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# A Contents

Volume 108, number 1, January 2019.

On the cover: *Making Sense of the Smart City*; illustration by Rob Z.

12 2019 AIA Honor Award Winners Announced

14 Leaving the Grid for the Lochside

16 Threatened Sites and Landscapes

18 An Oasis of the Future

## Tech + Practice

22 Best Practices: Navigating Family Ties in the Office

25 Detail: Pudasjärvi School Curved Columns

26 Next Progressives: Future Firm

30 Products: How to Specify Steel Doors for Schools

32 Opinion: The Complexion of Legacy in Architecture



34 Residential: Elemental

## AIA Architect

51 A Recipe for Housing Equity

53 Firm Leaders on the Future of Virtual and Augmented Reality in Architecture

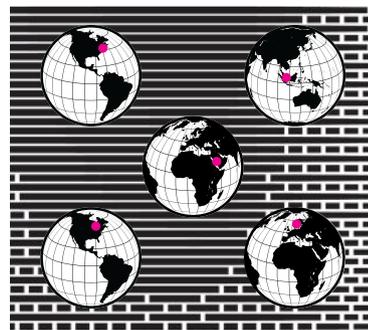
54 Can Technology Solve Architects' Productivity Challenge?

59 Reality Bytes

60 Places for People

## Editorial

104 A Bit Messy, and Better for It  
by Ned Cramer



64 What's Next: *Making Sense of the Smart City*

66 Marketing Spin  
by Karrie Jacobs

74 A Billboard of Progress  
by Elizabeth Evitts Dickinson

78 A Question of Privacy  
by Alex Bozikovic

86 Future Proofing  
by Elizabeth Evitts Dickinson

88 A Holistic Approach  
by Elizabeth Evitts Dickinson

92 We're Working On It  
edited by Wanda Lau



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#### **2019 AIA Honor Award Winners Announced**

Born in Japan, she moved to the U.S. to attend the Cooper Union in the 1970s and has taught at the Harvard Graduate School of Design since 1995, where she was the first woman to receive tenure and chair the architecture department. She is Toshiko Mori, FAIA, and she is the 2019 recipient of the AIA/ACSA Topaz Medallion. Also honored last month were Richard Rogers, HON. FAIA, with the Gold Medal; Payette with the Architecture Firm Award; Robert Traynham Coles, FAIA, with the Edward C. Kemper Award; and Karen Braitmayer, FAIA, with the Whitney M. Young Jr. Award. All awards will be presented at the 2019 AIA Conference on Architecture. —GREIG O'BRIEN

RALPH GIBSON

> Read more about all of the 2019 AIA Honor Award winners at [architectmagazine.com/awards/aia-honor-awards](http://architectmagazine.com/awards/aia-honor-awards).



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### Leaving the Grid for the Lochside

RIBA's House of the Year 2018, Lochside House in the Scottish Highlands, by Cambridge, England's Haysom Ward Miller, is three pitched-roof volumes and a detached studio constructed with local timber and stone, clad in charred Scottish larch, and finished with white plaster, light-hued wood, and large windows. But Lochside House is not just a beautiful piece of craftsmanship. It is also completely off-grid, relying entirely on its own electrical, water, and sewage systems. The house beat out ones by 31/44 Architects, 6a Architects, Chance de Silva & Scanner, Liddicoat & Goldhill, Sarah Griffiths and Amin Taha, and Tonkin Liu. —AYDA AYOUBI

> Read more about the Lochside House at [bit.ly/2018RIBAHouseOfYear](https://bit.ly/2018RIBAHouseOfYear) and see more images at [bit.ly/LochsideRIBA](https://bit.ly/LochsideRIBA).

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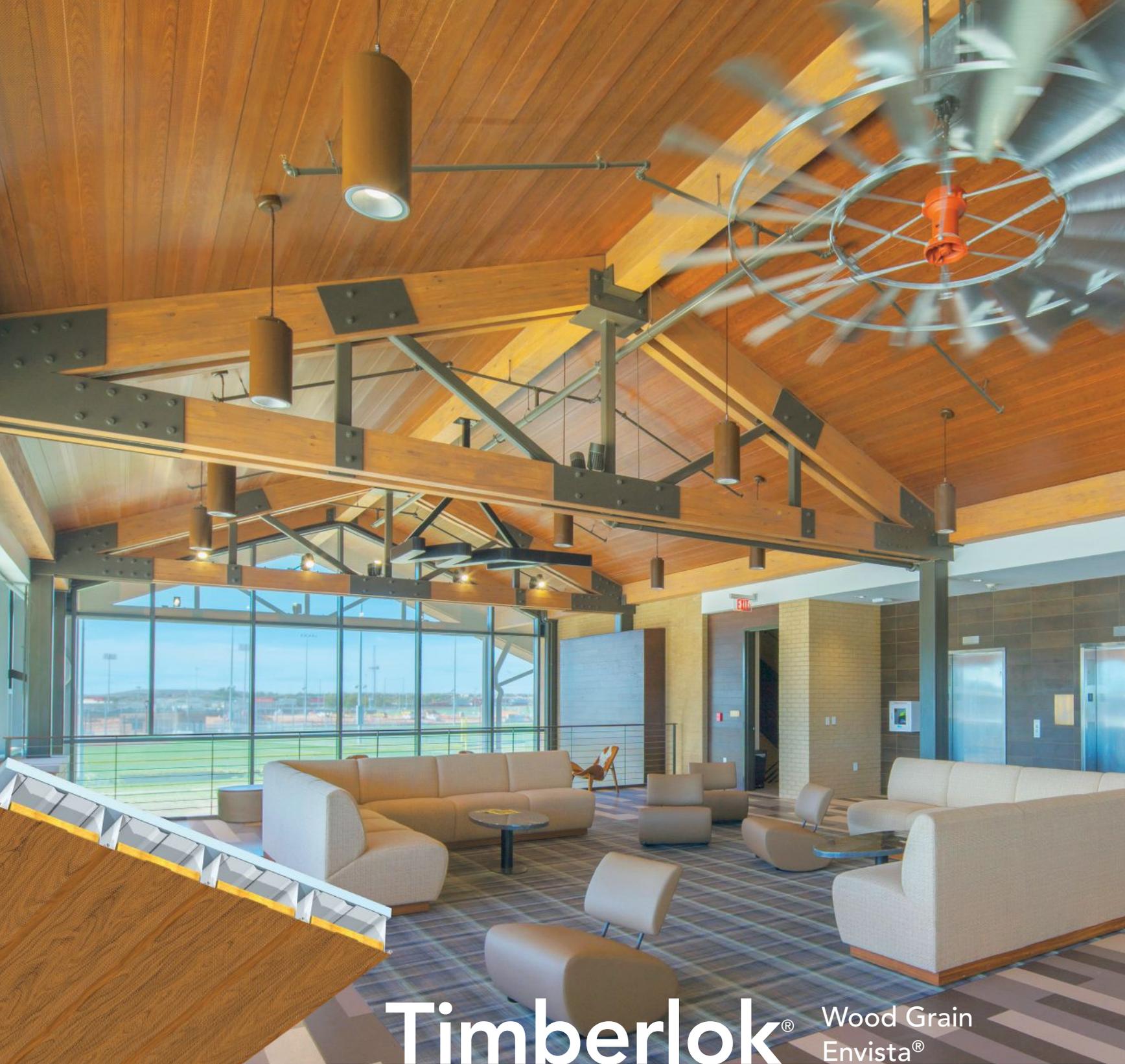
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### Threatened Sites and Landscapes

For the 15th year, the Cultural Landscape Foundation in Washington, D.C., has named historic civil and human rights sites and landscapes around the nation that are at risk of loss or deterioration due to lack of resources or development initiatives. The class of 2018 includes Susan B. Anthony's childhood home in Battenville, N.Y.; the Hog Hammock Gullah-Geechee community in Sapelo Island, Ga.; and Blair Mountain Battlefield (shown) in Logan County, W.Va.—the site of a 1921 coal miner uprising where 10,000 workers fought for safer working conditions, living wages, and the right to congregate. —KATHARINE KEANE

> To learn about all the sites named to the Cultural Landscape Foundation's annual list, visit [bit.ly/CLFSites](http://bit.ly/CLFSites).



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# Best Practices: Navigating Family Ties in the Office

TEXT BY MURRYE BERNARD, AIA

It is not uncommon for architects to keep business in the family by forming partnerships with their spouses, children, or siblings. Below, several practitioners offer advice for managing these personal relationships in the office.

## Play to Your Strengths

For Stanley Felderman and Nancy Keatinge, partners in life and at Culver City, Calif.-based Felderman Keatinge + Associates, consciously acting as teammates has ensured long-term success. "We have made it a point to emphasize that we work together," Felderman says of their 15-person practice, which they founded in the mid-1980s. "I think the key to success is to bring each other into the fold."

"Stanley has been incredibly supportive of me finding my voice," Keatinge adds.

"We come from different places," Felderman says. "Nancy's background is in theater and research, and she puts people and emotion as well as utility and functionality first—and I value that." With Keatinge focused on these pragmatic

aspects of a project, Felderman says he can hone his artistic vision.

Andrew and Jodi Batay-Csorba, the husband-and-wife duo behind Toronto-based practice Batay-Csorba Architects, report that capitalizing on their dual roles as designer and spouse can be particularly beneficial when working on residential projects with clients who are also couples. "It's disarming for people to know that those types of discussions are OK," Andrew says of the conversations that evolve around daily routines and lifestyle. "Domestic space becomes so personal, so to have the people doing the design also sharing that same relationship adds something."

## Strike a Balance (or Try to)

For those in family businesses, it can be challenging to manage emotions, opinions, and biases stemming from the office and from home. "When two people argue in an architecture office, you never think twice about it since [design is] so emotional anyway," Andrew says. "But I'm particularly conscious of it as a husband and wife."

He explains that it's essential to maintain open communication by harnessing family trust, thereby reducing opportunities for disputes. And by lessening conflict, you have more time to enjoy life beyond the office.

"We've been working together so long that the biggest thing for us is trying to find time for non-work things," Andrew says. "Our son is the healthiest thing that ever happened to

us. Spending time with him allows us to step away."

## Leverage Your Connection

Many design couples also report that their intimacy facilitates candor in their work, ultimately improving client relationships and final products. "In a lot of relationships, when you're in love with the person, you're a little more cautious," Felderman says. "But we are not afraid to challenge each other [or even] our clients, so they get to be part of our discovery process."

Keatinge and Felderman often bring their dogs to the office, where their daughters also stop by and do homework, thus creating a family-oriented environment that resonates in meetings: "That connection comes across in our presentations and makes us more attractive to clients," Keatinge says. "We feed off one another."

For Anda French, AIA, and Jenny French, sisters and principals at Boston-based practice French 2D, "a bizarre twin mindset" facilitates fluid communication and collaboration. "We share a shorthand," Anda French says. "We can just say a couple words and get to an idea really quickly." The two are also daughters of an architect-couple, and while they learned much from their parents (who studied with Louis Kahn), they have made it a point to approach architecture their own way.

"We're more committed than a married-couple firm," Anda French says. "They can get divorced!"

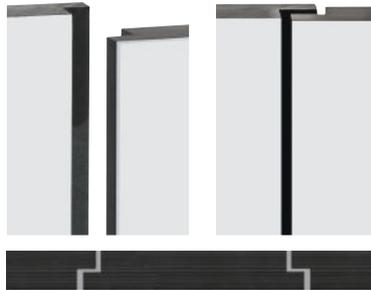
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—Andrew Batay-Csorba, founding partner, Batay-Csorba Architects

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# Detail: Pudasjärvi School Curved Columns

TEXT BY TIMOTHY A. SCHULER

At the new campus of the Pudasjärvi School in northern Finland, the prevalence of timber creates a multisensory experience. Wood is seen, felt, and smelled in the school's exposed log structure, branching glulam columns, and cladding.

Completed in late 2016, the largely rectilinear buildings of the 105,250-square-foot campus are topped by hipped roofs punctuated by boxy skylights, called "lanterns" by the designer, Finnish firm Lukkaroinen Architects. In the single-story classroom buildings, the lanterns are 22 feet wide and 23 feet to 34.6 feet long in plan, and project more than 10 feet above the roofline. They are supported by curving, glulam pine columns, which splay out from a central node roughly 10 feet up and connect to the lanterns' roof beams.

"The Y-shape of the columns is not only aesthetic, but also a functional choice in spaces where an excess of columns needs to be avoided," says project architect Pekka Lukkaroinen, the recently retired founder of the firm.

The columns measure 6.5 inches wide by 14 inches deep, and stand up to 36.6 feet tall, arching with a relatively shallow radius of 28.4 feet. In plan, the columns form an X at their base and are joined together with knife plates that likewise form an X. Each column utilizes two such plates along their height.

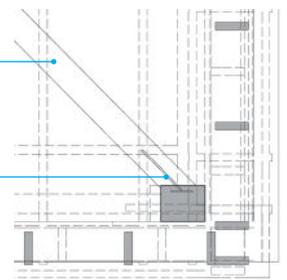
At the roof, the curved members connect to neighboring columns via embedded steel knife plates with angled 13-inch-long blades. Lukkaroinen



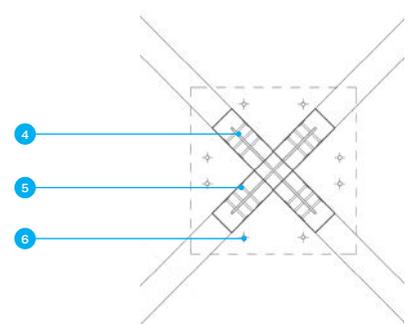
Architects worked with the structural engineers at Stockholm-based Sweco to develop the connections. The glulam was fabricated by log manufacturer Kontio just outside Pudasjärvi.

All told, the school used nearly 92,000 board feet of pine logs, the majority of which were harvested in the immediate area. "We wanted to create a unique character for the campus that would present, at the same time, the long history of the woodworking in the area as well as a modern and forward-looking atmosphere," Lukkaroinen says. "Wooden architecture has always had a special place in the Finnish architect's heart, and we are delighted to see a revival of wooden architecture going on in Finland."

Section A-A<sub>1</sub>



Section B-B<sub>1</sub>



1. 14" x 6.5" pine glulam column (typ.)
2. Ø12mm screws (18 max.)
3. 0.5"-thick steel knife plate, 13" long
4. 0.5"-thick steel X-shaped plate, 3' long
5. Ø12mm bolt (typ.)
6. Ø24mm bolt to floor (typ.)

