. allows water or moisture to drain
   b. needs additional installation steps
   c. requires redesigning the wall/siding assembly
   d. retains water behind the exterior sheathing

9. Typically available aluminum trim finish options include
   a. primed ready-to-paint only
   b. fade resistant standard colors only
   c. primed ready-to-paint, standard colors and anodized finish
   d) clear and bronze anodized finishes that never vary

10. Extruded aluminum trim can help contribute to LEED® credits in the following categories:
    a. Indoor Environmental Quality (IQ) and Materials and Resources (MR)
    b. Water Efficiency (WE) and Indoor Environmental Quality
    c. Materials and Resources: Recycled Content and Regional Materials
    d. Materials and Resources: Building Reuse

SPONSOR INFORMATION

TAMLYN®

XtremeTrim® is a line of extruded aluminum profiles for multiple panelized systems. With multiple options in reveals and profiles ranging in sizes from 5/16" to 1" and the ability to create custom extrusions we are in the business of providing the design community with solutions.

ADVANCED ENVIRONMENTAL FINISHES FOR WINDOWS & DOORS

FIELD PERFORMANCE AND THE APPLICATION PROCESS

Presented by:

Loewen

LEARNING OBJECTIVES

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

1. Discuss the characteristics of painted and anodized coatings.
2. Understand the painting application process to ensure a quality product is provided.
3. Review the anodize application process.
4. Examine considerations for architectural specifications for painted and anodized finishes.

CONTINUING EDUCATION

CREDIT: 1 LU

COURSE NUMBER: ARjuly2015.6

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By Paige Lozier

INTRODUCTION TO FENESTRATION COATINGS

For clients who choose to forgo the natural wood look, cladding can be selected to cover the exterior of window and door components. Aluminum is the most common metal selected, and when it is processed, it is either extruded to shape or is roll-formed, cut, and folded to shape. Of the two processes, extruded aluminum has superior strength, profiling, detailing and stability. When viewed microscopically, extruded aluminum also has a much more uniform surface, allowing for even paint distribution. A roll-formed product has more surface bulges and depressions, resulting in uneven paint distribution, which may lead to spotting as the finish ages.

It is important to note that in large windows and doors, like the expansive lift slide style, inferior products may be manufactured with roll-form aluminum over softer wood base materials. Over time these products can bend, twist, and eventually compromise the air sealing around the frame. In some situations poorly designed frames can make opening and closing windows and doors difficult, or even impossible.

Specifying windows and doors clad in extruded aluminum with a high performance coating will ensure the most durable product for a project. All extrusion coatings that are manufactured to protect aluminum building components such as windows and doors fall into one of the American Architectural Manufacturers Association's (AAMA) specifications, which we will discuss in a bit.

Untreated aluminum is dull gray, which is called a mill finish, but the color can be changed by either painting or anodizing the metal. The most commonly used paints for aluminum cladding are 50% and 70% polyvinylidene fluoride (PVDF), also called fluoropolymer paints. While the 70% PVDF paint formula is an industry standard, some manufacturers enhance the coating with ceramic pigmentation. The enhanced PVDF offers greater resistance to weathering, fading and especially chalking, which is the gradual appearance of white chalklike film common on aging painted aluminum.

With their excellent appearance and durable qualities, these paints meet the specifications of AAMA 2605 Superior Performance Organic Coatings on Aluminum Extrusions and Panels, which is the most stringent standard defined for extruded aluminum clad windows. This standard stipulates that painted finishes retain color and maintain chalk resistance for ten years and offer the best protection against cyclic corrosion (prohesion), pollutants, corrosion, and other harsh conditions, providing the most durable coating to ensure the long life of a building project.

Pigments are added to paint to provide color and can be blended to create a desired color to suit the aesthetics of an application.

WHAT IS PAINTING?

To get down to basics, painting is the application of a protective, decorative organic coating to the surface of a substrate. Pigments are added to paint to provide color and can be blended to create a desired color to suit the aesthetics of an application. Types of pigments include tints and metallics. Pigments also provide opacity to UV light by either absorbing or reflecting light, which often ensures a longer life for the coating. If a resin chosen for a coating system is UV transparent, the pigment must provide UV blocking protection for the primer layer. Pigment can affect a coating in two ways; it can increase porosity which makes the coating less corrosion resistant, or increase hardness and surface roughness which lowers the coating's gloss level.

There are two different painting methods, spray coating and coil coating. Spray coatings are electrostatically applied to pre-formed aluminum components such as windows and doors. In the spray coating method coatings can be sprayed on in a horizontal paint line or vertical paint line. Automatic spray bells are a typical method of applying paint, as the angle of the bells can be continually adjusted until all surfaces of the material are evenly covered.

Coil coating is a continuous, automated process for coating metal BEFORE fabrication into end products. The steel or aluminum substrate is delivered in coil form from the rolling mills. Coil coatings are roll-coated onto aluminum and clad steel sheet metal. The metal coil is positioned at the beginning of the coating line, and in one continuous process, the coil is unwound, pre-cleaned, pre-treated, pre-primed, and pre-painted before being recoiled on the other end and packaged for shipment. This process happens at up to 700 feet per minute. The sheets are then post-formed into architectural components.

Not all paints require a primer coat or clear coat, but bright colors such as red often require a top coat.

PAINTING—A MULTI-STEP PROCESS

Painting is a multi-step process that must be followed in order to produce a viable end product. The steps are racking, pre-treatment, painting, curing and quality assurance. Racking is achieved in various ways; materials are either laid on horizontal racks or hung vertically. The pretreatment process is crucial to a high performance finish and is also a multi-stage process. First, cleaning removes surface contaminants and water-soluble oil. Next a conversion coating layer is applied, which ensures adhesion of the paint and adds corrosion protection. The conversion coating can either use a chrome or chrome-free process. The higher AAMA specifications use chrome, which has consistently proven to perform better than a chrome-free process.

Chromium-based conversion pre-treatments have been used because they provide outstanding corrosion protection on aluminum, as well as excellent adhesion properties under organic coatings. But, due to the increasing cost of chrome disposal, as well as its environmental and health ramifications, non-chrome coatings are becoming increasingly popular in the aluminum finishing industry.

Non-chrome coatings will provide corrosion resistance and aid in the adhesion of organic coatings under a wide variety of process conditions, and are capable of meeting all AAMA specifications. The success of the final coating when using non-chrome conversion pre-treatments is dependent on the weight of the coating, which will be specified by the manufacturer.

Depending on the paint being applied, there may be a primer applied first, then the pigmented coating, and possibly a clear topcoat as well. Not all paints require a primer coat or clear coat, but bright colors such as red often require a top coat. The use of a clear topcoat will improve the durability of any coating, whether "borderline" bright colors or otherwise, because as clear resin degrades there are no exposed pigment particles to effect gloss retention values, fade, or cause anything but a slight chalk. Its presence adds an additional barrier protecting the color coat beneath. It's not necessary to apply a clear coat to meet AAMA 2605, but if the end goal is to extend durability, then application of a clear coat should be considered.

Curing of the paint is achieved through baking in a convection oven. The precision of the temperature settings ensures a consistent color and gloss. The material must reach peak metal temperature, which is between 350 degrees Fahrenheit and 450 degrees Fahrenheit depending on the paint type. During curing the solvents evaporate, leaving the pigment and resin on the substrate. Resin surrounds the pigment particles, binding them to the substrate.

Non-chrome coatings will provide corrosion resistance and aid in the adhesion of organic coatings under a wide variety of process conditions, and are capable of meeting all AAMA specifications.

Unlike quality control of anodized coatings, which is very manual, there are electronic tools that can be used for quality checks on painted surfaces.

QUALITY CONTROL TESTS

Quality control tests are conducted several different ways. Quality control inspects the Mil thickness (actual thickness of the paint surface) as well as the overall color and gloss consistency. Unlike quality control of anodized coatings, which is very manual, there are electronic tools that can be used for quality checks on painted surfaces.

A spectrophotometer instrument measures color to ensure the project material matches the approved color standard. A BYK-Gardner Color-Guide™ Gloss is a unique instrument that simultaneously measures color and gloss to make sure the material meets the specification.

Test sample panels of the painted product can be run at the same time as the project material batch. The AAMA specification tests are conducted on the sample panels to assure a quality product; test results should be kept on file so they can be referenced in the event of a job site issue. The samples are tested for:

- Impact resistance (ability of the finish to withstand being hit).
- Adhesion, which is tested by immersing the painted product in boiling water.
- Resistance to mortar application.
- Acid resistance.
- Overall Mil thickness of the surface.
- Pencil hardness.

Other panels are set up on a test fence in South Florida at a 45 degree angle for a prescribed number of years, facing directly into some of the harshest sun and environmental exposure, to check for chalk and fade when exposed to the sun and elements. A portion of the panel is protected so the original finish can be referenced for comparison. One year on the test fence equals approximately 2 ½ years of normal exposure. 70% Fluoropolymer painted panels cannot chalk more than 5 Delta E's over a 10 year period. These are critical factors to assure a long-lasting and maintenance-free finish on architectural products in harsh environments.