# Next Progressives: Future Firm

EDITED BY KATHARINE KEANE

**Location:**

Chicago

**Year founded:**

2016

**Firm leadership:**

Ann Lui, AIA, and Craig Reschke, AIA

**Education:**

*Lui:* B.Arch., Cornell University; S.M.Arch.S., Massachusetts Institute of Technology; *Reschke:* B.Arch., University of Tennessee; M.L.A., Harvard Graduate School of Design

**Firm size:**

Four to six

**How founders met:**

Our hands touched over a piece of trace paper at Skidmore, Owings & Merrill.

**Origin of firm name:**

In the beginning our name was a placeholder, as in, "At our future firm, we'll do this." When we needed to register the LLC, we decided to keep it.

Over time, we have come to think about how the name represents a balance between things that are "future"—vibrant, frenetic, energetic, forward-looking—and "firm"—the ways in which architecture should be stable, work well, and remain reliable.

**Mission:**

We make spaces—big and small—for people to come together in new ways.

**Favorite project:**

One of our self-initiated experimental projects is the Night Gallery, a nocturnal exhibition space in Chicago open from sunset to sunrise, during the warmer half of the year. The Night Gallery features film, animation, and media works by artists and architects and is organized around the public space on the sidewalk.

**Second favorite project:**

We just completed Studio 5524, a gallery, studio, and office for a Chicago painter. The project transformed an early 1900s building into a space for both creative work and semi-public gatherings. We loved the chance to design both through subtraction—the building had been built up with odd partitions and finishes over time—and preservation—retaining a few key historic elements that gave the minimalist space a unique character.

**Worst criticism you've ever received:**

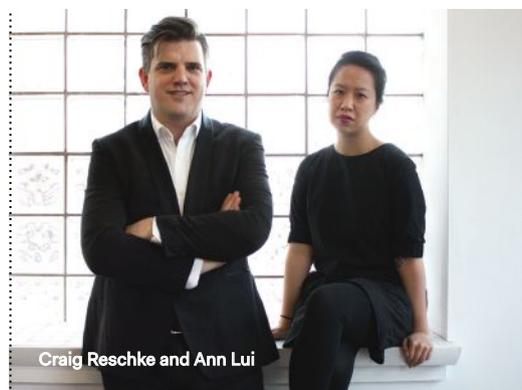
Some say everything we design looks like a "bunker or a barn." We take it as a compliment.

**Favorite place to get inspired:**

Night swimming at 31st Street Beach in Chicago.

**Greatest challenge to running a successful practice:**

To keep going. It took us a long time to realize that architecture is often about the collision of largely irreconcilable desires, restrictions, and regulations,



Craig Reschke and Ann Lui

and that it's our job to find elegant solutions in the face of these tangles.

**Design tool of choice:**

Pens in three different line weights. At past firms, we learned the thicker the line weight, the higher the pay grade. These days, we simultaneously function as principals, designers, and interns so we keep a range of options.

**Design aggravation:**

We once saw a sample of rubber sheets that were stamped and colored to look like bricks and intended to be stapled on the wall. We would probably avoid them.

**Architects should be discussing:**

How to survive the storm—ecological, political, economic, personal.

**Vice:**

*Reschke:* Roller coasters, screaming out the window while driving.

*Lui:* Sleeping, being optimistic.



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about brick the world has ever had.**

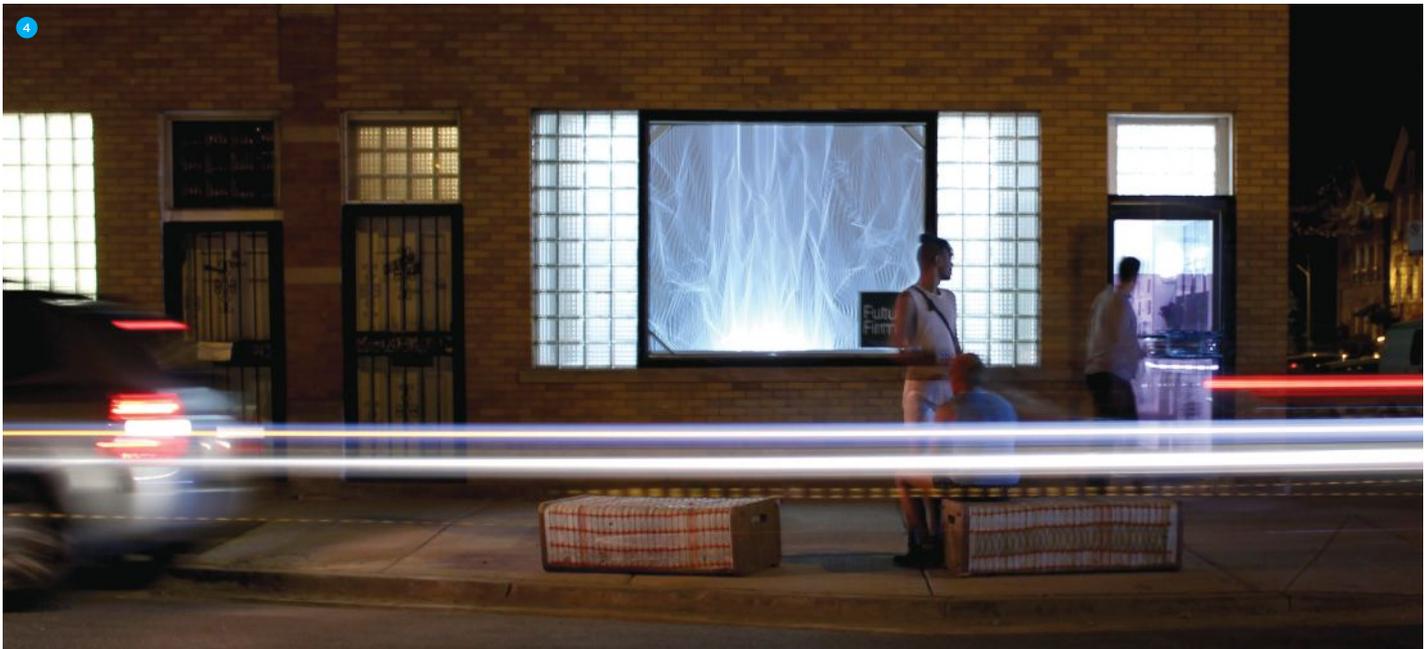
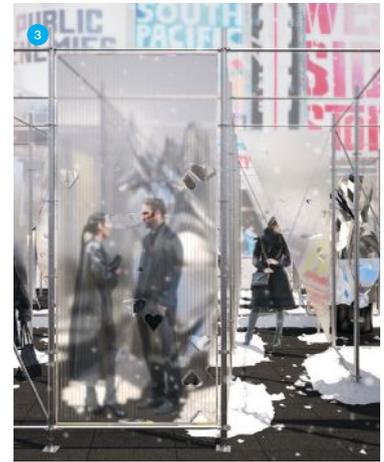
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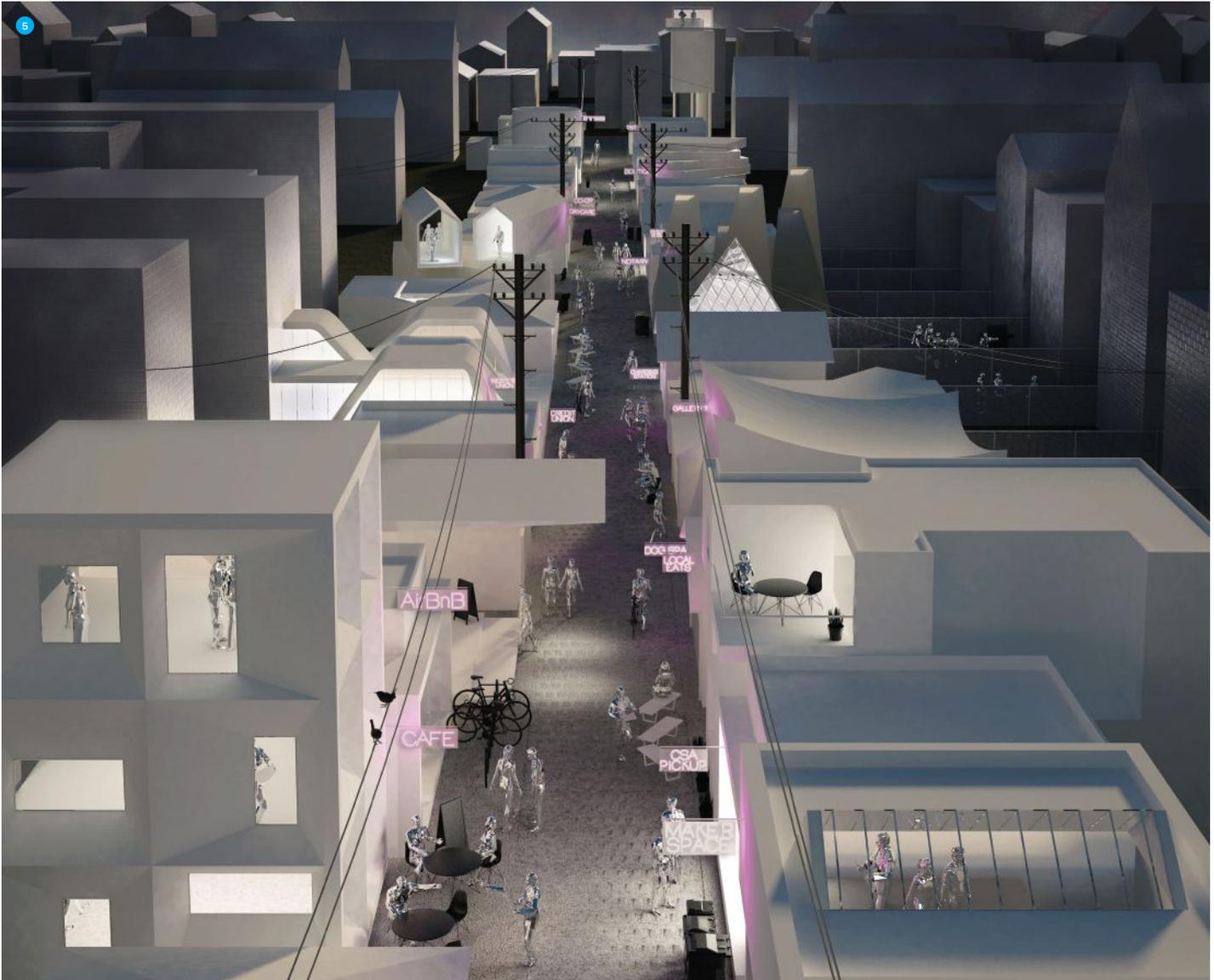
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**Next Progressives:  
Future Firm**





1. Designed for a site on Turtle Lake, Wis., this vacation residence is inspired by a midcentury bungalow previously on the property. 2. Future Firm converted a century-old medical office building into an artist studio, gallery, and office space in Chicago's Edgewater neighborhood. 3. Lui and Reschke collaborated with New York-based designer Andrew Heumann on this 2017 Times Square Valentine Heart Design Competition proposal. Constructed like a scaffolding system, the team hoped to evoke movie theaters of the 1960s and 1970s that "allowed for romantic encounters in an era of necessary anonymity." 4. Located in the Bridgeport neighborhood of Chicago, the Night Gallery exhibition space features a street-facing screen for projections of interactive websites, sensor-based installations, or animations such as the algorithm-based "When the Drawing is Moving," by Rhode Island-based designer Carl Lostritto (shown). 5. First displayed at the 2016 "50 Designers, 50 Ideas, 50 Wards" exhibition at the Chicago Architecture Center, the firm's Rebel Garages research conceives a city alleyway as an alternative community space. 6. The firm's 2016 "The Uncomfortableness of Getting into Bed With Others" alternative seating installation is designed to challenge one's sense of personal space.

# Products: How to Specify Steel Doors for Schools

TEXT BY LINDSEY M. ROBERTS

Sticky fingers, kicks, bangs from backpacks, and nonstop operation test the mettle of every school entry and exit door. Wood doors, while versatile and beautiful, generally won't survive the use. "A wood door can be gouged and scratched," says Jeff Wherry, managing director at the Steel Door Institute (SDI) in Westlake, Ohio. "If a steel door is gouged and scratched, it can be bonded." In fact, steel doors are the only tested door type that has passed FEMA's tornado tests, says Trent Turner, director of hollow metal marketing at Assa Abloy in Lebanon, Tenn. Even with steel tariffs driving up prices, architects say that the investment in steel doors will pay off.



## Materiality

Portland, Ore.-based BRIC Architecture, which specializes in educational design,

opts for galvanized or galvanized steel exterior doors for schools. Both zinc-coated, corrosion-resistant alloys go through the same hot-dip coating process, increasing their durability. Galvanized steel goes through an extra annealing (heat-treatment) process that makes its coating sturdier and more scratch-resistant.

## Classification

The SDI classifies steel doors as standard duty, heavy duty, extra heavy duty, and maximum duty. "We always use [extra heavy duty], 16-gauge doors," says Susan Wurdeman, a specifications writer and associate at BRIC. "Sometimes we'll even go to maximum duty. ... For schools, you need durable [products]."

## Hardware

Steel doors can be specified with electronic hardware, as many schools now require keycard access. Doors can be prepped with power supply cables that will plug-and-play with the building power supply, or have conduit preinstalled so that an electrician can install wiring on-site, Turner says.

## What's Inside

Hollow metal doors are available with five standard core types: honeycomb, polystyrene, polyurethane, steel-stiffened, and mineral. A honeycomb core is made of hardened cardboard and can have a fire-rating of up to three hours. A polystyrene core, made of a slab of insulating foam, can also be fire-rated

up to three hours. A polyurethane core has better insulating properties, but cannot be fire-rated. Steel-stiffened doors are more durable, can be fire-rated, and reduce sound transmission. Lastly, mineral core doors can reduce heat transfer dramatically, even allowing occupants to pass by doors unaffected by heat from a fire on the other side.

## Looks Matter

Steel doors can be given a faux wood finish with a clear coat that resists stains and graffiti. "[People think] steel doors are industrial and mundane, but if you look at some of the product offerings, you'll see that there's a myriad of looks and styles," Wherry says.

## Lites for Daylight

Steel doors can contain half-lites and quarter-lites, or even be fashioned into Dutch doors. Panels can be cut out of solid doors to accept a glass lite. While fire-resistant lites are available, the cutout will cause a thermal break, which may be acceptable if the ability to see through the door takes precedence.

## Certifications

Steel doors are tested by the SDI for "strength, quality, consistency, security, weather- and fire-resistance, wear and tear, and longevity" to ensure the highest "manufacturing, performance, and quality standards," according to the SDI. An SDI-certified door also maintains compliance with ANSI and ASTM standards.

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# Opinion: The Complexion of Legacy in Architecture

TEXT BY KIMBERLY DOWDELL, AIA



In 1947, my grandparents purchased a modest Victorian-style home near Belle Isle on Detroit's East Side, becoming the first black family to integrate the neighborhood. That house, in which I lived until the age of 9, became part of the fabric of a disinvested neighborhood and, like many buildings in the area, was eventually demolished. One reason I decided to become an architect, at age 11, was to help improve my hometown as a whole and thus prevent more families' memories from being bulldozed over.

Today, my work is focused on creating strong neighborhoods in which people feel safe and empowered to build a good life. As an African-American woman, I am acutely aware that the affected neighborhoods throughout the United States are disproportionately black, while the profession tasked with envisioning their rebirth is disproportionately white. As the newly inaugurated 2019–2020 president of the National Organization of Minority Architects (NOMA), I hope to help ensure the success of minority-owned architecture firms so that they will be at the forefront of this important work.

As such, I was struck by the absence of African-American-led firms on the recently released ARCHITECT 50—a blemish that has existed on this

otherwise inspiring and prestigious list since its inception in 2009. But their lack of representation extends beyond this one list: African-Americans are outright missing from the profession. Of the more than 113,000 architects in the United States, approximately 2,250 are African-American—less than 2 percent of the profession in a country that is 13 percent African-American.

Consider the impact of this underrepresentation in the communities in which many minority architects grew up—and may still reside. Are cities better off with design authorship from architects intimately familiar with the environment? Should communities of color be designed and built by a diverse team? Should every neighborhood benefit from diversity of thought and experience in design? I think the answer to all of these inquiries is yes.

According to the United Nations, two-thirds of the world's population will be living in cities or other urban centers by 2050; the number of people living in U.S. cities will grow from approximately 300 million to 400 million. Meanwhile, by 2045, this country's population will become mostly non-white, according to a recent study conducted by the Brookings Institute.

As cities redevelop to accommodate this influx, architects will no doubt have a hand in building the future. But *who* will be these architects and *for whom* will they build?

As in politics, representation matters in city building. I am encouraged by

the current support in the profession to heighten diversity in architecture—such as scholarships, grants, and mentorship programs—but much remains left to do, particularly as it relates to helping our minority firm owners create sustained legacies that will positively influence their communities.

My presidential platform is “ALL in for NOMA 2020.” By the end of my two-year term, I would like to see greater Access, Leadership, and Legacy building in the profession, particularly among the African-American community, which is the most underrepresented minority. As NCARB reports unprecedented numbers of minority students entering the profession and getting licensed, we also need more opportunities for minorities to grow into leadership positions, start their own firms, and build a sustainable legacy for the future. NOMA, for one, offers year-round programming and an annual conference to recruit talent, develop best practices, and educate designers on how to gain recognition for quality work and prepare for succession planning and legacy building.

When architects are empowered to design for the health, safety, and welfare of their own communities, they have a personal stake in the work—and in the results. If we don't support the future of our communities with sensitive design, who else will?

*Kimberly Dowdell, AIA, is an architect and real estate developer in Detroit, and teaches at University of Michigan Taubman College.*

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# Residential: Elemental

TEXT BY EDWARD KEEGAN, AIA

The Chilean coast near the town of Los Vilos, roughly 250 kilometers north of Santiago, is a rough and rugged landscape marked by deep ravines and dramatically cut stone inlets and cliffs. It's this difficult—even brutal—environment that inspired 2016 Pritzker Prize laureate Alejandro Aravena's Santiago, Chile–based firm Elemental to design a starkly simple three-volume composition as its contribution to the star-studded Ochoalcubo development, which features, among other housing, weekend retreats by 16 noted architects—eight from Japan, including Kengo Kuma, HON. FAIA, and Sou Fujimoto, and eight from Chile, including Felipe Assadi, Guillermo Acuña, and Aravena.

Named Casa OchoQuebradas (Eight Ravines) after the site's topography, the Elemental house is set 23 meters (about 75 feet) above the Pacific Ocean. The seaside climate is somewhat difficult, with temperatures averaging 59 F. "It's a very windy coast, with cloudy mornings and very sunny afternoons," Elemental partner Víctor Oddó explains.

The commission came with minimal program requirements: four bedrooms and four baths. Elemental designed a solution that can accommodate just a couple for a weekend or a larger group of guests for longer periods. The 289-square-meter (about 3,111-square-foot) house is crafted out of just three materials: reinforced concrete, wood, and glass.



From the south, Casa OchoQuebradas appears as three monumental concrete forms in the landscape.

## Project Credits

*Project:* Casa OchoQuebradas, Los Vilos, Chile

*Client:* Withheld

*Design Architect:* Elemental, Santiago, Chile · Alejandro Aravena, Víctor Oddó, Suyin Chia (project team)

*Collaborators:* Alexander Frehse, José Esparza Chong Cuy, AIA, Carlos Portillo, Isaías Moreno, Clémence Pybaro

*Structural Engineer:* Luis Soler P. & Associates

*Mechanical Engineer:* Geocav

*Size:* 289 square meters (3,111 square feet)

*Cost:* Withheld

> To see more images of this project, visit [bit.ly/CasaOchoQuebradas](http://bit.ly/CasaOchoQuebradas).

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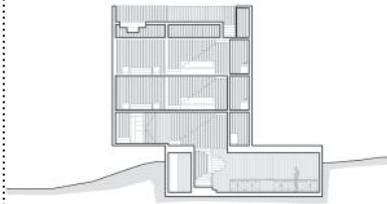


## Residential: Elemental

A horizontal volume, measuring 10.90 meters (36 feet) by 15 meters (49 feet) comprises the main living level, which is set into the landscape and can be used as a complete home for two. A continuous space for kitchen, dining, and living areas, all under a 3.54-meter (11.5-foot) ceiling, is bisected by a circular fire pit—open to the sky through a second, monumental canted volume—that can be closed off with sliding glass doors. Oddó notes that the canted volume is not just a chimney: “It’s a room for fire—a piece of outdoors indoors,” he says. The master bedroom occupies an alcove next to the living room, where it enjoys floor-to-ceiling glass facing southwest toward the ocean. This portion of the house runs from the northeast to the southwest, facing the ocean, and the fact that the northeastern half is partially below grade directs all views out toward the water.

Above this lower, main living level, the primary tower volume measures 3.2 meters (10.5 feet) by 9.7 meters (32 feet) with a height of 9.74 meters; it is cantilevered roughly 3.5 meters (11.5 feet) off the top of the horizontal mass. And entry to the house is hardly obvious: In order to reach the front door on the southwest face of the tower, visitors must walk from grade onto the concrete roof of the horizontal lower volume and navigate a narrow exterior slot between the tower and the 6.52-meter-tall (21-foot-tall) canted concrete volume—the one that ventilates the fire from the main living space underfoot.

Section A–A<sub>1</sub>

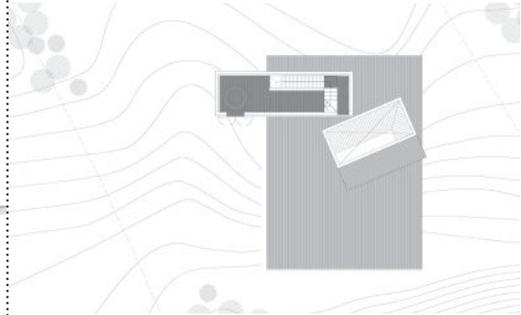


From the entrance, a spiral stair of precast concrete descends to the living spaces while a straight-run wood-and-steel stair rises to the additional bedrooms and bathrooms—one each on the ground, second, and third floors—and an open terrace atop the tower. The tower’s ocean-facing façade is clad in 4-inch-wide acetylated pine wood boards, which conceal floor-to-ceiling shutters that provide large openings for each of its interior spaces. Operable insulated glass doors lie just behind the shutters and provide natural ventilation. When closed, the shutters create a monolithic blank façade (even the front door can be concealed) echoing the concrete expanses of the other three sides of the tower.

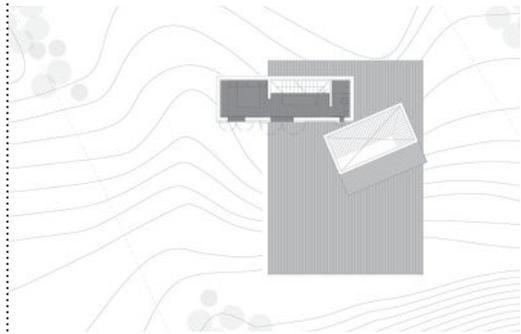
The simplicity of the mechanical systems matches the almost rudimentary nature of the house, with central heating provided by a combination of a gas-fired boiler, hot-water-finned tube radiators, and, of course, the fire pit. In the summer months, cooling is produced entirely via natural cross ventilation.

The boundaries between the principal materials of vertical wood boards and board-formed concrete can sometimes seem blurred as the 4-inch-wide pine board’s dimensions match those used as formwork for the exposed concrete walls on the other three sides of the tower, and for the other two volumes. And the color—which is already pretty close—will get even closer. “Wood turns gray over

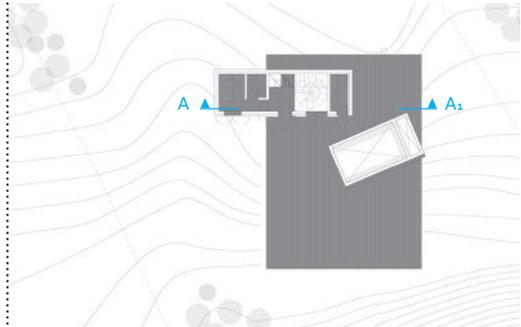
Roof Plan



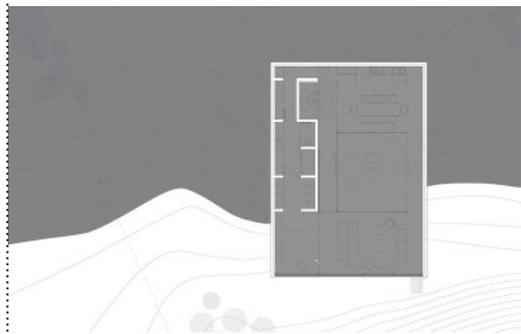
Third-Floor Plan

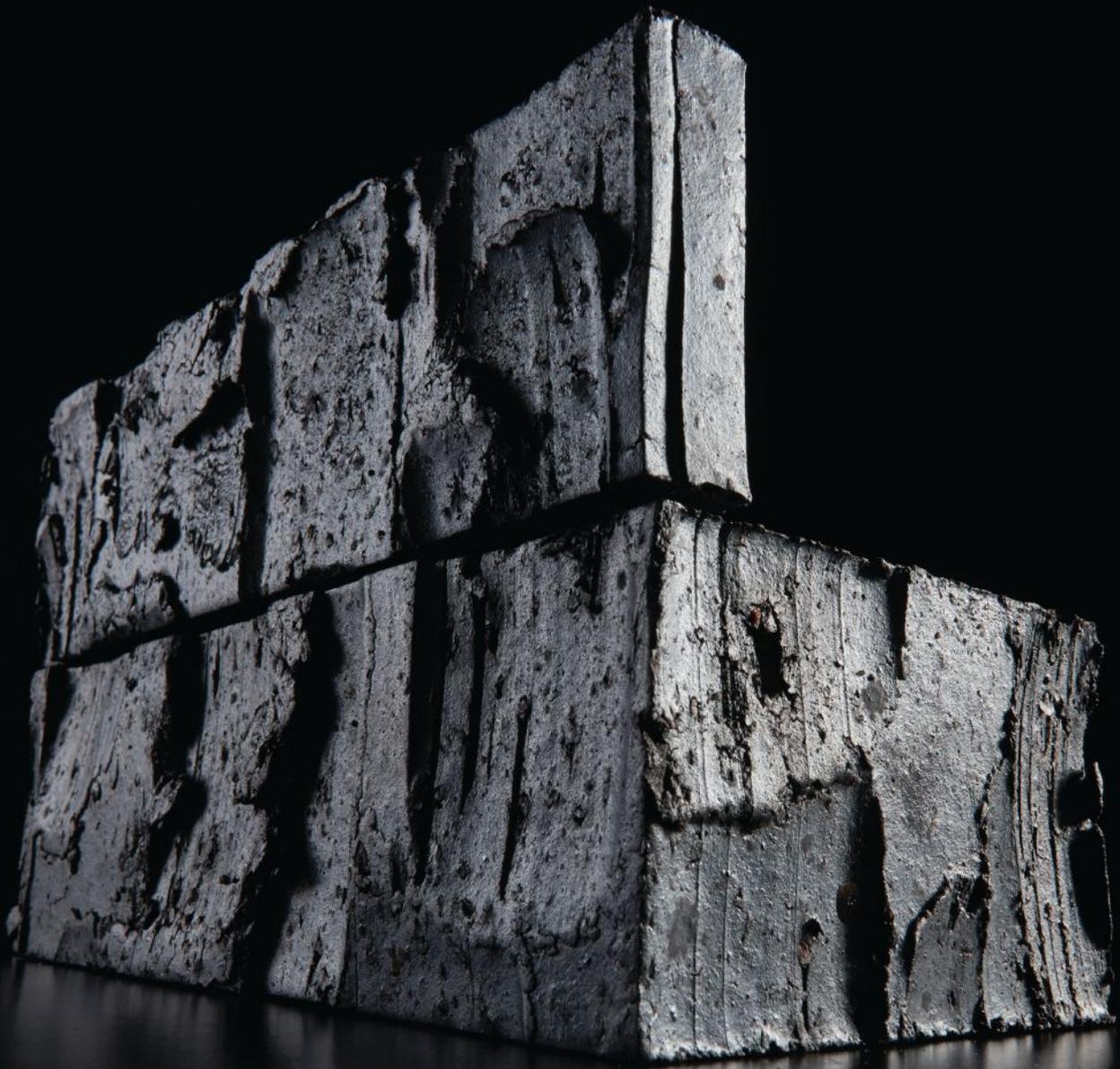


Ground-Floor Plan



Lower-Level Plan





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**Residential:  
Elemental**

time," Oddó says. "We expect these pieces to age as a stone, acquiring some of the brutality of the place." The concrete floors, with their polished finish, provide some modest contrast.

Casa OchoQuebradas aspires to both the simplicity and complexity of the natural world. Its balance—of roughness and refinement, of mass and transparency, of shelter and exposure—sets it apart in a harsh, but hauntingly beautiful landscape.