ENVIRONMENTAL CONSIDERATIONS OF PAINT

In order to be a good steward of the environment, the applicator should ensure that all VOC's, chrome waste and wastewater are captured and destroyed rather than being allowed to get into the air or waterways. Solvent vapors, which contain VOCs, should be sprayed and cured in a 100% enclosed capture area. They are then routed to and destroyed by a thermal oxidizer. All paint-related waste can be removed from landfill by fuel-blending and reusing the waste as heat energy. The applicator can also utilize a paint solvent recycle program.

In order to be a good steward of the environment, the applicator should ensure that all VOC's, chrome waste and wastewater are captured and destroyed rather than being allowed to get into the air or waterways.

PAINT SPECIFICATIONS AND PERFORMANCE

When people describe paint systems, they are typically referring to the resin system incorporated in the paint. The resin system determines the properties and performance of the paint. A typical gallon of 70% fluoropolymer (PVDF) liquid paint is 10% pigment, 20% resin and 70% solvent. Most of the volume is solvent, which flashes off during the curing process. 70% fluoropolymer means that 70% of the binder/resin is a fluoropolymer. 50% fluoropolymer paint means 50% of the binder/resin is a fluoropolymer. With baked enamel, 100% of the resin component is acrylic or polyester.

AAMA specifies paint by different levels of performance from color, chalk and gloss retention, to salt spray resistance.

AAMA 2603 PAINT SPECIFICATION

AAMA specifies paint by different levels of performance from color, chalk and gloss retention, to salt spray resistance. AAMA 2603 is the lowest of the standards and is used mainly for interior applications. Baked enamel paints meet the AAMA 2603 specification. AAMA 2603 baked enamel coatings are harder than the PVDF coatings and are used quite often for interior application where color retention is not required. These paints are less expensive than PVDF paints, but have poor resistance to color fading, chalking and gloss retention, as well as fair chemical resistance. Note that manufacturers would never recommend using windows and doors that only offer an AAMA 2603 paint specification.

AAMA 2605 finishes exhibit outstanding resistance to humidity, color change, chalk, gloss loss and chemicals.

AAMA 2604 PAINT SPECIFICATION

The AAMA 2604 paint specification is an intermediate specification for performance. A typical paint to meet this specification would be a 50% fluoropolymer, which provides improved color fastness and overall performance. This finish will provide good color and gloss retention as well as good hardness and reasonable abrasion resistance at a moderate cost. A limitation of a 50% fluoropolymer coating is its limited gloss range, which is from 25% to 35% reflectance. Cost-sensitive exterior applications such as storefronts, doors and high traffic areas are typical for this coating.

Note that when you see the names Kynar and Hylar these are not finished paints; they are trade names for the PVDF resin used in high-performance fluoropolymer paint coatings.

AAMA 2605 PAINT SPECIFICATION

The overall performance of a coating improves as the percentage of PVDF in the paint increases. AAMA 2605 is the high-end exterior specification. A typical paint to meet this specification is a 70% fluoropolymer. While 70% PVDF paint is a better performing finish, it is also a much softer finish. Because of this softness some manufacturers use blue tape on clad finishes to protect the finish during manufacturing and installation. These finishes exhibit outstanding resistance to humidity, color change, chalk, gloss loss and chemicals. Limitations are limited gloss range (25–35% reflectance), fair hardness and higher cost. Typical applications for this finish are exterior products and large monumental architectural projects.

WARRANTY INFORMATION

Typically, standard warranties look at film integrity, chalk, fade of a coating and gloss retention. These are primarily the result of a breakdown of the resin system, although organic pigments in the system can also contribute to degradation. Therefore, film integrity is determined by the resin system used; polyvinylidene fluoride (PVDF), silicone modified polyesters (SMP) or polyester. As the resin system degrades the coating surface gets rougher and gloss decreases.

It is interesting to note that different paint manufacturers and applicators offer different warranties for a set period of time based on the type of pretreatment used. Because chrome is considered the best type of pretreatment overall, fluoropolymer paint suppliers promote chrome phosphate pretreatment for the maximum corrosion protection available. With chrome pretreatment, manufacturers typically offer up to a 20-year warranty including adhesion. If a non-chrome pretreatment is used, a manufacturer may not offer a warranty on seacoast projects, and only a 10-year warranty on other projects, or they may require additional testing and a chrome primer to receive a 20-year warranty that includes adhesion. Window and door manufacturers who offer considerably longer warranty than the industry norm are bearing the cost and risk associated with these warranties 100% on their own.

QUIZ

1. True or False: Extruded aluminum has a more uniform surface than roll-form aluminum, allowing for even paint distribution.
   a. True b. False

2. Which coating meets AAMA 2605 Specifications?
   a. 70%PVDF b. 50% PVDF
   c. 10% PVDF d. Anodized

3. True or False: Spray coating is applied before aluminum sheets are fabricated into end products.
   a. True b. False

4. True or False: Chromium-based conversion pre-treatments have been used because they provide outstanding corrosion protection on aluminum, as well as excellent adhesion properties under organic coatings.
   a. True b. False

5. True or False: 70% Fluoropolymer painted panels cannot chalk more than 5 Delta E's over a 10 year period.
   a. True b. False

6. True or False: Chalking is caused by a degradation of the resin systems at the surface of the finish, due predominantly to ultra violet rays.
   a. True b. False

7. Which process produces an oxide film that is uniform, hard and protects the rest of the aluminum substrate from deterioration?
   a. Painting b. Anodizing

8. Which of the following is a benefit of etching aluminum before anodizing?
   a. Hide superficial scratches b. Allow for use of recycled billet
   c. Lower gloss level to reduce sunlight glare d. All of the above

9. True or False: In colored anodizing, the longer the component is immersed, the darker the color.
   a. True b. False

10. Which of the following is the AAMA specification for anodizing?
   a. AAMA 2605 b. AAMA 611-12

SPONSOR INFORMATION

Loewen has developed a reputation for windows and doors that are distinctive and also cutting edge in their functionality. Loewen products offer performance, to keep homes comfortable and energy efficient, and strength to protect against the worst that nature can deliver. Blending modern engineering and custom craftsmanship we achieve uncommon strength and dramatic designs.

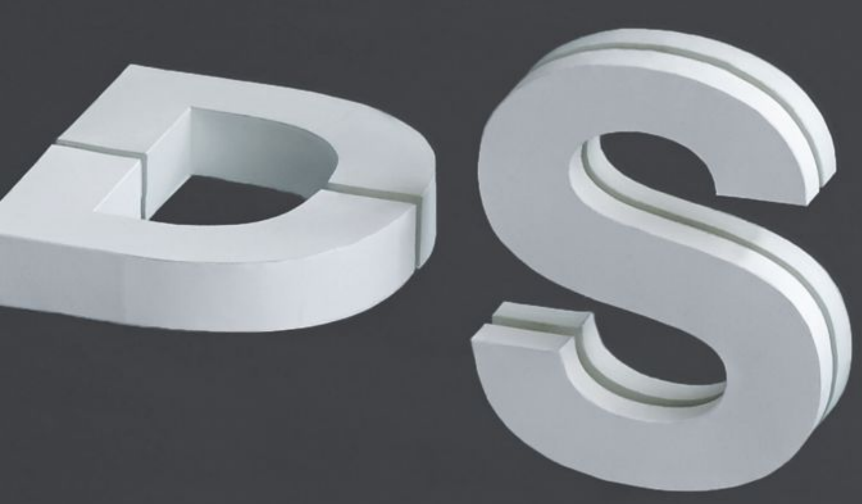
This article continues on http://go.hw.net/AR715Course6. Go online to read the rest of the article and complete the corresponding quiz for credit.

9th Annual

INTRODUCTION BY WANDA LAU
TEXT BY COURTNEY HUMPHRIES AND JENNY JONES
LETTERING BY RAMON CARRETÉ

Research can be hard to justify, even in an industry that prides itself on results. Regardless of whether success is measured in portfolio-perfect pictures or kilowatts of energy savings, innovation in architecture wouldn't happen without individuals willing to put themselves out there.

It is this dogged spirit of purpose-driven risk-taking that jurors Marc Fornes, Joyce Hwang, AIA, and Steven Rainville, AIA, chose to celebrate in this year's R+D Awards. From 120 submissions, they identified nine projects—one first award, two awards, and six citations—crafted by teams that are blazing trails in the built environment, with little more than conviction as their guide.



> *Juror bios and project credits for the winning entries can be found on page 118.*

First Award
Pulp Pavilion
Ball-Nogues Studio

CHRIS MILLER

Since 1999, the Coachella Valley Music and Arts Festival has drawn the rich and the famous to the Southern California desert for a six-day party packed with stunning installations that give the live bands a run for their money. For Los Angeles design firm Ball-Nogues Studio, the event was ideal for debuting a building material it had been developing for years: recycled-paper pulp.