**1.** The approach to Casa OchoQuebradas involves passing the blank concrete façade of the tower and walking onto the roof of the main living level before reaching the front door on the tower's other side. **2.** Roof terrace on top of the tower. **3.** Floor-to-ceiling glazing on the southwestern façades maximize ocean views.

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**Residential:  
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**1.** The master bedroom on the main level can be closed off from the living spaces by a floor-to-ceiling sliding door. **2.** The central fire pit on the main level can be opened to the entire floor via sliding glass doors, and vents up through the cantilevered concrete volume above. **3.** On the second and third levels of the tower, a guest bedroom and guest bathroom—lined entirely in exposed concrete—flank the straight-run stairs. **4.** A circular staircase leads from the entrance down to the main living area on the lower level. Despite the fact that this level is set into the hillside, the glass walls (at left) allow ample light into the kitchen from both the open-topped volume over the fire pit and the glazed façade beyond.





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# METAL BUILDING ENVELOPE DESIGN BEST PRACTICES

## ADVANTAGES AND BENEFITS OF HORIZONTAL INSULATED METAL PANELS

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### LEARNING OBJECTIVES

Upon completion of this course the student will be able to:

1. Illustrate the multi-faceted practical and aesthetic benefits of horizontal insulated metal panels (IMPs) in metal building envelope design.
2. Understand the various panel and trim options available for insulated metal panels.
3. Examine how installation best practices and framing requirements for horizontal insulated metal panels impact building envelope aesthetics and performance.
4. Evaluate the importance of and requirements for on-site testing and product warranties.

### CONTINUING EDUCATION

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Think about most metal buildings. In the past, architects and builders designed commercial and industrial facilities for practical purposes—low-cost and easy construction made these buildings popular for warehouses and factories. Until recently, there was no role for aesthetics.

Now, thanks to innovations in building envelope design, metal buildings are growing in popularity and architects are using them in residential, office, retail, and institutional building designs. As design popularity grew, so too did the emergence of gaps in design and functionality caused by metal panel design deficiencies. These deficiencies caused lower R-value, thermal bridging, discontinuities in air barriers, and condensation.

Horizontal insulated metal panels (IMPs) solve these design deficiencies with the added benefits of aesthetic appeal, faster installation, and easy maintenance.

### INTRODUCTION TO HORIZONTAL INSULATED METAL PANELS

Horizontal IMPs are two single skin metal panels on either side of a factory-foamed-in-place core. There are two membranes, exterior and interior, and the foam core. The exterior membrane functions as the water, air, and vapor control layer. The interior membrane provides another layer of air and vapor control, and the foam core provides a layer of thermal control. IMPs can be used in any climate or environmental condition, making them adaptable to many building design projects across different climate zones.

#### Practical Benefits of Horizontal Insulated Metal Panels

There are several practical benefits to horizontal IMPs versus a conventional metal building cladding. In those buildings, insulation is draped between the panel cladding and structure,

compressing it and causing it to lose R-value, or thermal resistance. The IMP eliminates those issues.

The ease of installation is a key practical benefit of horizontal IMPs. Insulated metal panels are installed as a single monolithic element, allowing for faster building completion in almost any kind of weather without risk to system integrity, as opposed to multiple installation steps for other insulated wall systems.<sup>1 2</sup>

Another practical benefit of horizontal IMPs is that they do not experience significant thermal bridging. Unlike conventional construction where the cladding is attached to the building structures, IMPs have concealed attachments within the insulation. Second, IMPs provide a continuous air barrier due to specialty joints and seams as well as concealed fasteners. Concealed fasteners are preferred because they are incorporated into the double tongue and groove and help improve thermal short circuit.

Additionally, discontinuities that often occur in conventional construction due to the various layers (insulation, vapor, thermal) are eliminated with the use of foam panels at corners, around windows and doors, and any openings that give rise to air, thermal, and insulation gaps.

### Aesthetic Benefits of Horizontal Insulated Metal Panels

Not only do horizontal IMPs offer several practical benefits in metal building design, but they also offer versatile aesthetic advantages. There are a variety of panel profiles, widths, colors, and finishes to choose for design projects ranging from industrial to office buildings. Panels are also available in textured finishes and custom colors, and horizontal IMPs can be used with vertical panels and panels of different widths on the same wall. There are many design possibilities, reveals, and profiles to choose from.



IMPs are available in a wide variety of colors as featured in the Kickapoo Tribe Government Building pictured above.

Horizontal IMPs are also lightweight compared to other insulated wall panel systems, and require less maintenance. Many offer additional choices for wall panel accessories, like continuous corners and aluminum extrusions.<sup>3,4</sup>

### Insulated Metal Panel Ratings

In addition to their practical and aesthetic benefits, IMPs have been tested to various test standards to meet building code requirements and insurance listing agencies. These tests include ratings for fire, structural strength, thermal transmittance, foam core properties, water leakage, and air infiltration. It is important for architects and designers to request the ASTM testing results for IMPs to ensure that the product meets their requirements for a specific job. Below are tested results for IMPs against various environmental, fire resistance, and structural tests. All the results have been tested to the American

## CASE STUDY: UROLOGY MEDICAL OFFICE BUILDING

**Project Overview:** Urology of Virginia expanded their Virginia Beach campus by 12,500 square feet to accommodate an imaging center, ambulatory surgery center, cancer clinic, and additional exam rooms.

**Project Specifications:** 7.2 Insul-Rib™ and Architectural Horizontal Metal Panels in Signature® 300 Silver Metallic color

**Challenge:** Use a high-tech, modern aesthetic concept for the new structure and maximize available land by constructing the new building two inches from the existing structure.

**Solution:** Horizontal insulated metal panels directly addressed the two core challenges with their sleek appearance and higher safety regulations due to the new structure's proximity to the existing building.

A metal panel manufacturer supplied corrugated panels for the main entrance and stairwells and smooth panels for the third floor to add visual interest and break up the mass of the new three-story building. The 7.2 Insul-Rib™ panels featured a polyurethane foam core to deliver superior insulation, and the Architectural Horizontal IMPs were positioned with patterning aligned with the windows, enhancing symmetry and cohesion.



Urology of Virginia, Virginia Beach Campus

Society for Testing and Materials (ASTM) standard unless otherwise noted.

### Thermal Transmission and Air Leakage

In a measurement of the resistance to heat flow, or R-value, of a construction assembly in a guarded hot box, horizontal IMPs achieved a rating of R-8.5/inch of panel thickness at a 40-degree Fahrenheit mean temperature. Horizontal IMPs are generally available with R-value ratings between R-7 and R-48, depending on project specifications.

When measuring air leakage through wall panel joints, horizontal IMPs resulted in a value of less than 0.01 cubic feet per minute, per square foot at 20 pounds per square foot of static pressure. This is in comparison to standard metal panels, which can have ratings of 0.003 cubic feet per minute, per square foot at 12 pounds per square foot of static pressure.

### Fire Resistance

The surface burning characteristics of foam core horizontal IMPs measure an average flame spread index of 20 and a smoke developed index of 350. The wall fire performance of horizontal IMPs, measured by the American Society for Testing and Materials, exceed the standard requirements of a maximum flame spread of 25 and a maximum smoke developed index of 450.<sup>5</sup>

### Structural<sup>6</sup>

The negative and positive load resistance of horizontal IMPs will vary based on panel

thickness and spans between supports. There are various fastening options to increase the negative load capacity of horizontal IMPs.

When it comes to deflection, or the degree to which a structural element is displaced under a load, the maximum deflection criteria for insulated wall panels is typically L/180<sup>7</sup>. Local building codes should also be consulted for any additional structural limitations, as the climate could impact load resistance.

### INSULATED METAL PANEL USE IN METAL BUILDING DESIGN: PROJECT CONSIDERATIONS

Horizontal IMPs offer many advantages for building owners, designers, and contractors, beginning with their practical use in many applications. These include architectural, commercial, industrial, and institutional markets. In any of these project scenarios, IMPs offer better thermal performance, reduced building operational expenses, faster dry-in with a quicker manufacturing timeline, and accelerated construction schedules. This means that projects with IMPs can be completed faster, using fewer raw materials in manufacturing, and achieve superior performance.

In addition, some IMPs can span greater distances than single-skin panels and are fire, wind, hail, water, insect, and rodent resistant. With these advantages in mind, it's important for architects to consider several IMP design considerations that can impact the building's structure and exterior envelope. Even the best

product can suffer deficiencies if it's ill-suited to particular project specifications.

Design considerations should begin with project design loads. The architect or designer should know the project design loads, then use the load tables to determine necessary panel thickness—which should be based on the required R-value—and width, profile, and gauge. Once architects have determined project design loads, the next step is to choose the appropriate metal panel thickness and width. There are many options to choose from, including:

- 24 to 42 inches width
- 1 to 53 feet run, depending on geometric requirements
- 2 to 6 inches thickness
- Flat, embossed with a pattern, or striated appearances

There are multiple wall profiles available, depending on project requirements. For example, when architects choose the same panel thickness, width and panel profiles can vary and still engage with each other. Picture this design setting that's possible with horizontal IMPs: an architectural flat panel can be used for the lower portion of the building, and half-way up a striated panel is used to contrast profiles and design. Profiles range from flat exterior to stucco embossed and more, depending on project specifications and design

needs. Exterior IMPs are standard 22 gauge, and interior IMPs are standard 26 gauge with options for 24 and 22 gauge depending on the building's use and location.

Horizontal IMPs achieve superior R-values due in large part to the foam insulated core. The foam core provides enhanced energy efficiency through double tongue-and-groove interlock combined with vapor seal mastic in the grooves. These characteristics combine to increase thermal performance and eliminate air and moisture intrusion, if the sealant is applied properly. Compared to a field assembled glass fiber insulation system, the foam core of IMPs offers an R-value that achieves more than twice the amount of energy efficiency.<sup>5</sup>

When designing metal buildings, choosing materials that improve building strength is an important consideration. The structural strength of horizontal IMPs is extremely solid due to the composite action between the flat facings and foam core. For example, a 2-inch panel can satisfy most wind load requirements in the range of 20 to 30 pounds per square foot and can be met with 7 to 10-foot span conditions. Panel thickness will vary depending on the thermal requirements and structural span tables; however, narrow panels tend to be stronger because there are more fasteners per square foot of panel area. It is recommended that the typical wall or roof panel attachments should be a minimum of 16-gauge steel.<sup>5</sup>

Proper alignment of the building's structural framing is critical to the successful use of horizontal panels. Panel end support framing, as well as window, door, and other framed openings must be located exactly as detailed, plus or minus one-eighth of an inch, to ensure that the panels properly fit on each wall. It is also critical that all inside and outside corners are square and plumb, plus or minus one-eighth of an inch in twenty feet. Architects must decide where they want the vertical panel joints. And, where ever the panel starts and stops, double studs are required.

### STRUCTURAL ALIGNMENT

Proper alignment of the structural members to which the panels are to be attached is critical. Before beginning installation of wall panels, verify that all structural framing is properly aligned.

To allow for the proper fitting of the vertical joint assemblies, the structural supports at the panel ends must be positioned and plumbed to within plus or minus one-eighth of an inch of the specified spacing. Once these supports are verified to be properly installed, pull a string line between them to ensure that the intermediate structural supports are in line. Any structural members that are inside of the string line will cause the wall panels to bow inward, resulting in panel stress and oil canning, and possibly thermal buckling.

- Panel tolerance varies according to the structural support spacing, though the substructure must not allow installed panels to bow inward of the steel line.
- Support spacing over 8'- $\frac{1}{4}$ " out-of-plane tolerance (Outward Only)
- Support spacing between 8' and 4'- $\frac{1}{8}$ " out-of-plane tolerance (Outward Only)
- Support spacing less than 4'- $\frac{1}{16}$ " out-of-plane tolerance (Outward Only)

Using horizontal insulated metal panels in a variety of construction settings has clear practical and aesthetic benefits. They achieve optimal building code ratings, help improve a building's energy efficiency, and allow for flexibility in design. In the next section, learn just how flexible horizontal IMPs are with their variety of panel and trim options.

### PANEL AND TRIM OPTIONS FOR HORIZONTAL INSULATED METAL PANELS

One of the most useful aesthetic benefits of horizontal IMPs is that they can be used with other building materials interchangeably. For



example, horizontal wall panels can be installed flush with glass curtain walls for a modern, open building environment. In another design example, corrugated and smooth panels can be used together to increase visual interest. Horizontal metal panels also provide a pleasing aesthetic when paired with vertical panels, different colors, or varying panel widths on the same wall. They can also be constructed with continuous wrap corners, adding to a building's symmetry and design.

Architects will find it helpful to become familiar with the various panel and trim options available for horizontal IMPs so they can approach project design with a blank canvas. Plus, as building and energy codes become increasingly more stringent, insulated panels are particularly advantageous in achieving sustainable design and code compliance.

### PANEL APPEARANCE

Visually, horizontal IMPs are extremely appealing because their flush appearance provides a monolithic look well-suited for high-profile architectural applications. Available panel profiles include<sup>8</sup>:

- Smooth/Flush
- Ribbed
- Embossed
- Stucco
- Striated

The design flexibility of horizontal IMPs cannot be understated. From a variety of color and finish options to choices in reveal, trim, facings, and corners, architects and designers can incorporate many different looks. As mentioned above, panel widths range from 24 to 42 inches and panel thicknesses range from 2 to 3 inches, and either can be mixed on a single wall.

There are a variety of joint configurations to suit different aesthetic, thermal, and project load requirements. Ensuring continuity in joints between panels is relatively easy, but make sure to pay close attention to continuous seals between panels, at all openings, corners, and interfaces. Joint configuration options include reveals from one-eighth to three inches. Reveals are not available in every profile. Panel edges are roll formed to create interlocking side joints, which accommodate the concealed fastener and clip system and achieve the panel-to-panel seals with half-inch increments.

 This article continues on <http://go.hw.net/AR012019-3>. Go online to read the rest of the article and complete the corresponding quiz for credit.