The inexpensive, abundant waste material has been used in everything from disposable drink trays to furniture and sculpture, but Ball-Nogues wanted to go further—much further. "We didn't begin with a specific architectural objective," says principal Benjamin Ball, ASSOC. AIA. "We wanted to see where the experiments would lead us."

The studio started with shell structures. After mixing a slurry made from paper pulp and water, they used a homemade pressure sprayer to apply it to objects, tensioned fabrics, and even a Volkswagen Beetle, and then allowed it to harden.

Eventually, Ball says, "we had this intuition that we could spray the pulp over matrices or lattices of string." By suspending rope between fixed armatures and adding layers of slurry, they could create a rigid, self-supporting structure. The rope gave the composite material tensile strength while the hardened pulp provided compressive strength. Weaving the cordage between fixed armatures, however, yielded the strongest structures. The studio could also produce structures that ultimately are in compression by flipping the entire assembly upside down.

For the 2015 Coachella festival, Ball-Nogues designed a pavilion made of seven 20-foot-tall woven "trees" that joined together in a latticed roof. To ensure their design could endure the highly public venue, they ran multiple failure tests on mock-ups to understand the composite material's mechanical and structural properties. A finite element analysis of the entire pavilion helped simulate its performance under live and wind loads.

Construction took place near the festival site in Indio, Calif. Seven team members hand-wove jute rope around a removable metal-and-wood truss to create the initially upside-down trees. From the extensive experimentation and mock-ups, Ball says, "each of our staff became a specialist in a specific rule related to weaving" such as the density, porosity, and rope length within a given part of the tree.

The team sprayed 12 layers of paper pulp onto the ropes. Each layer was dyed with a different pigment, which became an indicator of how many layers each fiber had accumulated. Additional finish coats enhanced the structure's multicolor effect. Cranes transported the trees from the staging area to the site, where the team flipped and anchored them, and then removed the trusses.

The pavilion was a hit. Covering 1,300 square feet, it offered a shady and joyful respite from the raucous event. After the event, but still at Coachella, Ball-Nogues and their structural engineer conducted

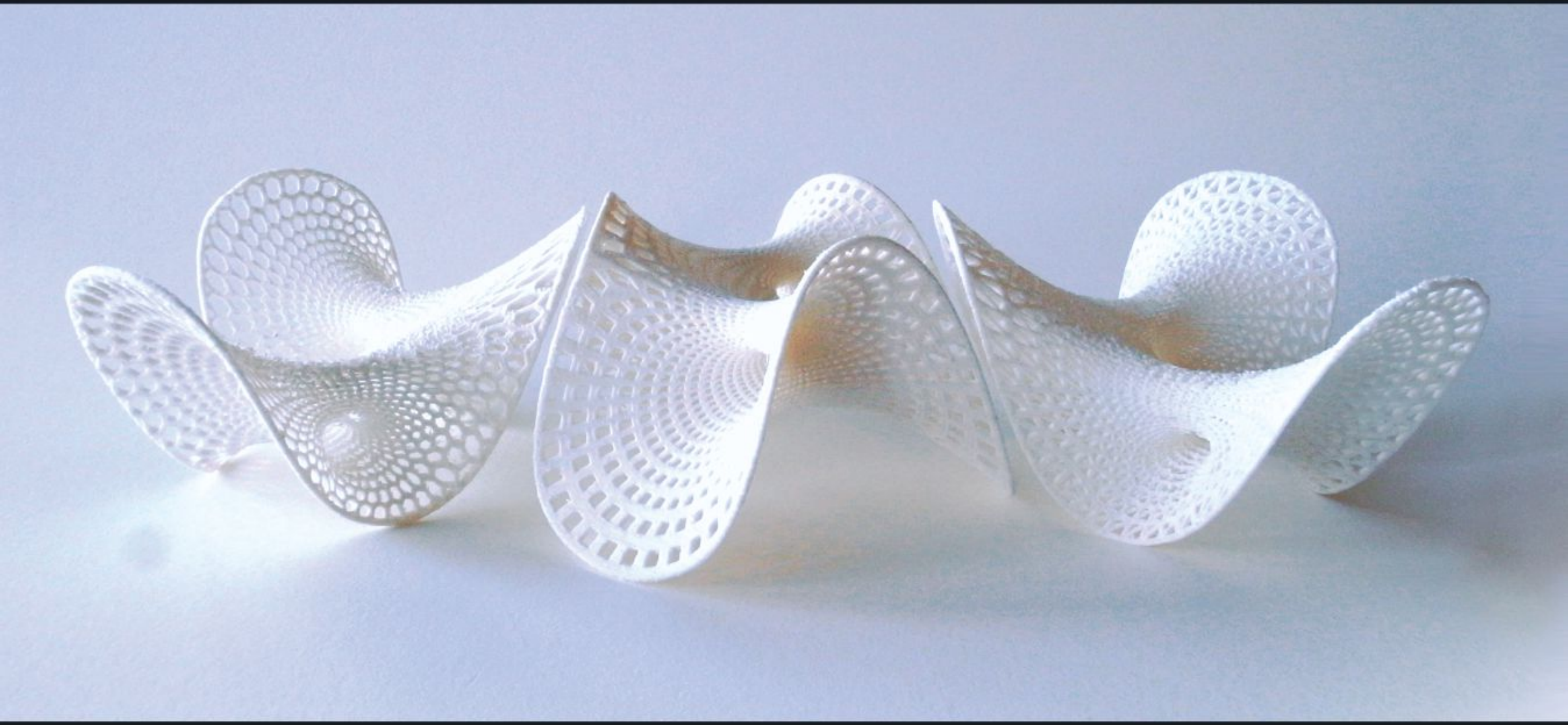
RAFAEL SAMPAIOROCHA



destructive tests with the pavilion to validate the hypotheses of its properties. The pavilion was then sent through a wood chipper and composted.

The project's innovative design, ambitious scale, and novel use of a recycled material wowed the jury. "The team took a huge risk," juror Steven Rainville said. "I've never seen this before." Juror Marc Fornes appreciated the studio's approach to discovery. "It's fresh and exciting," he said. "It drives you to go out and do research."

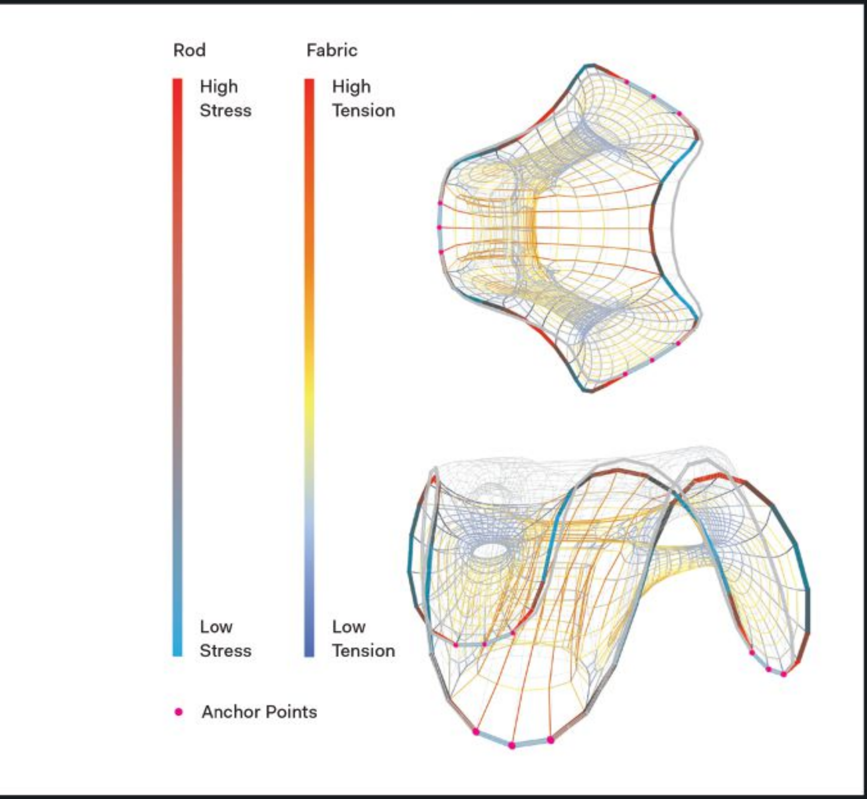
Ball-Nogues' co-principal Gaston Nogues says the technique can be used for indoor structures or as a temporary shelter—but only in dry climates, for now. In its current formulation, the composite material would dissolve in a rainstorm. With additives and waterproof coatings, however, it may be possible for future structures to withstand the elements. Juror Joyce Hwang, for one, wants Ball-Nogues to continue their exploration. "I can't wait to see another project made with the same method," she said. —C.H.