### QUIZ

1. The interior membrane provides another layer of air and vapor control, and the foam core provides a layer of \_\_\_\_\_ control.
  - a. Thermal
  - b. Vapor
  - c. Water
  - d. Air
2. What R-value did horizontal IMPs achieve at a 40-degree Fahrenheit mean temperature?
  - a. 6.5 per inch
  - b. 7.5 per inch
  - c. 8.5 per inch
  - d. 9.5 per inch
3. What is the maximum deflection criteria for horizontal IMPs?
  - a. L/175
  - b. L/180
  - c. L/190
  - d. L/195
4. Horizontal IMPs have various design options, including flat, embossed with a pattern, or \_\_\_\_\_ appearances.
  - a. Circular
  - b. Striated
  - c. Square
  - d. Straight-line
5. To allow for the proper fitting of the vertical joint assemblies, the structural supports at the panel ends must be positioned and plumbed to within plus or minus \_\_\_\_\_ of an inch of the specified spacing.
  - a. One-half
  - b. One-sixteenth
  - c. One-fourth
  - d. One-eighth
6. The Dynamic Water Penetration Test (AAMA 501.1) is used to evaluate:
  - a. Water penetration of windows, walls, and doors using dynamic pressure
  - b. Structural adequacy of external wall systems' ability to withstand water penetration and air leakage
  - c. Water-tight seals of large glass areas
  - d. Water penetration of curtain walls
7. Options for corner panels in horizontal IMPs include:
  - a. Pre-formed
  - b. Rubber gasket
  - c. End fold detail
  - d. Vertical joint trim
  - e. All of the above
8. Structural design elements such as long panel lengths, dark colors, and attachment to structural elements that may deflect under load can each cause excessive oil canning or stress buckling of the exterior panel skin due to:
  - a. Thermal bow
  - b. Water infiltration
  - c. End case details
  - d. Rubber gasket penetration
9. Inside and outside corners should also be square and plumb, plus or minus one-eighth of an inch for every \_\_\_\_\_ feet of wall.
  - a. 15
  - b. 20
  - c. 50
  - d. 30
10. When panels are fully engaged, what is the maximum plus or minus joint reveal at the panel exterior?
  - a. One-eighth
  - b. One-tenth
  - c. One-sixteenth
  - d. One-fourth

### SPONSOR INFORMATION



Since 1976, MBCI has provided customers with quality metal roofing and wall products, superior service and competitive pricing. It remains the industry-leading manufacturer of metal roofing and metal wall panels and other products. With its large product selection and full engineering and design capabilities, MBCI supports both the design community and customers from project conception through project completion. [www.mbc.com](http://www.mbc.com)

# CLARIFYING PRODUCT TRANSPARENCIES

LIFE CYCLE ASSESSMENT, ENVIRONMENTAL AND HEALTH PRODUCT DECLARATIONS

Presented by:

**SLOAN**



## LEARNING OBJECTIVES

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

1. Examine the need to reduce the environmental impact of buildings and the global demand for product transparency in the building industry.
2. Describe the relationship between Product Category Rules (PCRs), Life Cycle Assessments (LCAs), Environmental Product Declarations (EPDs), Health Product Declarations (HPDs), and Declare Labels.
3. Identify how product transparency reports such as LCAs, EPDs, HPDs and Declare Labels help meet the demand for product transparency.
4. Understand how to interpret product transparency reports and apply these tools to specify sustainable and healthy building products.

## CONTINUING EDUCATION

AIA CREDIT: 1 LU/HSW  
 AIA #: AR012019-1  
 GBCI CREDIT: 1 CE  
 IDCEC CREDIT: .1 CEU  
 ASPE CREDIT: 0.10 CEU



Use the learning objectives above to focus your study as you read this article. To earn credit and obtain a certificate of completion, visit <http://go.hw.net/AR012019-1> 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.

## ENVIRONMENTAL IMPACT OF BUILDINGS AND THE CONSTRUCTION INDUSTRY

The construction industry and the operations and maintenance of buildings have an enormous environmental impact. According to the Rocky Mountain Institute, "In the United States, building operations such as lighting and HVAC are responsible for 73 percent of the country's electricity consumption and 38 percent of all CO<sub>2</sub> emissions. And, according to the U.S. Geological Survey, "Building operations use 13.6 percent of all potable water, which is roughly 15 trillion gallons of water per year." In addition, the multitude of chemicals used in building products and construction are having a detrimental effect on the health, safety and welfare of building occupants. Unfortunately, Americans spend approximately 90 percent of

their time indoors, compounding the health effects of poor indoor environmental quality caused in part by these chemicals.

## BUSINESS DRIVERS FOR SUSTAINABILITY

Sustainability initiatives have developed throughout the corporate world and are now widely accepted as a core business value rather than a temporary trend. Customers, investors, environmental interest groups and governments are taking a greater interest in sustainable companies. According to a 2011 global McKinsey Study, 73 percent of executives say sustainability is a priority on their CEO's global agenda. Sustainability objectives are changing from managing reputation and compliance to creating business value. CEO's say business drivers include cost reduction, risk management,

competitive advantage and revenue increase. Cost reduction is accomplished by optimizing material energy and resource use across the value chain. Risk management seeks to comply with regulation, mitigate risk from materials and processes of concern, and gain visibility into the supply chain. To gain competitive advantage companies may enhance their brand and reputation and appeal to employees, customers and investors. Revenue increases are seen when customer preferences for sustainability labeled goods are fulfilled and new sustainable product portfolios are built.

## INTRODUCTION TO TRANSPARENCY REPORTS

Architects and designers are increasingly seeking high-profile projects and insisting on certifications that take a whole-building

## PRODUCT TRANSPARENCY TERMINOLOGY

### The Guidelines—Product Category Rule (PCR)

“Set of specific rules, requirements and guidelines for developing Type III environmental product declarations for one or more product categories.” (ISO 14025)

### The Analysis—Life Cycle Assessment (LCA)

“Compilation and evaluation of the inputs, outputs and the potential environmental impacts of a product system throughout its life cycle.” (ISO 14040)

### The Declaration—Environmental Product Declaration (EPD)

“Providing quantified environmental data using predetermined parameters and, where relevant, additional environmental information.” (ISO 14025)

### Health Product Declaration (HPD)

An HPD discloses the materials or ingredients in products and their associated health effects and helps specifiers identify chemicals of concern that are present in any building products.

### Living Building Challenge

A green building framework created by the International Living Future Institute (ILFI)

that certifies the development of buildings, neighborhoods, villages/campuses and cities and evaluates a project’s performance against seven separate metrics: site, water, energy, health, materials, equity and beauty.

### Declare Label

A transparency platform and product database allowing manufacturers to publicly ‘declare’ the life cycle sustainability of their products or projects based on the inclusion of environment- and occupant-friendly materials and chemicals.

### Program Operator

An independent agency appointed to manage the EPD process and its associated PCR.

### Cradle-to-Grave

Raw material extraction through product use and disposal.

### Cradle-to-Gate

Raw material extraction to the factory gate.

### Gate-to-Gate

From one defined point on the life cycle to a second set point further along the life cycle.

procurement requirements for governments and industry. LCAs, EPDs and HPDs collectively provide information about the environmental performance and impact of products and offer objective means to compare similar products. Ultimately, the benefits of transparency are that it enables buyers to make more informed decisions about the products they purchase, helps to drive down costs, spurs further advances in product sustainability and increases safety as manufacturers strive to create the best product possible.



LEED v4’s more stringent requirements raise the bar for project teams and building product manufacturers to more holistically assess environmental impacts across the entire life cycle of a product.

## LEED V.4 AND LCA/EPD

Green building rating systems such as LEED are demanding transparency and disclosure as well. Earlier versions of LEED allowed manufacturers to make sustainable product claims based on one attribute, while the product’s other characteristics may not have made the grade. LEED v4’s more stringent requirements raise the bar for project teams and building product manufacturers. To more holistically assess environmental impacts across the entire life cycle of a product, LEED v4 is leading the charge in using verified LCA data.

A new credit asks manufacturers to provide EPDs or third-party verified life cycle assessments.

Manufacturers must now provide more detailed information on material content and comprehensive environmental impact. Instead of obtaining certification of recycled content from a manufacturer, the project team will now request an Environmental Product Declaration or third-party verified life cycle assessment. Just having an EPD contributes to one point, while showing that their product’s impacts are below industry averages contributes to a second point. Recycled content will still help, but only for the responsibly sourced raw materials credit.



There is global demand for product transparency in the building industry, from manufacturers, procurement officers and consumers to suppliers, contractors, architects and building owners.

approach to sustainability. Knowing what’s in the materials used to construct these buildings is the best path to sustainable design. There is global demand for product transparency in the building industry, from manufacturers, procurement officers and consumers to suppliers, contractors, architects and building owners. However, questions remain among these parties about how to evaluate and compare the environmental profiles of similar building products and materials. The roadmap

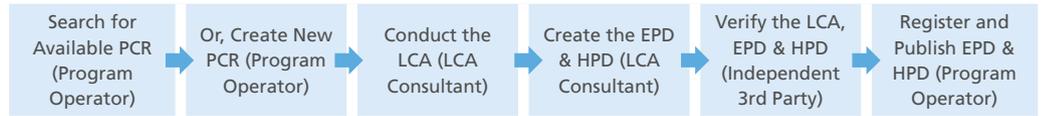
to transparency and health is achieved by product disclosure, more standards bases and use of more authentic data certifications.

Product transparency reports like Life Cycle Assessments (LCAs), Environmental Product Declarations (EPDs), Health Product Declarations (HPDs) and Declare labels for building material products help customers and their clients earn valuable credits within the LEED rating system (and other green building systems) and meet a growing number of

The LEED v4 Materials and Resources (MR) credits combat some of the environmental issues with chemicals of concern. Materials and Resources Credit Categories include:

- Building Product Disclosure and Optimization—EPD credit
  - This credit intends to “encourage the use of products and materials for which life cycle information is available and that have environmentally, economically and socially preferable life cycle impacts.” It’s also designed “to reward project teams for selecting products from manufacturers who have verified improved environmental life cycle impacts.”
- Building Product Disclosure and Optimization—Sourcing of Raw Materials credit
  - This credit intends to “encourage the use of products and materials for which life cycle information is available and that have environmentally, economically and socially preferable life cycle impacts. It will also “reward project teams for selecting products verified to have been extracted or sourced responsibly.”
- Building Product Disclosure and Optimization—Material Ingredients credit
  - This credit encourages “the use of products and materials for which life cycle information is available and that have environmentally, economically and socially preferable life cycle impacts.” It also “rewards project teams for selecting products for which the chemical ingredients in the product are inventoried using an accepted methodology and for selecting products verified to minimize the use and generation of harmful substances.” The credit also “rewards raw material manufacturers who produce products verified to have improved life cycle impacts.”
- Building Life Cycle Impact Reduction credit
  - The intent of this credit is “to encourage adaptive reuse and optimize the environmental performance of products and materials.” Project teams will demonstrate reduced environmental effects during initial project decision-making by reusing existing building resources—maintaining or renovating existing structures or reusing salvaged materials—or showing a reduction in materials use through a Life Cycle Assessment (LCA).

**FROM PCRS TO EPDS**



Other green rating systems are demanding transparency and disclosure, including the IGCC, Green Globes, BREEAM, NAHB Green and the Living Building Challenge.

**PRODUCT CATEGORY RULE (PCR)—THE GUIDELINE**

Now let’s discuss the relationship between Product Category Rules (PCRs), Life Cycle Assessments, Environmental Product Declarations, Health Product Declarations and Declare Labels. A prerequisite to conducting an EPD is the establishment of a Product Category Rule, according to ISO 14025, for the particular product or system. Think of a PCR as The Guideline.

EPDs are developed after a product LCA is conducted, and are based on applicable PCRs. A PCR is a “how-to” guide for conducting future LCAs that support the production of an EPD specific to the product category being assessed (e.g., plumbing, carpet, steel framing). A PCR sets clear and reproducible “ground rules” for how to conduct the LCA and the scope, laying out which impacts must be reported and ensuring that all EPDs under the same category report on the same information in a controlled and consistent manner.

The first step in the PCR development process is to gather a team of multi-stakeholder experts that represent the target industry. Next, a Program Operator is appointed to manage the EPD process and its associated PCR. Any EPD

based on the PCR is third-party verified to ensure it follows the PCR requirements and accurately reflects the LCA report. The verified EPD is then registered through the Program Operator website and made publicly available. The validity period for the EPD is typically five years.

**LIFE CYCLE ASSESSMENT (LCA) THE ANALYSIS**

The first Life Cycle Assessments were conducted in Europe to quantify the environmental impacts of a particular product throughout its life cycle to identify opportunities for improvement. Now US companies are utilizing this tool to take a more in-depth look at a products’ range of environmental impacts including water use, greenhouse gas emissions and effects on human health and more.

LCA measures the environmental and health impacts associated with a product, examining each stage in its life cycle from raw material extraction, materials processing, manufacturing, distribution, use, repair and maintenance, to eventual disposal or recycling. An LCA study is a “snapshot in time” that measures the product’s burdens, including what goes in (the amount of energy and raw material it takes to make a product), and what goes out (the amount of waste, water pollution and emissions) across the product life cycle. If the burdens across the life cycle are lower, the footprint will be smaller.

**Types of LCAs**

The International Organization for Standardization (ISO) series 14040 series standardizes LCAs. Typical types of LCA system boundaries include:

- Cradle-to-grave: Raw material extraction through product use and disposal.
- Cradle-to-gate: Raw material extraction to the factory gate.
- Gate-to-gate: From one defined point on the life cycle to a second set point further along the life cycle.

**Stages of an LCA**

The stages of an LCA project are Goal and Scope, Life Cycle Inventory (LCI) analysis, Life Cycle Impact Assessment (LCIA) and Interpretation of Results.



US companies are utilizing Life Cycle Assessments to take a more in-depth look at a products’ range of environmental impacts including water use, greenhouse gas emissions and effects on human health and more.

The first part of an LCA study consists of defining the **Goal of the study and its Scope**. The goal of the study should include a statement of the reason for carrying out the research as well as the intended application of the results and the intended audience. The scope of an LCA is used to specify the reason for conducting the study, including identifying a product's function, determining the intended audience and how the results will be used, and setting system boundaries (cradle-to-gate, cradle-to-grave, gate-to-gate). The goal and scope also identify data requirements to ensure the results are reliable. Finally, the goal and scope acknowledge study assumptions and limitations and establish a time and geographic reference.

A **Life Cycle Inventory (LCI) Analysis** collects, validates and aggregates input and output data to quantify energy, water and material use, and environmental discharges and waste such as air emissions, solid waste disposal and wastewater discharges associated with each life cycle stage. A sensitive step in this calculation process is the allocation of flows such as releases to air, water and land.

**Life Cycle Impact Assessment (LCIA)** assesses the potential human and ecological effects of energy, water and material usage and the environmental releases identified in the inventory analysis. The LCIA translates the raw data into a potential impact on human health and the environment using category indicators, impact categories, equivalency factors, characterization models and weighting values.

**Interpretation of Results** is an iterative process that takes place throughout the first three stages to assess the LCA results in the context of project goals. The interpretation phase aims to reach conclusions and recommendations in accordance with the defined goal and scope of the study. Results from the LCI and LCIA are combined and reported to give a complete and unbiased account of the study.

### Critical Review

Upon completion, the LCA is critically reviewed by an independent third party for conformance to ISO standards. Validation of results is particularly important if the manufacturer wishes to use the results externally to compare other products.

## QUIZ

- Which LEED v4 Materials and Resources credit is designed to reward project teams for selecting products from manufacturers who have verified improved environmental life cycle impacts?
  - Building Product Disclosure and Optimization—EPD
  - Building Product Disclosure and Optimization—Sourcing of Raw Materials
  - Building Product Disclosure and Optimization—Material Ingredients
  - Building Life Cycle Impact Reduction
- What is the first step in creating an Environmental Product Declaration?
  - Conduct the LCA
  - Search for an available PCR
  - Verify the EPD
- A \_\_\_\_\_ is a "snapshot in time" that measures the product's burdens, including what goes in and what goes out across the product life cycle.
  - PCR
  - LCA
  - EPD
  - HPD
- In a Life Cycle Assessment the \_\_\_\_\_ step collects, validates and aggregates input and output data to quantify energy, water and material use, and environmental discharges and waste such as air emissions, solid waste disposal and wastewater discharges associated with each life cycle stage.
  - Goal and Scope
  - Life Cycle Inventory Analysis
  - Life Cycle Impact Assessment
  - Interpretation of Results
- \_\_\_\_\_ provide increased transparency on products consumers are requesting and allow consumers to make side-by-side comparisons of products.
  - PCRs
  - LCAs
  - EPDs
  - HPDs
- Which environmental impact does an EPD report?
  - Carbon footprint
  - Acidification
  - Depletion of fossil fuel
  - Recycled content
  - Energy
  - All of the above
- After Health Product Declaration data is collected it is compiled in a report that discloses the following information:
  - Certifications and Compliance
  - Content in Descending Order of Quantity
  - Accessories
  - All of the above
- For a product to receive the Declare Label all ingredients are vetted through the \_\_\_\_\_ Red List which identifies over 800 chemicals that have been designated as harmful to living creatures, including humans, or the environment.
  - Living Building Challenge's
  - USGBC's
  - Green Building Initiative's
- Which level of Declare label certification means the product contains some chemicals that ILFI has designated as temporary red list exceptions?
  - LBC Red List free
  - LBC compliant
  - Declared
- Which of the following are examples of commercial restroom plumbing products with an EPD?
  - Waterfree and hybrid urinals
  - Diaphragm flushometers
  - Piston flushometers
  - Battery sensor flushometers
  - Vitreous china fixtures
  - All of the above

## SPONSOR INFORMATION



Sloan is the world's leading manufacturer of commercial plumbing systems. Sloan has been at the forefront of the green building movement since 1906 and provides sustainable restroom solutions by manufacturing water-efficient products such as flushometers, electronic faucets and soap dispensers, sink systems and vitreous china fixtures for commercial, industrial and institutional markets worldwide.

 This article continues on <http://go.hw.net/AR012019-1>. Go online to read the rest of the article and complete the corresponding quiz for credit.

# Introducing Rotary White Maple Door Faces

Today's Best Choice for Flush Doors.



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The wrong face veneer can open the door to visual problems that can ruin your walk-through. But there's good news: the best solution for a reliably attractive and uniform look is nature's best kept secret — Rotary White Maple door faces from Columbia Forest Products.

## All the advantages. None of the drawbacks.

Columbia Rotary White Maple solves most veneer match and assembly problems. Specify it for flush doors, and eliminate these visual issues:

- **Barber pole effect** - found in maple and birch book-matched faces
- **Splice line related issues** - often seen in book-matched and slip-matched faces
- **Wild, unwanted grain patterns** - common in rotary birch faces
- **"Machine gun" repeated defects** - in book- and slip-matched faces
- **Door-to-door inconsistency** - caused by veneers with pronounced grain patterns like birch and oak

For a Sample Kit, Spec Form or advice

**Call our veneer experts  
at 800-231-4148**

Or visit  
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# AIA Architect

## AIA Voices



PHOTOGRAPHY: TONI GREAVES

### A Recipe for Housing Equity

**Affordable housing can foster long-term investment.**

Michelle Black, AIA, is a senior associate at Carleton Hart Architecture in Portland who is well-versed in both affordable housing and historic preservation. One of her recent projects highlights the crossover between those areas: the Buck-Prager Building, a 1918 structure that was formerly a maternity hospital and is being redeveloped as affordable housing. Like many cities, Portland is in the middle of a housing crisis, and expertise like Black's is a necessary part of the solution.

As told to Steve Cimino

Since its foundation almost 25 years ago, Carleton Hart Architecture has been immersed in the field of affordable housing, working closely with nonprofit developer clients that serve people and communities in the area. One of those clients, Northwest Housing Alternatives, brought [the Buck-Prager] project to us, knowing we have experience with affordable housing, historic buildings, and complicated project structures; this one touched all three. The site, located in Portland's Northwest District, is a high-opportunity area within walking distance of public transit, shops, healthcare, and the social services located downtown. It offers everything you'd hope for in an urban neighborhood, which means it's exactly the kind of area that low-income citizens stand to gain the most from but usually cannot afford to live in.

I've been lucky to work with great affordable housing clients who are sensitive to both their residents' needs and to the neighborhoods that they're building in. These are clients that have long-term relationships with specific areas; they care about adding

to the community. I think affordable housing tends to be more sensitive to its surroundings than market-rate development.

I met a memorable housing advocate at a conference last year, a priest who had gotten into housing through his church's mission. He spoke about his own work and described how people want a magic bullet for the housing crisis, but the solution is going to be more like a recipe. We will have to deploy multiple techniques for each unique situation: from permanent supportive housing to temporary family shelters, zoning incentives to bond dollars, workforce training to healthcare services, and beyond.

I see rehabilitation and reuse of existing building stock as an important part of that recipe. There is intrinsic value in existing structures, both financially and architecturally. That being said, older buildings—specifically historic buildings—often require extensive upgrades to meet current codes. There is a point where what you're gaining is outweighed by what you have to overcome. It's not a magic bullet, but it can be an important part of any affordable housing strategy. **AIA**



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# AIANow



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By Michele Russo

Sixty-six percent of firm leaders report that virtual and augmented reality will be one of the biggest trends impacting the industry over the next five to 10 years.

While over a quarter of architecture firm leaders report that there has already been a significant impact of virtual and augmented reality (VR and AR) on the industry today, a much more significant share report the same impact will be true in five years—at 66 percent. VR and AR are a disruptive technology in many fields, and architecture is no exception. According to AIA's 2018 Firm Survey report, 16 percent of architecture firms, including two-thirds of firms with more than 50 employees, already use virtual reality in their practice.

The science behind the impact of the accelerated use of VR and AR on the brain is still outstanding, but clearly firm leaders are eyeing it as a technology trend coming their way.

# AIA Feature

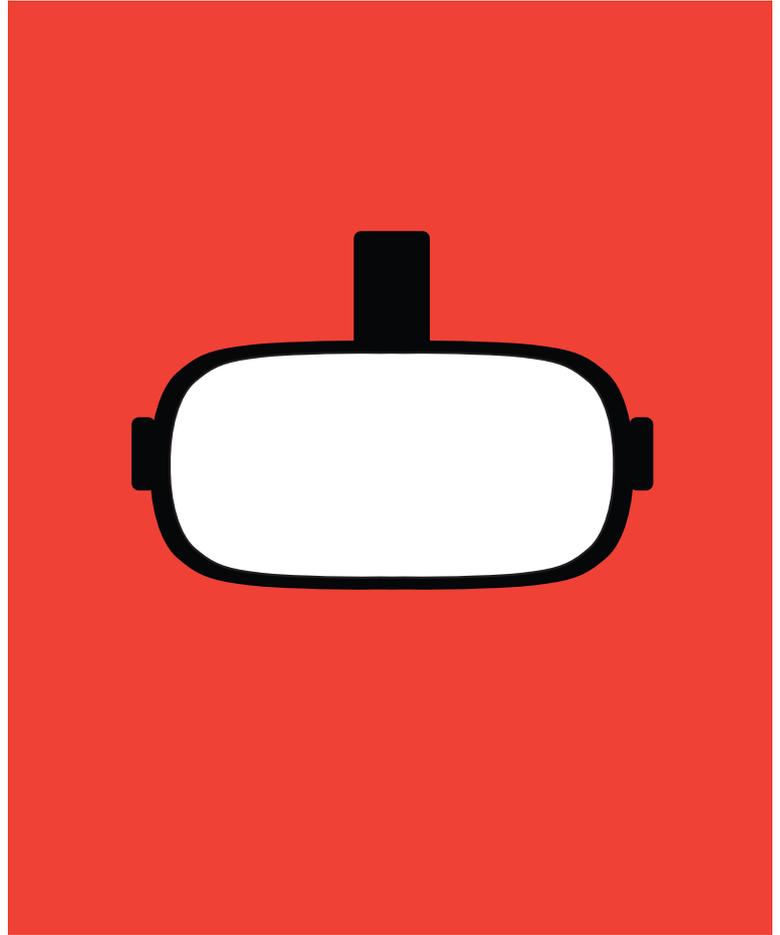
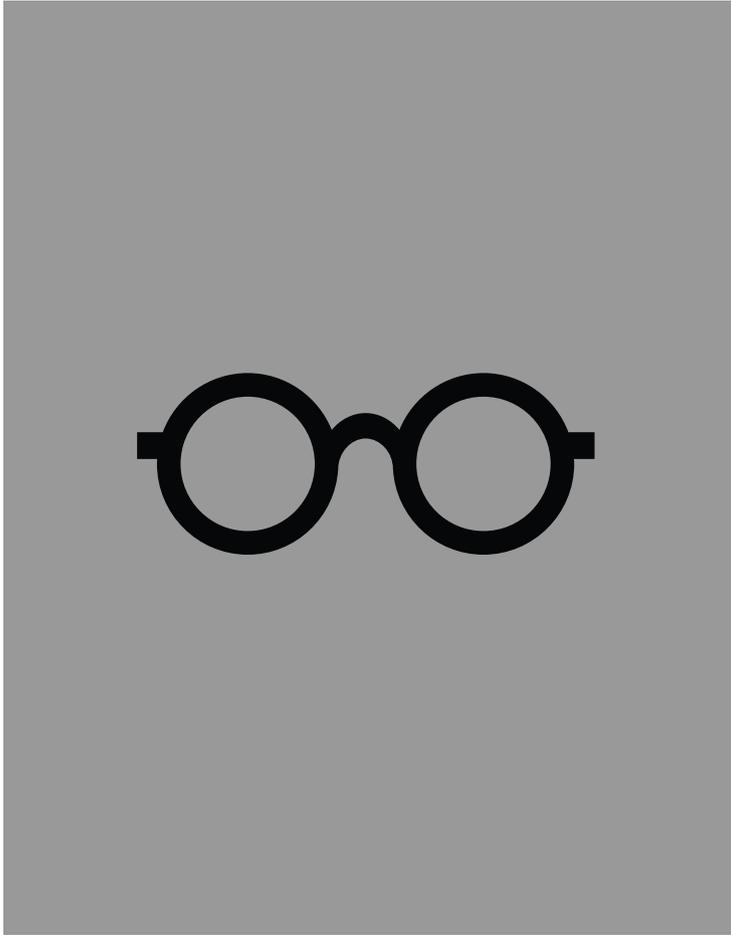


ILLUSTRATION: SCOTT LIVINGSTON

# Can Technology Solve Architects' Productivity Challenge?

By Kermit Baker, HON. AIA

The technological revolution that is just beginning to hit the AEC industry has the potential to dramatically lift profitability for firm owners—and in doing so lift compensation for architects. To get there, firms will need to have a better strategic vision of how to harness these technologies to make the design process more efficient.

Architects, as well as the entire AEC industry, have been on a solid run over the past several years. Since the current construction recovery began in 2011, spending on construction projects nationally has increased almost 10 percent per year and, as a result, payrolls at architecture firms have increased about 4.5 percent annually. As a profession, architecture is almost back to where it was when the Great Recession began in 2008.

Business conditions have been so good that we may not have noticed that the design professions are still stymied by many of the same old business problems. Fees continue to be under tremendous pressure, even though many firms have more work than they can comfortably handle. Maintaining profitability remains a challenge for a significant share of firms. Compensation for architects continues to be well below that of other professions with comparable educational requirements; architects bemoan the fact that many of their college classmates who chose careers in law, medicine, business management, or technology had higher starting salaries than they likely will see even after 15 to 20 years of architectural practice.

There are many reasons why architectural practice remains challenging from a business perspective. Phillip Bernstein, an associate dean and senior lecturer at the Yale School of Architecture, points to the architecture business model as the chief culprit. Many firms price their services as a commodity—for a fixed price or as a percentage of the costs of construction—which typically doesn't provide a premium for a superior design solution. If architects were instead rewarded based on the performance of their designs—health facilities that improved health outcomes, schools that enhanced educational performance, or offices that commanded higher rents—owners would no doubt be willing to increase fees commensurate with these outcomes.

But there may be a more basic reason for the business challenges that the profession faces. Key to increasing employee compensation and business profitability is to increase the productivity of the workforce.

Productivity is the measure of how much output can be produced in a given period of time. Since it is fundamentally a manufacturing concept, productivity is a bit trickier to apply to service industries like design because quality is integral to determining the value of a service. The quality of one's work is often more important than the quantity. However, the basic relationship is the same: If architects produce more high-quality services, firms will generate more revenue.

Even with the significant complexities that surround the measurement of architects' productivity, there are good reasons to factor this concept into the analysis of how well the profession is performing. On its face, the results are not good. Twenty years ago, architects, as a profession, were designing almost 20,000 square feet of nonresidential space in the U.S. for each architectural position at U.S. firms. Currently, this figure is just half that, under 10,000 square feet per architectural employee.

However, this situation is not as bad as it appears. Architects are doing more building renovations and retrofits, which don't increase the amount of building space. They are also providing clients with additional design services that don't directly translate into additional space—including space planning,

zoning and code compliance, historic preservation, and sustainable design—and providing planning and predesign services as well as post-construction operations and maintenance services.