Award:
Pure Tension Pavilion
Synthesis Design + Architecture

To showcase its high-tech V60 model, Volvo Car Italia wanted a exhibition pavilion that was iconic, portable, easy to assemble, and suggestive of the vehicle's three modes of propulsion: diesel, electric, and hybrid. Synthesis Design + Architecture (SDA), in Los Angeles, won the international design competition by tacking on two requirements of its own: The pavilion had to charge the car's battery and fit inside the back of the V60 for storage. In short, it would become a practical, essential accessory that embodies the car's sustainability message.

Inspired by the lightweight, tensile membrane roofs of Frei Otto, SDA founder and principal Alvin Huang, AIA, and his team explored potential configurations for the pavilion using Grasshopper plug-in Kangaroo as well as through physical models built with wire and nylon stocking. The team added visual interest to a conventional tent-form with the pavilion's three apices, a nod to the V60's three modes of operating. To add stability and lift to ensure



CATERINA MOSCA

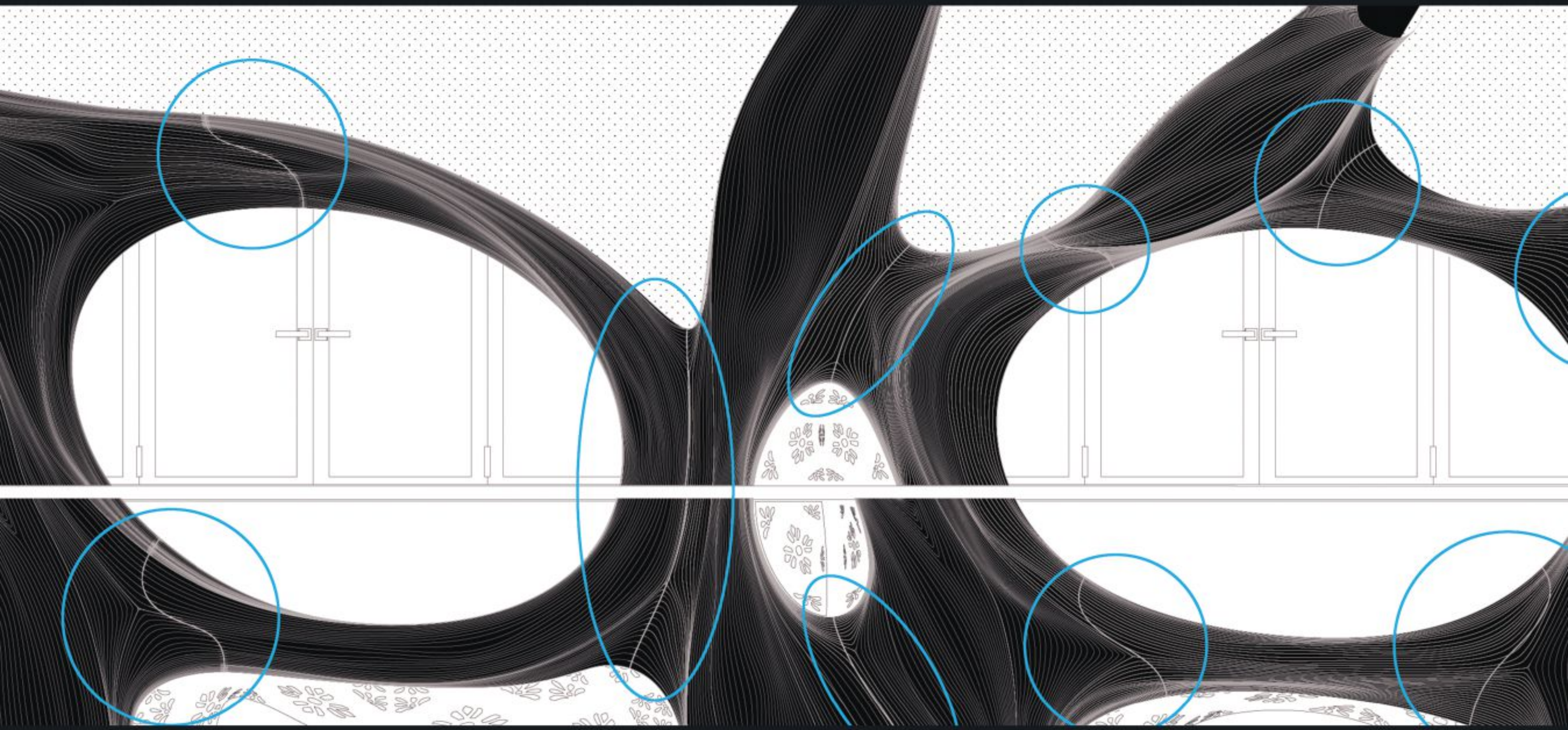
clearance for bystanders, the team introduced two catenoid tunnels in the membrane.

SDA had four months to turn its design concept into reality. It collaborated with the Los Angeles office of BuroHappold Engineering and Elgin, Ill.–based Fabric Images to develop a frame of 24 pre-bent 3-inch-diameter aluminum pipes that slip-fit together and through neoprene sleeves in the pavilion membranes much like tent poles. The team also simplified the frame's geometry into five arcs that create what Huang says is a hybrid between a hyperbolic paraboloid and a minimal surface.

Next came enabling the pavilion to harvest solar power. The firm created a heat map to determine which thin photovoltaic–panel layout would capture the most solar energy, using Rome as the test site because the pavilion would debut in Italy. They then hand-stitched the two curvilinear fabric membranes from a series of flat pieces, and stitched the 252 flexible solar panels to the mesh, tucking the wires into fabric channels. "It was a highly digital design process with a highly manual assembly process," Huang says.

The prototype fits into two 65-inch-by-15-inch-square cases and can be assembled and dismantled by two people in less than an hour. After piecing the frame together, the users would zip the neoprene sleeves around it, and then zip together two vinyl-encapsulated, polyester-mesh membranes to create the final structure. The aluminum frame pushes outward while the tensioned skin pulls inward, holding the pavilion's form in equilibrium.

Though juror Steven Rainville was initially lukewarm to the project's marketing focus, he respected its multifunctionality. Overall, the design and fabrication process captivated the jury. "The pavilion has a magical lightness," juror Marc Fornes said. SDA is currently refining the pavilion's design, in collaboration with Volvo, to produce a limited commercial edition that is smaller, easier to assemble, and more efficient in charging the car. —C.H.



Award:
Bar Raval
Partisans

Renowned Toronto chef Grant van Gameren and his partners envisioned their pintxos and tapas bar styled in a modern interpretation of Spanish Art Nouveau. Local firm Partisans responded with a design that covered the 1,500-square-foot restaurant's bar, walls, and ceiling with sinuous, voluptuous wood panels.

CNC milling was the obvious choice for fabrication, but the technology is rarely applied to projects of this scale and complexity, juror Marc Fornes said. "This is an exquisite application of the technology, and certainly a precise one," he said.

Beyond the organic forms of Art Nouveau, Partisans wanted to carve sinewy ribbing across the panels for a sculpted effect. "We started to look at these things as being informed by tendons and muscle fibers because our clients are so muscular and tattooed," says Partisans co-founder Alexander Josephson. But creating the complicated and continuous geometry was unchartered territory. Taking cues from Antoni Gaudí, Partisans hand-

JONATHAN FRIEDMAN

sketched drawings and hand-carved foam and clay models to refine the panels' appearance.

After 3D scanning their foam and clay models, the designers worked with local fabricator Millworks Custom Manufacturing (MCM) to CNC-mill 1-square-foot samples to determine which wood type and which bit size would provide the desired effect. Ultimately, they selected mahogany and a 1-inch bit. Their prototypes, however, revealed a problem: warping and shrinking due to wood's hydroscopic and anisotropic properties. The defects were most palpable at panel joints. To minimize visual disruptions, reduce deflections, and increase the panels' durability during fabrication, Partisans designed an "S"-seam that allows the panels' edges to be perpendicular to the carvings.

The designers also used a Grasshopper script to detect intersecting toolpaths and move them to prevent overlap and maintain the fluid, sinewy pattern. "We had to create lines that defined the actual, specific position of the drill-bit head," Josephson says.

Partisans shared its digital models with MCM to ensure workability, but translating the panels' complex geometry and scrolling toolpaths into machine code resulted in errors. MCM worked with Tolland, Conn.–based computer-aided manufacturing software firm CNC Software to write 19 software patches to resolve the issues. Simulations ensured the errors were resolved before the 60-plus panels were fabricated.

Still, some of the panels' extreme curvature made the ribbing impossible to achieve. As a result, Partisans had to revise the geometries in real-time while MCM cut the panels. On three occasions, these adjustments caused misalignments across panels—the trailing lines at one panel edge failed to match those on the adjacent panel. "So we'd have to go back [and] change the entire line in a whole section of the bar," Partisans co-founder Pooya Baktash says.

Juror Steven Rainville applauded Partisans' commitment to its design concept. "This project makes the bridge from technology to craft," he said. —J.J.

Citation:
Co-Robotics and Construction
Rust Belt Robotics Group

Imagine a bustling construction site where robots do most of the tradesmen's dirty work, so to speak—hauling materials, climbing ladders, and navigating scaffolding. Assistant professor of architecture Michael Silver is leading the multidisciplinary Rust Belt Robotics Group at the University at Buffalo, State University of New York, to develop humanoid robots that interact with people in dynamic environments.

Though many researchers are in the race to develop construction robots, Silver, a self-taught roboticist, and his team are consulting with contractors, tradespeople, and trade unions to ensure their robots add value to the industry. His research in co-robotics—meaning that the machines work alongside people and not in isolation—focuses on making people more productive and profitable.

In the past two years, Rust Belt Robotics has built three generations of small-scale, but increasingly complex, android prototypes coined On-Site Construction Robots (OSCR, pronounced "Oscar"). The first OSCR lifted a lightweight, 3D printed ABS-plastic brick, took a few steps, and then set the brick down in a precise spot. OSCR-2 (bottom left) lifted three ABS bricks and stepped up a 1-inch-tall riser. The third OSCR (top left) walked on four legs for greater stability and strength, carried and deployed lightweight but standard-size bricks. It also navigated the group's laboratory space and tracked other color-coded bricks using a video camera.

Now the team is building its fourth prototype—a bipedal robot that can use its hands to grip and stack waterjet-cut sandstone blocks. Enabled with Wi-Fi, this larger machine will combine the capabilities of the previous OSCRs with the ability to 3D scan a site and communicate information and photographs back to the humans it is assisting. Silver also wants to increase the intelligence and functionality of the robots by programming them to transmit BIM data via the cloud. Rust Belt Robotics is now leading a three-year effort to deploy an OSCR to an actual jobsite.

Juror Steven Rainville applauded the group for diving into such a competitive research area that shows promise in altering the future of the construction industry. "This is really cool to me," he said. —J.J.

Citation:

Queen Richmond Centre West Sweeny &Co Architects

With the surging demand for office space in downtown Toronto, it was inevitable that developers would begin eyeing the city's historical stock. Local firm Sweeny &Co Architects saw an opportunity to preserve two adjacent structures built with traditional brick-and-beam construction in one such neighborhood.

Principal Dermot Sweeny and his team proposed constructing a new 11-story office building on the site—but starting 80 feet in the air. The structure would clear the existing four- and five-story buildings in their entirety. The buildings' owner, Allied Properties REIT, agreed. All that was left was how to execute the plan. Initially, the architects considered using box trusses to hold up the proposed 302,000-square-foot Queen Richmond Centre West. But the approach would have required hundreds of visually messy cross-bracing members, says principal John Gillanders.

Instead, the architects teamed with local firm Stephenson Engineering to design and develop three mega supports. Dubbed delta frames, the 80-foot-tall frames consist of four upper and four lower legs that converge 40 feet in the air, like giant toy jacks.

Welding the legs to plates at the frames' midpoints would not be enough to stop them from splaying. The team decided to secure the legs with more elegant—and much stronger—custom nodes, designed by local firm Cast Connex. Using 3D modeling and rapid prototyping to finalize the node's shape and integration, the team eliminated the need for shear studs and reinforcing bars in the node. "We kept working at it backward and forward until everyone believed it was not only beautiful, but that it would work and was manufacturable," Sweeny says.

Cast Connex cast the steel nodes in chemically bound sand molds, each of which comprise 22 pieces that lock into a 3D puzzle. The 2-inch-thick, 40-inch-diameter steel legs were welded to the nodes on site, and the frame was pressure-filled with concrete from the bottom up. Each delta frame can support nearly 18 million pounds—the equivalent of approximately 400 tractor-trailers.

The team is "using methodologies that are progressive in how they resolve the structural solution," juror Steven Rainville said. "But the result of it is also quite nice, architecturally." —J.J.

JIMMY WU

Detroit

- Cheap property
- State land bank
- City owned
- City land bank
- Hispanic population
- Caucasian population
- Mass transit use
- Education index
- Parks
- Schools
- Major roads
- Highways
- Areas of interest
- Production territories
- Education territories
- Civic territories
- Religion territories
- Available property
- Zones of influence
- Blue collar population
- Religion index
- Youth population
- African-American population
- New business connectors
- Selected rails
- New local circulation

Citation:
Radical Railbanking Master of None

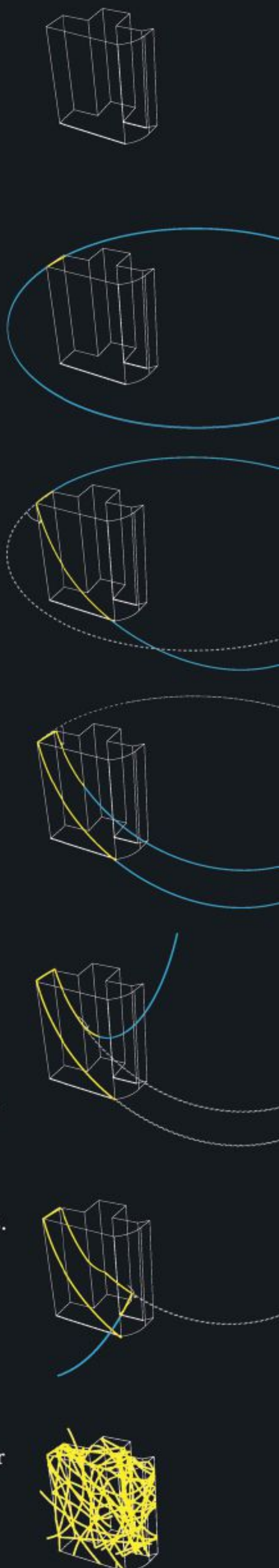
By drawing on the practice of railbanking—the repurposing of abandoned rail corridors into recreational trails—McLain Clutter, director of the Ann Arbor, Mich.–based design and research practice Master of None, hopes to end the notion of living on the wrong side of the tracks. Clutter, also an assistant professor at the University of Michigan Taubman College of Architecture and Urban Planning, and his research assistant Sehee Kim are using geographic information systems (GIS) to manipulate and repackage geodemographic data to transform Detroit's rail corridors into public spaces that bring together residents with different backgrounds.

When considering how to address developable properties across the country, real-estate investors are increasingly examining geodemographic data using GIS. But their approach, Clutter says, often reinforces stereotypes about race, ethnicity, religion, and income level and thus deepens divisions between communities.

Instead, he appropriates the data imaging tools that city planners typically use to implement zoning policy from Esri, the world's largest producer of GIS software, and mixes in demographic data from the U.S. Census Bureau and other public sources. He applies his own scripts and models to re-cut the data and find the areas with the most intense population-density values. These regions are isolated and re-grafted to serve as the basis for a second set of models, interpolating a series of demographic values. Through continued analysis, these second-generation models isolate the most intense slope values, which represent the areas with the greatest potential for change. The subsequent maps visually illustrate new types of urban environments in these areas.

For example, when evaluating how to develop the sprawling lots where mortar production factories once stood along the railway in the northwest Detroit neighborhood of Conner Creek, a Radical Railbanking zoning map recommends introducing religious institutions, production centers, civic infrastructure, a transit center, and parks to create a commons that causes existing enclaves and neighborhood populations to intermingle.

"This project uses GIS in a thought-provoking, unconventional, and almost delirious kind of way," juror Joyce Hwang said. —J.J.



Citation:
Bands
Eric Owen Moss Architects

The tangle of steel arcs that wraps the forthcoming 16-story office tower (W)rapper, in Los Angeles, may look like superficial flourish, "but it's fully structural," says Dolan Daggett, project director at Eric Owen Moss Architects (EOMA), in Culver City, Calif.

Indeed, 11 of the 14 bands serve as the building's primary load-bearing system and provide lateral stiffness. The exoskeleton also enables a column-free interior and variable floor-to-ceiling heights, and contributes to the unique views from each floor.

Though many buildings employ exoskeletons, the jury was intrigued by EOMA's use of a polar-coordinate system rather than the conventional rectilinear grid. Juror Steven Rainville wondered how EOMA justified its approach to achieving a column-free floor plan. Daggett says the bands emphasize the building's creative program. "It allows us to make a much more dynamic structure," he says.

Each band emerges from an exterior wall before sweeping across the building elevation following an arc with a unique radius and center point. The bands run parallel to the building face before turning 90 degrees at building corners. Detailing the bands' corner joints was particularly difficult because the adjoining arc segments would be coming in at varying angles. The team developed a universal half-notched connection, similar to a lap joint in carpentry, that maintains the bands' flush surface at corners regardless of the orientation of the incoming segments.

The hollow, built-up steel-plate bands are fixed in section at 5 feet by 1 foot, but vary in thickness to tune their load-bearing capacity. EOMA developed wrapping scripts with Digital Project software to test the band configurations for structural performance. Structural elements tie the bands to the floor plates to transfer the building's gravity and lateral loads.