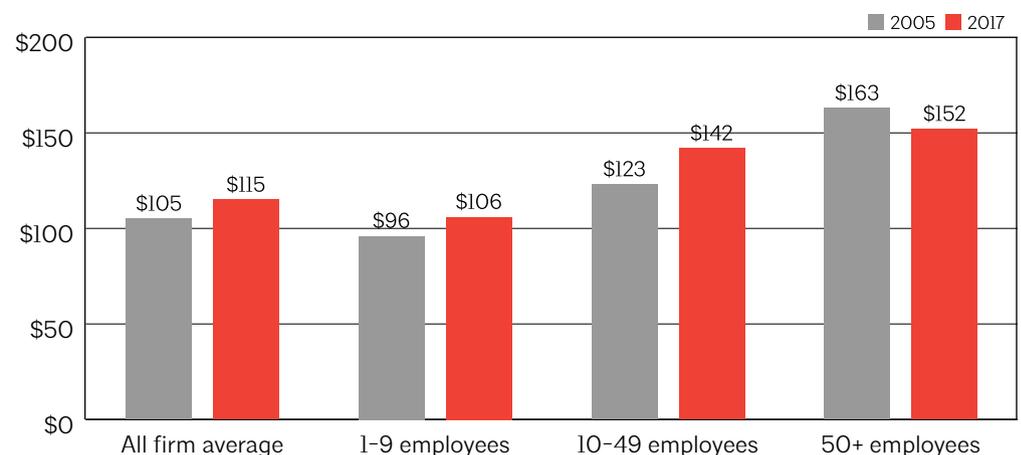
Since design activity doesn't always show up as increased building space, firms more traditionally look at net revenue per employee as a proxy for the concept of productivity. Conceptually, this measure makes sense, since the services that clients are willing to pay for are probably a reasonable measure of an architect's productive activity. However, even this measure doesn't paint a very favorable picture for trends in architect productivity. Net revenue per employee (adjusted for inflation) has increased only modestly in recent years—less than 1 percent per year on average between 2005 and 2017. For larger firms, this measure of productivity declined over this period (Figure 1).

### Emerging Technologies and Improvements in Productivity Gains

In most industries, new technologies have been the critical pathway to increased productivity: Think Henry Ford and the automotive assembly line that allowed workers to focus on a single repetitive task, or more recently,

FIGURE 1: Net Revenue per Employee Has Increased Only Slightly Over Past Decade

Revenue per employee, in thousands, average across all firms, in 2017 dollars.



# AIA Feature

CONTINUED

computers, the internet, smartphones, and—in the case of architects—AutoCAD and BIM.

While there may be some debate as to whether design software has made architects more productive, increasing productivity in service industries like architecture is a challenging task. Technology may improve the quality of the service provided (better building designs) but not the quantity provided (more building designs). For architecture, like many service industries, quality is often difficult to measure.

Still, several new technologies currently being developed and applied could dramatically affect the productivity of architects, including:

- Virtual reality, augmented reality, and real-time rendering: to visualize, test, and validate designs;
- 3D printing: for design models and, potentially, on-site production of construction products;
- Big data and predictive modeling: to monitor consumer behavior, construction processes, and project history;
- The internet of things, including sensors that generate data: to control systems and monitor behavior; and
- Artificial intelligence and machine learning: to generate best practices and prototypes.

Architecture is not the only field that is witnessing a revolution of new technologies. Others could dramatically change the construction process or the environment in which design and construction occur. These emerging technologies include:

- Enhanced construction materials: such as specially cured concrete, smart fenestration, microbiology, nanotechnology;
- Robotics, automation, drones, and industrialized design: to improve productivity in construction;
- Off-site construction processes: such as prefabrication, modularization, and preassembly; and
- Autonomous vehicles: that will influence building designs, use of space, and locational choices.

However, most of these emerging technologies are largely unproven in terms of how they could influence the AEC industry. And even if there were a consensus that a technology could potentially reshape the profession, the timing of that change is unknown. The time frame for the adoption of

generally accepted technologies is surprisingly long and unpredictable.

The adoption cycle for BIM is a good example. An AIA survey estimated that in 2005 about 10 percent of architecture firms were using BIM on billable projects. Since then, it has come to be viewed as the industry standard and it is used by virtually all firms with 50 or more employees. But as of 2017, fewer than half of all U.S. architecture firms reported using BIM on billable projects, and over a quarter of firms don't use BIM and have no plans to use it in the future.

Still, architects are confident that many of these emerging technologies will have a significant impact directly on architecture or on the AEC industry more broadly over the coming decade. In a survey conducted in April 2018, architect respondents were asked which emerging technologies would have a significant impact on the AEC industry over the next five to 10 years. Almost two-thirds felt that virtual reality (VR) and augmented reality (AR) would become popular technologies, likely because of the growing adoption of BIM that facilitate the use of these related applications. Other technologies were viewed as being almost as significant, with the internet of things, enhanced construction materials, and off-site construction processes viewed as having a very significant impact on the AEC industry over the next five to 10 years by more than half of architecture firms (Figure 2).

## The Productivity Disconnect

These results suggest that architects are surprisingly bullish regarding the potential impact of emerging technologies on design practice and construction techniques. Despite

their enthusiasm, however, the emerging technological revolution is likely to have minimal impact on architect productivity for the foreseeable future for three reasons:

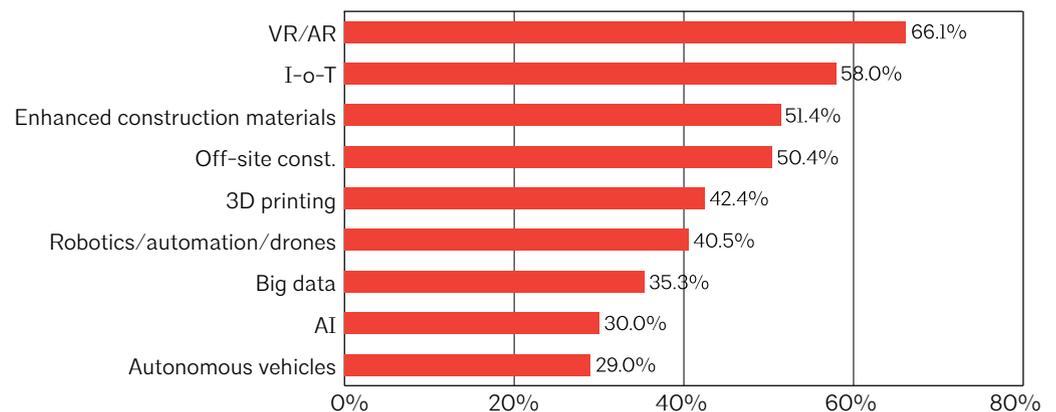
- Firms have a difficult time not only implementing productivity improvements but even assessing whether productivity is a major concern that they should be addressing;
- To the extent that they view productivity as a concern, firm leaders generally focus on more immediate and tangible fixes, not on introducing unproven technologies where the benefits are unlikely to be realized for many years; and
- Many architecture firms strive to be perceived as technologically sophisticated. This goal may encourage them to remain fluent with emerging technologies, but not to encourage them to actually implement the technologies in their practices.

Also, given that productivity of architects is difficult to measure, it's easy for firms to think that their productivity is better than it is. In a recent survey of architecture firms, most felt that their firmwide productivity levels had increased over the past few years. When asked how they would rate their architecture staff's productivity compared to that of their peers, only one in six firms felt that their staff was less productive than that at their peers, a third felt that they were as productive, and half felt that they were more productive. Many firm leaders thus must be overestimating the productivity of their staff.

Even though architecture firms generally believe that their productivity will increase in the coming years and recognize the potential of these emerging technologies to reshape the

FIGURE 2: Emerging Technologies are Predicted to Impact the Industry Over the Coming Decade

Share of firms rating trend as "very significant" in terms of impact to AEC industry over next 5-10 years



profession, most focus on more immediate issues to improve their practices' day-to-day operations. For example, most architects use smartphones and tablets on projects, and most use cloud computing to make project information more accessible. By way of contrast, however, very few use VR or 3D printing for billable project tasks.

When asked in a recent survey to identify one thing that they would do to improve productivity at their firm, access to emerging technologies was rarely mentioned. Only 5 percent of firms mentioned anything that had to do with technology, and most proposed innovations that involved enhancements to their current AutoCAD and BIM systems, not an implementation of any new and emerging technologies.

Instead, firms were quick to point to the need for improved training or professional development for their staff. Over a third of firms listed the need to hire more experienced staff as their single best action to improve productivity. Improving project management, coordination, and communications among the project team was the next most commonly desired productivity enhancer, listed by more than a quarter of firms. Improving firm strategy, operations, systems, and management resources was a common response, with almost 20 percent of firms selecting an action in this category. Avoiding nonbillable outside distractions (such as texting, email, and social media), better cooperation from clients in making key project decisions, better definition of the scope of projects, and avoiding overdesign were also mentioned.

While harnessing emerging technologies doesn't seem to be a prime motivation for improving productivity at firms, developing or maintaining technological proficiency is a priority for many. When asked to characterize the degree of technological sophistication among their staff and at their firm on a five-point scale—from "not technologically sophisticated" to "very sophisticated"—almost three-quarters rated their firm as either 4 (fairly sophisticated) or 5 (very sophisticated).

This focus on technological competence apparently encompasses more traditional products and systems rather than emerging technologies. However, this strategy has been very successful in generating better results for firms through more-efficient operations, improved communication across the design team, attracting better employees, or producing a better-trained staff. Firms that rated themselves highly in terms of technological sophistication have been

performing better recently, with above-average revenue growth for 2018 as well as above-average profits for the year (Figure 3). It may be that the adoption of emerging technologies has less to do with staff

productivity and firm profitability, and more to do with the fact that productive and profitable firms are more likely to promote an image of being on the leading edge of pursuing new ideas. **AIA**

FIGURE 3: Technologically Sophisticated Firms Have Been More Profitable  
2018 profitability by perceived technological sophistication, average percent across all firms

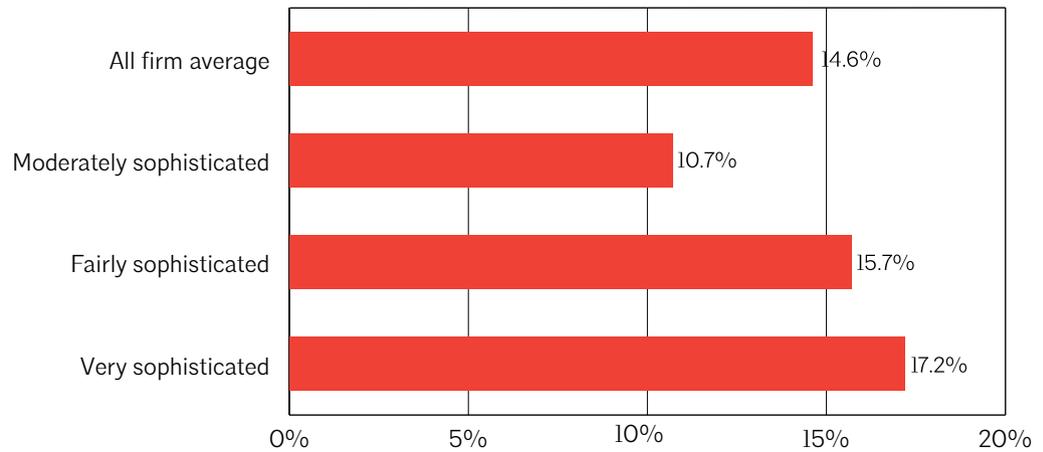


FIGURE 4: Potential Productivity Enhancements for Design and Construction

<p><b>01</b></p> <p>Off-site construction processes</p>	<p><b>02</b></p> <p>Artificial intelligence/machine learning</p>	<p><b>03</b></p> <p>Big data/predictive modeling</p>
<p><b>04</b></p> <p>Virtual and augmented reality, real-time rendering</p>	<p><b>05</b></p> <p>Robotics/automation/drones/industrialized design</p>	<p><b>06</b></p> <p>3D printing</p>
<p><b>07</b></p> <p>Autonomous vehicles</p>	<p><b>08</b></p> <p>Enhanced construction materials</p>	<p><b>09</b></p> <p>Internet of things</p>



# Expert-led travel for architecture enthusiasts

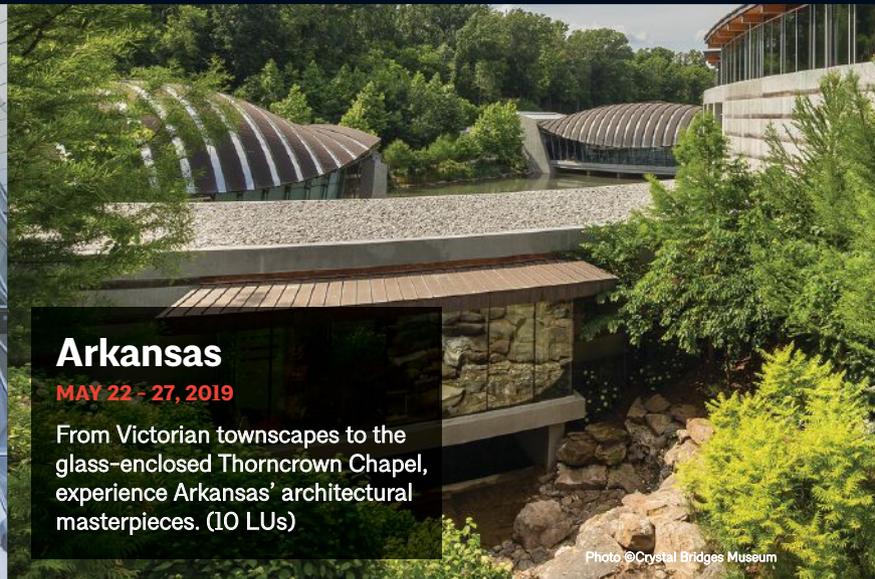


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# AIAFuture

## Reality Bytes

**Firms are calling VR a design process game-changer. But what does that mean?**

According to the American Institute of Architects' 2018 firm survey, "The Business of Architecture," virtual reality (VR) technology is currently utilized by about 67 percent of large firms. Roughly a quarter of mid-sized firms have followed suit, shaking out to approximately 16 percent of firms overall.

It will be important to track the use of VR in the future, the survey emphasizes, to see if it remains a differentiator for larger firms or becomes a more widely used mainstay of firm practice. But with the increased ubiquity of smartphones—and the increased affordability of technology like the Oculus Go and Samsung Gear VR headsets that currently run about \$200—VR is becoming a viable option for more practicing architects than ever before.

While the development of VR was originally fostered by the entertainment and gaming industries, architects quickly perceived the possibilities it held for bringing designs to life. When forward-thinking members of the AEC industry started experimenting with the use of VR around 2015, it seemed to herald the arrival of a whole new way of designing. For the first time, clients could gain a firsthand feel for a space that didn't even exist yet—and request changes that could be made easily with a few clicks or keystrokes. It was an unparalleled way to recognize a design as complete, even before the first beam was raised or nail was hammered into place.