Though Daggett says city approvals will take longer than a structure that complies with the prescriptive code, (W)rapper demonstrates how buildings can be engineered for their particular use. —C.H.

Citation:
Philip J. Currie Dinosaur Museum Teeple Architects

Located near Highway 43 in Wembley, Alberta, the Philip J. Currie Dinosaur Museum celebrates one of the world's richest dinosaur-bone beds, Pipestone Creek. The prehistoric remains and the region's hilly topography helped inform Toronto-based Teeple Architects' design of the triangulated structure and its timber skeleton—a pivoted A-frame in which as many as six structural members can converge at one joint.

Tying those members together requires elaborate custom connections, for which the firm initially planned to use steel. Then it determined that laminating CNC-milled Douglas fir plywood would be less complex, expensive, and difficult to craft, says principal Stephen Teeple. Wood would also preserve the aesthetic of the building, which was constructed with beetle-kill pine timber.

Working with Vancouver, British Columbia–based engineering firm Fast + Epp, the architects used Rhinoceros to model and then deconstruct the nodes into manageable 2D pieces for milling. The largest nodes, at more than 59 inches tall and 94 inches wide, stack together approximately 180 plies.

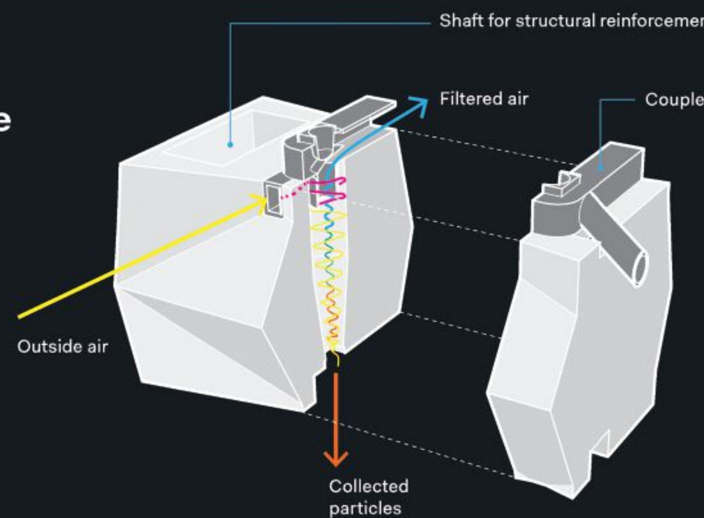
Using the plug-in Grasshopper, Fast + Epp virtually inserted stainless steel screws, as long as 47 inches, through the modeled nodes as rebar. Similar to a strut-and-tie system, the screws allow the nodes to handle both compression and tension loads, which the firm confirmed through physical mock-ups.

The 3D models also helped Delta, British Columbia–based StructureCraft Builders ensure quality during fabrication. Six-inch-long wooden dowels were inserted into holes drilled into each ply, positioning it within the node stack. Screws were then drilled where the models indicated. "It was a natural flow from the model to production," Teeple says.

"Even though it's a simple project, it was quite innovative in terms of thinking about a joint," juror Joyce Hwang said. Juror Steven Rainville liked that the firm also found a new use for waste material. "It's showing the industry that you can change the paradigm." —J.J.

TOM ARBAN

Citation:
Breathe Brick
Both Landscape and Architecture



In Cairo, an annual temperature inversion brings a fog of dust and burning biomass called the Black Cloud. When Carmen Trudell began researching the city's air quality five years ago, she thought about her brother's treatment for kidney failure: What if a building, like the organ, could filter toxins and protect people?

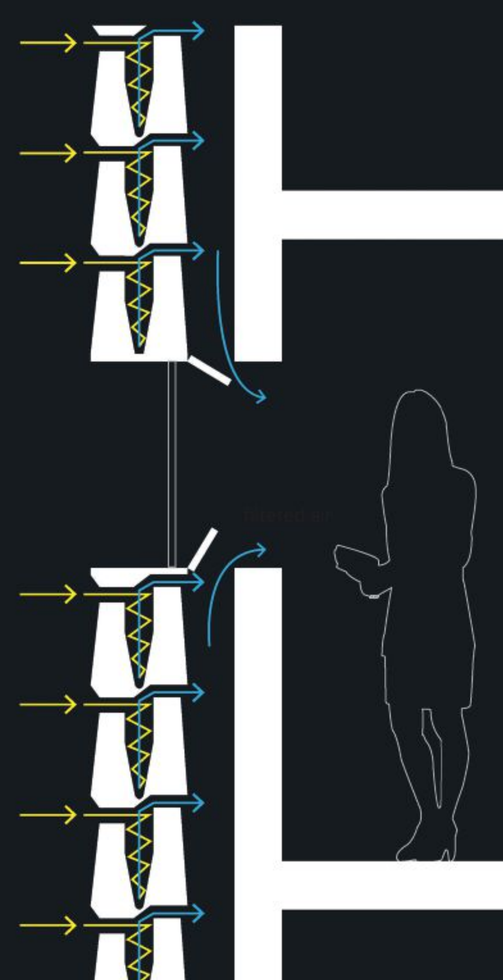
Since then, Trudell, now at the firm Both Landscape and Architecture, in Charlottesville, Va., and an assistant professor of architecture at California Polytechnic State University, San Luis Obispo (Cal Poly), worked with students and fellow environmental engineering associate professor Tracy Thatcher to develop a building component that could double as a passive filtration system.

Inspired by vacuum cleaners that spin air through a vortex to separate particles, the team "came up with the idea of putting a cyclone inside of the exterior wall," Trudell says. They developed the Breathe Brick, a porous concrete masonry unit that stacks to form an air-filtration and structural façade system.

The faceted surface of the bricks helps direct outside air to rectangular inlet ports. A cyclone filter cast directly into the concrete form causes the incoming air to spin, winnowing out particulates. Brick couplers made from recycled plastic help align the stacking modules' two vertical shafts—one to accommodate structure reinforcement, and one to send the distilled particulates into a collection hopper at the wall base. The filtered air that passes into the cavity of the double-wythe wall system could then supply an HVAC system or interior space directly.

The jury appreciated the relatively inexpensive, low-tech solution to a worldwide problem. "Breathe Brick is a clever way of taking the heavy particulates out of the air as a byproduct of making a building," said juror Steven Rainville.

To test the Breathe Brick concept, Cal Poly engineering students constructed a small-scale wind tunnel, 2 feet in diameter and 12 feet long, into which they blasted cornstarch and flour against four prototype modules. The units captured 30 percent of fine particles—which are found in smoke and haze—and as much as 100 percent of coarse particles, which simulate dust. The next step for Trudell and her team is to test the Breathe Bricks' performance in a full-scale wall. —C.H.



Double-wall assembly

Judges

French architect **Marc Fornes** is the principal and founder of TheVeryMany in New York, as well as a self-described connoisseur of computer science. His work focuses on investigating design through codes and computational protocols. He received a master of architecture and urbanism from the Architectural Association School of Architecture in London.

Joyce Hwang, AIA, is an associate professor of architecture at the University at Buffalo, the State University of New York, and the director of Ants of the Prairie, a research and practice firm in Buffalo, N.Y., that confronts contemporary ecological conditions through creative means. She received an M.Arch. from Princeton University and a B.Arch. from Cornell University.

Steven Rainville, AIA, is a principal at Seattle-based Olson Kundig Architects, which he joined in 1996. He is also the director of the firm's R&D department as well as the founder of Mind Mine, the firm's forum for crowd-sourced ideas that break down boundaries between industries. He received his B.Arch. from Washington State University.

Credits

Pulp Pavilion, page 104
Client: Coachella Valley Music and Arts Festival
Design Firm and Fabricator: Ball-Nogues Studio, Los Angeles · Gaston Nogues, Benjamin Ball, ASSOC. AIA (project leads/designers); Rafael Sampaio Rocha (project manager); Ricardo Garcia, John Guinn, Fernando Marroquin, Rafael Sampaio Rocha, Forster Rudolph, Corie Saxman, Nicole Semenova, Ethan Schwartz (onsite project team); Andrew Fastman, AIA, Michael Anthony Fontana, Cory Hill, James Jones, Mora Nabi, Jacob Patapoff, Allison Porterfield (support)
Lighting Programming: F. Myles Sciotto
Structural Engineer: Nous Engineering · Omar Garza
Funding: Commission from Goldenvoice
Size: 1,300 square feet

Pure Tension Pavilion, page 108
Client: Volvo Car Italia
Design Firm: Synthesis Design + Architecture, Los Angeles · Alvin Huang, AIA (principal); Filipa Valente, Chia-ching Yang, Behnaz Farahi, Yueming Zhou
Structural Engineer: BuroHappold Engineering
Electrical Engineer: Ascent Solar

Bar Raval, page 110
Client: Grant van Gameren, Mike Webster, and Robin Goodfellow
Design Firm: Partisans, Toronto · Alexander Josephson, Pooya Baktash, Jonathan Friedman, INTL. ASSOC. AIA, Ivan Vasyliv, Ariel Cooke
Consultant and Fabricator: Millworks Custom Manufacturing
Special Thanks: Klaudiusz Kociolek, Gregory Rybak, Nick Savage, CNC Software/Mastercam
Size: 1,500 square feet

Co-Robotics and Construction, page 112
Design Firm: Rust Belt Robotics Group, University at Buffalo, State University of New York (SUNY)
OSCR-1 and OSCR-2 Team: Ball State University · Mike Silver, Mahesh Daas, Josh Vermillion (faculty); Yevgen Monakhov, Jason Foley, Matthew Fullenkamp, ASSOC. AIA, William Zyck, Justin Krasci, Michael Bolatto, Tyler Cox, ASSOC. AIA, Glenn Cramer, ASSOC. AIA, Robert Cichocki, Antone Sgro, Derek Anger, Tianxia Peng, Derek Newman, David Smith, Yao Xiao, Matthew Wolak, Thomas Friddle (students)
OSCR-3 Team: University at Buffalo, SUNY Team · Mike Silver, Karthik Dantu (faculty); Colin Jacobs, Tim Ruhl, Albis Del Barrio, David Heaton, Gary Chung, David Lin, Georine Pierre, Robert Miller, Johnny Lynch, Daniel Fiore, Dylan Burns, Jia Jian Feng You, Marc Velocci (students)

Queen Richmond Centre West, page 113
Client and Funding: Allied Properties REIT
Design Firm: Sweeny &Co Architects, Toronto
Structural Engineer: Stephenson Engineering
Fabricators: Cast Connex, Walters Group
Construction Management: Eastern Construction
Electrical Engineer and Lighting Designer: Mulvey & Banani International
Mechanical Engineer: The Mitchell Partnership
Special Thanks: Michael Emory, Hugh Clark, John Stephenson, Jeffrey Stephenson, Carlos de Oliveira, Frank DeCaria, Renato Tacconelli, Tim Verhey
Size: 302,000 square feet

Radical Railbanking, page 114
Design Team: Master of None, Ann Arbor, Mich. · McLain Clutter (project adviser); Sehee Kim (student research assistant)
Funding: University of Michigan Office of Research, funding for Artistic Productions and Performances, 2011; University of Michigan Taubman College of Architecture and Urban Planning
Special Thanks: Syracuse University School of Architecture · Mark Linder

Bands, page 115
Client: Samitaur Constructs · Frederick and Laurie Samitaur Smith
Design Firm: Eric Owen Moss Architects, Culver City, Calif. · Eric Owen Moss, FAIA (architect); Dolan Daggett, Vanessa Jauregui, Nicholas Barger, Zarmine Nigohos, Sean Briski, Raul Garcia, Scott Nakao, Richard Yoo (project team)
Structural Engineer: Arup
Size: 183,000 square feet

Philip J. Currie Dinosaur Museum, page 116
Client: Philip J. Currie Dinosaur Museum
Design Firm: Teeple Architects, Toronto · Stephen Teeple, Martin Baron, Mark Baechler, Will Elsworthy, Lang Cheng, Carla Pareja, Gloria Perez
Architect of Record: Architecture | Tkalcic Bengert
Structural Engineer: Fast + Epp
Mechanical Engineer: Hemisphere Engineering
Electrical and Civil Engineer: AECOM
Exhibit Consultant: Reich+Petch
Landscape Architects: Scatliff+Miller+Murray
LEED Consultant: Enermodal Engineering (now part of MMM Group)
Contractor: PCL Construction Management
Fabricators: StructureCraft Builders in collaboration with Fast + Epp
Size: 42,000 square feet

Breathe Brick, page 117
Design Firm: Both Landscape and Architecture, Charlottesville, Va. · Carmen Trudell (primary investigator)
Collaborators: California Polytechnic State University, San Luis Obispo (Cal Poly) · Tracy Thatcher (consultant); Natacha Schnider, Kate Hajash, Cameron Venancio, Justin Wragg, Jennifer Thompson, Michelle Kolb (student research assistants); Rensselaer Polytechnic Institute · Kateri Knapp, Kyleen Hoover (student research assistants)
Funding: Cal Poly College of Architecture and Environmental Design's Planning, Design and Construction Institute

Residential:
Sir John Soane's Museum Restoration
London
Julian Harrap Architects

TEXT BY KATIE GERFEN

PHOTOS BY GARETH GARDNER

There are few houses that hold more fascination for architects than that of Sir John Soane. The three-townhouse complex on London's Lincoln's Inn Fields not only holds Soane's extensive collection of artworks and architectural models, but also serves as an example of the British architect's experimentation with interior layouts, lighting, and decoration. Until May, the only areas on view have been those he intended to be public. The second floor of the main house at No. 13, which contains Soane's private apartments, has been closed to visitors since the 1860s, but thanks to a meticulous restoration by London's Julian Harrap Architects (JHA), the suite of rooms is now open to all.

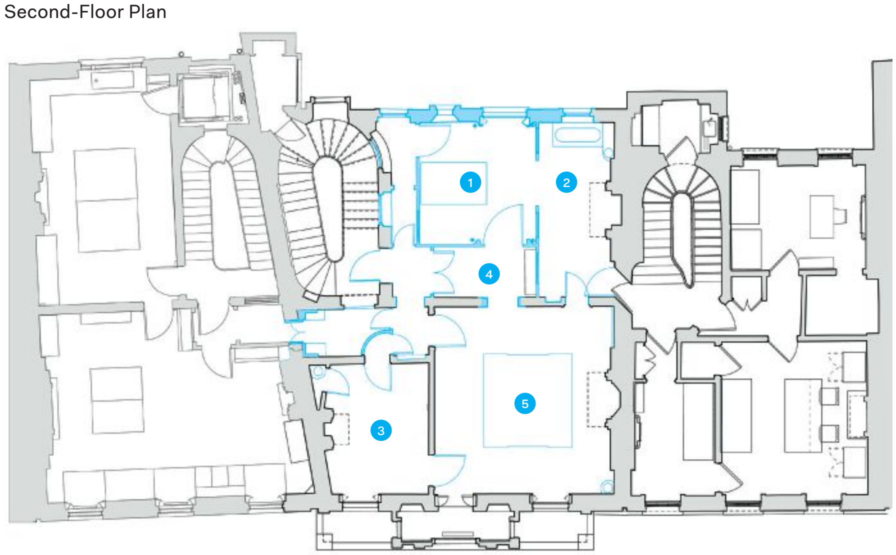
The research for the restoration took nearly two years, almost twice the length of the actual construction period that followed. The effort was focused on re-creating the space as it was in 1837, when Soane died; it's the key date for all restoration of the museum, as stipulated in the Act of Parliament that gifted it to the country. The architects and historians consulted the museum's archives, which included engravings of the rooms that were prepared for an illustrated 1835 catalog. One such engraving of the Model Room is so detailed that "the pictures can be identified by this drawing," says JHA partner Lyall Thow. "It would have been done by someone in Soane's office, so Soane would have been standing over him looking at him drawing it saying, 'Show this and show that.'" The team also consulted Soane's own writings and the museum curators' records.

Until 2008, these curators used the private rooms either as their home or office, and some made substantive changes. Varnish had been applied to the perimeter of the wood floors (specifically, to the areas left exposed around large area rugs), wallpaper had been painted over (and over), architraves and elevations had been reworked, and entire rooms had been reconfigured. Nearly two centuries' worth of alterations needed to be undone while the rest of the museum was still functioning—not just the public areas on the lower floors, but also the offices on the level above—providing no small logistical challenge.

Helpfully, the cost of materials spurred many of the past renovators to reuse Soane's original materials. (When curator James Wilde carried out the most extensive retrofit in 1889, he removed doors and partitions and reused them in new cabinetry and decorative elements.) This allowed the restoration team to reclaim many original materials and return them to their rightful places, rather than having to resort to replication. But, Thow says, "if the archive and the drawings don't tell you everything, sometimes you have to step into the mind of what he was trying to achieve."

The result is a faithful return to Soane's original vision. "I love to think of him not being able to sleep and wandering around the model stand," Thow says. "It's so interesting that he chose to sleep almost among his collection—he was so passionate about architecture."

Second-Floor Plan



Previous Page: The wallpaper in Mrs. Soane's Morning Room (shown) and throughout the rest of the apartments was reprinted by Adelphi Paper Hangings after the original pattern was discovered in situ by wallpaper experts Sandiford & Mapes. The color was reproduced based on small swatches preserved in sample books in the Victoria and Albert Museum archives.

1. Soane's Bedroom
2. Bathroom
3. Mrs. Soane's Morning Room
4. Book Passage
5. Model Room

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The bathroom features a covered bathtub and the original wood floors, stripped of Victorian-era varnish and rubbed with lime and sand to bring back the original patina. Soane's bedroom is beyond, at left.

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The Model Room was restored to include its original full-height open entry into the daylit Book Passage. In 1833, after Soane's wife died, he moved the models to her former bedroom and arranged them as they are seen today. The Model Room was one of the last of the architect's major renovations.

Project Credits

Project: The reinstatement of Sir John Soane's Model Room and private apartments, London
Client: Sir John Soane's Museum
Architect: Julian Harrap Architects, London · Lyall Thow, Caroline Wilson
M/E Engineer: The Spencer Clarke Partnership
Structural Engineer: Mann Williams
General Contractor: Kingswood Construction
Lighting Consultant: Charles Marsden-Smedley
Wallpaper Specialist: Sandiford & Mapes
Specialist Decorators: Hare & Humphreys
Furniture Restorers: Arlington Conservation
Size: 1,056 square feet
Cost: Withheld

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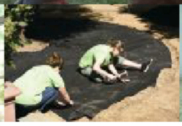
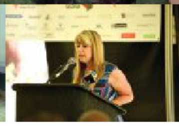
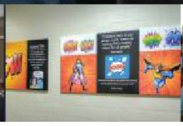
The lightwell over the Book Passage is lined with renderings, which have been returned to the locations they hung in during Soane's life. Christopher William Hunnemann painted the portrait of Soane holding a compass in 1776.

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Pictured above is the projectAtlanta Design Team (left to right):
Chris Bivins, Jay Silverman, Delishia James (client of CH/GA), Sydney Thompson, Mario Cambardella, Shawn Alshut, Stephanie Wolfgang, Ed Alshut, Brandon Chambers, Brandy Koch. Not pictured: Doug Wozniak, Aaron Albrecht






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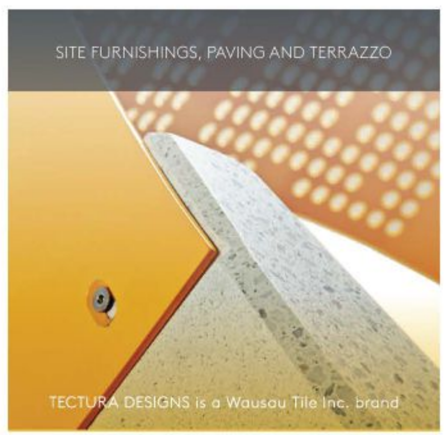

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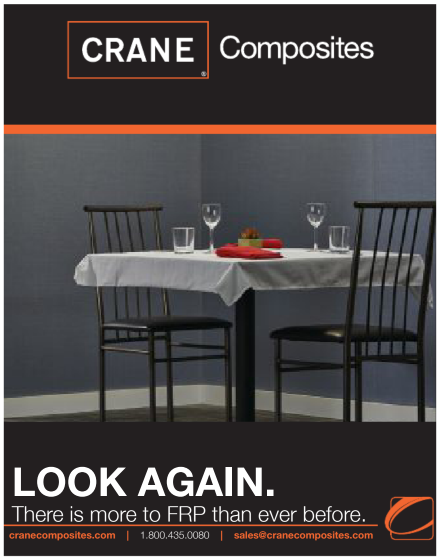
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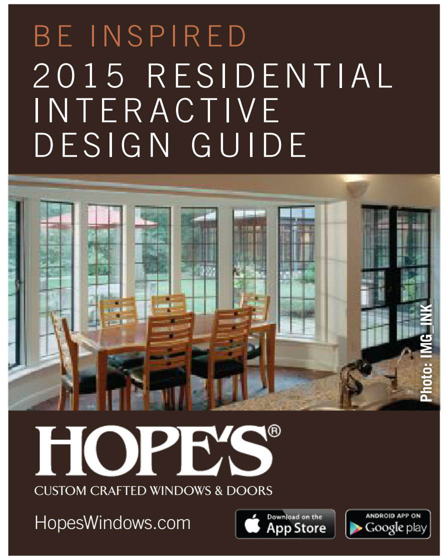
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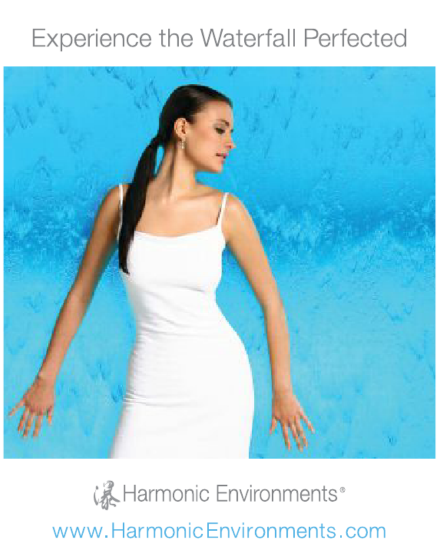
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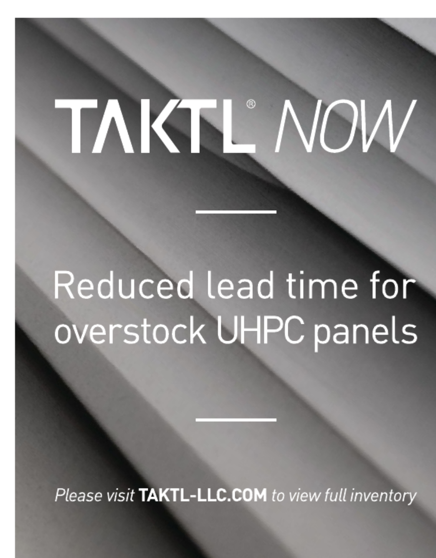
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Editorial: A Different Kind of Hero

The 1972 demolition of the Pruitt-Igoe housing complex in St. Louis, which observers such as Tom Wolfe celebrated as a bullet to the head of urban renewal, was in reality just the beginning of a painful and protracted end. Chicago's Cabrini-Green, arguably the best known of the housing projects and the setting for the CBS sitcom *Good Times*, didn't start coming down until 1995; the last tower block was razed in 2011. Earlier this year, the Chicago Housing Authority finally unveiled a draft plan for redevelopment of the 65-acre site. (As for Pruitt-Igoe, today most of its 57 acres are overgrown forest, untended and awaiting redemption.)

It takes time to dismantle an institution. As enthusiasm and funding for the welfare state have waned in the United States, so too, it seems, has the incidence of grand public gestures in infrastructure, architecture, and planning. Certainly, the Cabrini-Green replacement scheme is nothing spectacular. It requires design bravado in small doses at most. And that may be almost alright, to borrow a phrase from Robert Venturi, FAIA.

The new Cabrini-Green plan follows the received wisdom for remediation of American cities these days: complex public-private partnerships instead of top-down government-led initiatives, a restored street grid instead of Corbusian megablocks, and proximity to parks and transit instead of isolation behind the barricade of an interstate highway. Add to all that a careful mix of densities, uses, and incomes. Social scientists continue to debate the merits of this planning strategy, but time will tell on the ground. Build the place, let it set for a decade or two, and we might just have ourselves a sustainable neighborhood.

So has the possibility of heroic, publicly minded architecture and urbanism expired in the United States? Must American architects forevermore look abroad—to China, the Middle East, or elsewhere—for opportunities on the grand scale? In my darker moods, thinking of the many post-industrial, *après*-modern reclamation projects underway, such as the 606 elevated park in Chicago or Lincoln Center in New York, I worry that we will be reduced to building upon the shoulders of giants, the way medieval masons quarried the ruins of imperial Rome for raw materials.

In brighter moments, however, I imagine such present-day practices as a sort of noble quest to right historical wrongs—both architecture's own occasional missteps and those of society at large. There is a lot of work to be done, not always sexy on the surface, but essential. Freeways can be buried. Anti-urban bunkers can be opened to the street. Hermetically sealed energy hogs can be taught to breathe naturally. Marginalized neighborhoods can be knit back into the city fabric.

There will always be clients who want big, bold new buildings, and there will always be designers who are willing and able to provide. That's axiomatic, and good. It's also good that architecture—as a profession and as a culture—is embracing another kind of heroism, one that offsets Daniel Burnham's one-sided enjoinder, "Make no little plans." Because right now this country needs architects who are willing to forego the Howard Roark cliché and find the joy in tight budgets, limited briefs, and seemingly mundane programs. Architecture—and America—needs a new kind of hero.

STEPHEN VOSS

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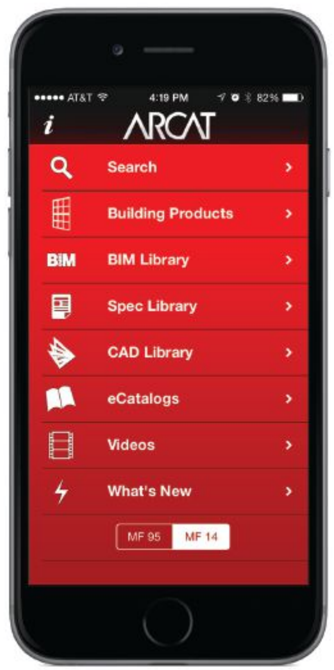

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