Three years later, the buzz around VR has continued to increase and firms are seeing the very real benefits that the technology can have when it comes to saving them—and their clients—time and effort. Islay Burgess, AIA, digital design manager at Gensler's New York office, says that giving clients the opportunity to immerse themselves in a design allows them to feel more comfortable and confident when making decisions that will affect how the space will ultimately look and feel as well as what materials—even furniture and décor—will work best. "It definitely, definitely helps them make [big] decisions much faster," Burgess says.

For Gensler and other large international firms, VR has become an indispensable part of their design process over the last several years, largely through Revit plug-ins like Enscape, which provide a live link from building information modeling (BIM) data to a virtual walkthrough.

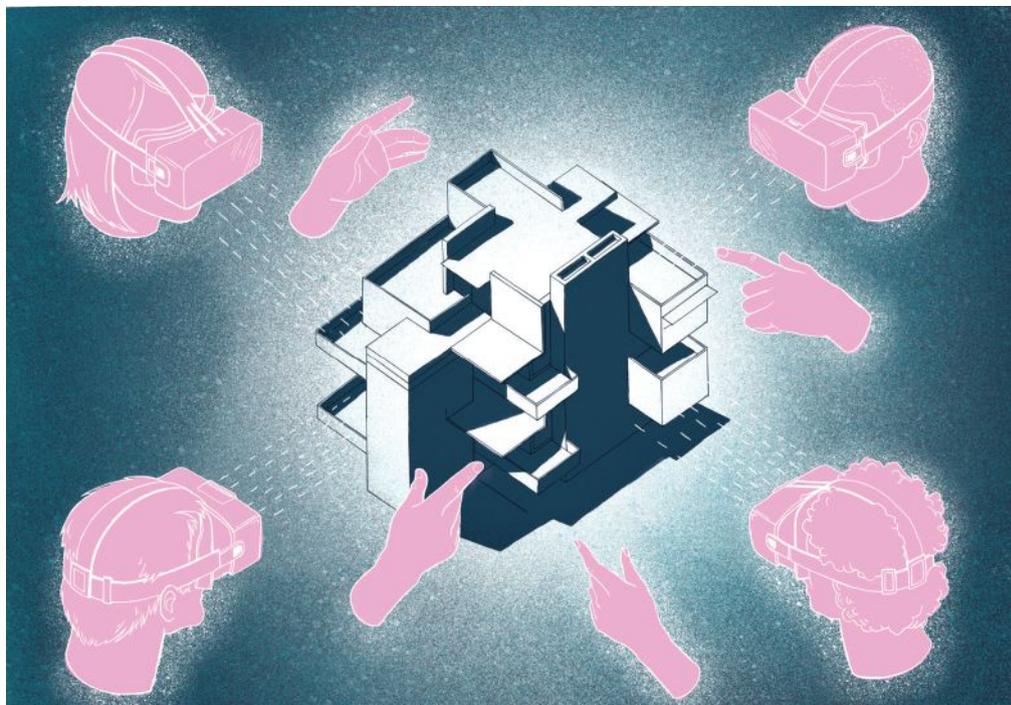


ILLUSTRATION: LAUREN NASSEF

In one scenario, Gensler was working on the Manhattan headquarters for a company that was moving into the city, and the design team was having trouble getting a signoff from the company's CEO on the materials palette. After three weeks of spinning their wheels trying to come up with new samples and new ways to depict how the finished product would look, Burgess and the design team decided to use the project's existing BIM data to try something new.

"We put some of the materials in, rendered [it] out in 360, and took it to the CEO—and within 15 seconds he was like, 'Yup, okay, cool,'" Burgess says. "He knew where the views of the Hudson River were, he knew what the new high-gloss ceiling looked like, he knew how that interacted with the metallic underside of a staircase and the wood floor, and he could just get it all with the right lights, with the right materials, and the right geometry all together.

Separate from decisions about materials, the designers at Gensler have found that one of the most invaluable VR features allows a space to be rendered as a simple white model. They've been taking advantage of this aspect to help define the early programming stages of a building or space design.

"We're going in and saying, 'Don't even worry about the ceiling or the floor or materials yet—just 150 people on a floor, this is what it feels like,' and making even leasing decisions via VR and what that feels like—how much sun comes in and hits the desks, what partition heights need to be to let sun into the third or fourth desk in the row. We're using it for mostly everything now," Burgess says.

### Paradigm Shifts

It's easy to see how VR can be useful when working closely with a single client, but when it comes to large-scale public works projects—such as international firm HOK's ongoing \$200 million expansion and modernization of the Hartsfield-Jackson Atlanta International Airport domestic passenger terminal—VR is allowing the firm to effectively communicate their vision to a wider swath of stakeholders. The sweeping redesign includes two large canopies that enclose curbside pickup and drop-off areas, and a redesigned central atrium space.

"We have almost immediate answers to these questions about the choices we make architecturally," says Matt Breidenthal, senior principal at HOK and the lead structural engineer on the project. "We deal with the public trust when we create architecture for an airport. They have high aspirations and high hopes. Using VR really helped attune design with time and money, and the airport's big ambitions for their facility and our city simultaneously." For this particular project, VR played a significant role in helping the design and construction team confidently make decisions and reach conclusions.

"It's good for when you think everyone is talking the same language, but you aren't really sure," Breidenthal says.

Aligning design with time and money is a recurring theme when architects discuss the benefits of delivering projects with the aid of VR. In terms of helping architects communicate what is possible within the constraints imposed by time and budget, the value of providing a sense of spatial

# AIA Future

CONTINUED

relationships and very nearly tangible materials specifications is unparalleled.

Kat Schneider is an architectural and user interface designer at Arrowstreet Innovation & Research (AIR), a smaller research group within Boston's roughly 100-person Arrowstreet firm. She explains that AIR began about two years ago when the firm decided to focus more closely on the paradigm shifts that were beginning to take place within the profession. VR granted the architects at Arrowstreet the unique opportunity to exclude a person's surroundings and allow them to focus on critical decision-making.

Arrowstreet has also been at the forefront of incorporating augmented reality (AR) into designs, which has been particularly helpful—according to Schneider and her colleagues Amy Korté, AIA, a principal at Arrowstreet, and Kachina Studer, a VR designer—with efforts around sustainability and resilience. Arrowstreet has used AR to help model the potential effects of climate change, particularly in relation to their Parcel K residential project, which is adjacent to Boston Harbor and located on a flood plain. Communicating resilience solutions through a tabletop AR model, Korté says, is the most effective way to explain how environmental and climate issues might be mitigated through building design.

"We can give it to somebody for them to explore on their own time, which I think is the real value," Schneider says.

## Using VR to Engage with Communities

When the key stakeholders aren't necessarily just commercial clients but community members or the larger public, VR can be essential in the process of gaining understanding and buy-in for a design, particularly when it comes to schools, according to Schneider, Korté, and Studer.

"It's been great for community engagement because, honestly, visuals are going to be the best way to describe a problem or a solution and get everybody on board," Schneider says. Over a series of 30 community meetings that were part of the design process for King Open School, a net-zero charter school in Cambridge, Mass., Arrowstreet leveraged VR to talk about sustainability features that would be embedded within the building and frame discussions about the advantages of the features with different age groups.

"What we were finding, and continue to find, is that VR serves as the great equalizer for talking about design and performance features within the space," Schneider says. **AIA**

# AIA Perspective



PHOTOGRAPHY: GREG POWERS

## Places for People

I am delighted and excited to serve as AIA's 2019 president. The honor of helping to lead this 162-year-old institution is a career highlight and an opportunity that I intend to make the most of this year.

Last year was a strong one for AIA and our profession. Together, we advanced critical legislative initiatives in Washington D.C., and statehouses across the nation. We continue to make our shared values clear, including respect for the environment, the need for housing policies that promote safety and human dignity, and the fundamental right of everyone to enjoy equal access to opportunity and advancement at school and work.

We start 2019 at a time of relative prosperity, which gives us a chance to prepare for and reflect on the type of future we want for our profession. My vision of architecture's future is one where the profession is celebrated as much for its diversity as it is for its creativity, and known as much for its spirit of inclusion as it is for its ability to find innovative solutions—not just because that is the right thing to do, which of course it is, but because the long-term vitality and prosperity of this profession depend on it.

I happen to be the second African-American to become AIA president, but that's not what I

choose to focus on. What I am focused on is the day when we no longer need to acknowledge the second, third, or fourth of any group. I am focused on a future where architecture is admired as a profession where anyone, without regard to race, gender, or family wealth, can excel and achieve their highest dreams unfettered by biases both covert and overt.

I am focused on making sure that the next generation of architects enters a profession that is inclusive, diverse, and nurturing. We want to be a profession that embraces the creativity and the talent of anyone who dreams of advancing society through a better-built world.

It is clear to me that the ability to meet the challenges of our time—from mitigating the detrimental impacts of climate change, to ensuring that everyone has access to safe and affordable housing, to expanding economic opportunity—will depend on the perspective and talent of everyone.

Ultimately, I dream that architects will lead efforts to create a fairer, more sustainable, and more peaceful world that embraces all and disenfranchises none. Simply put, tomorrow's challenges can only be successfully met if we all work together in a spirit of mutual respect, and with the understanding that diversity, inclusion, and equity make us stronger—as a profession, as a nation, and as a global society. **AIA**

William Bates, FAIA, 2019 AIA President



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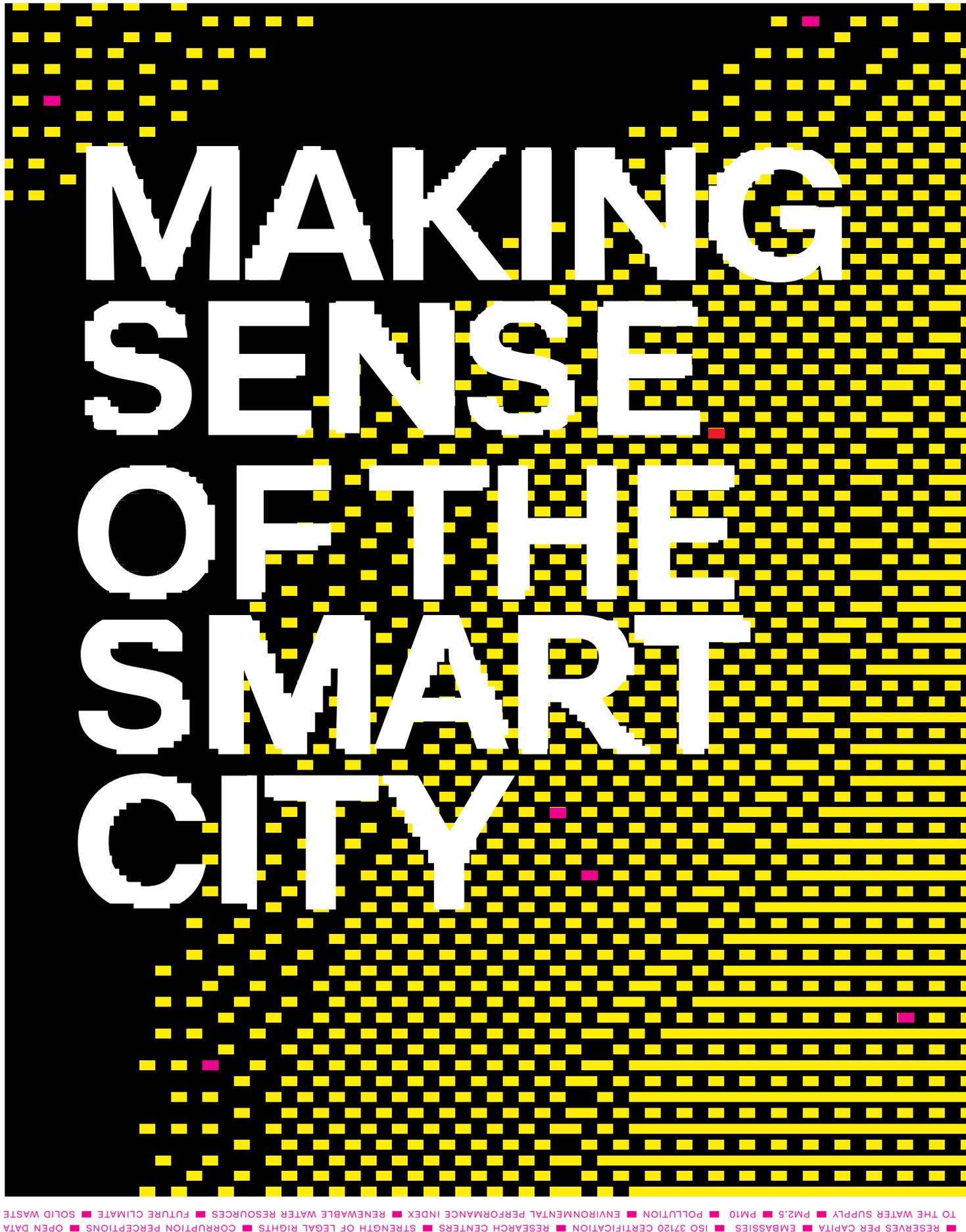


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**What is a Smart City?** Since the concept gained widespread prominence in the aughts, its definition has been ever-evolving—and elusive. That’s in no small part because of the staggering pace at which technology has developed: Broadband was cutting edge at the turn of the century while today we live in an age of big data and the internet of things. In its 2018 report, “Smart Cities: Digital Solutions for a More Livable Future,” McKinsey Global Institute defines smart cities as **places that “put data and digital technology to work with the goal of improving the quality of life.”** Imagine countless sensors tracking building performance, traffic conditions, city services, and citizen and pedestrian preferences, creating an endless stream of information that can help make urban living more productive, cost-effective, and sustainable.

**At least that’s the utopian vision.** Very few ground-up projects have actually been built, and the ones that have, for the most part, have fallen well short of those ambitious aims. Consider Songdo, in South Korea, which sports serious technological efficiencies but has been disparaged by critics as characterless. **What makes a city smart can’t be defined solely by its tech.** How do you measure a city’s soul, the kind of urbanism that Jane Jacobs espoused, with lively neighborhoods and sidewalks and gathering places that encourage serendipitous encounters among its residents?

At a 2014 European Union conference about smart cities in Brussels, Rem Koolhaas, HON. FAIA, took the stage after several gurus had already presented. **“I had a sinking feeling as I was listening to the talks by these prominent figures in the field of smart cities because the city used to be the domain of the architect, and now, frankly, they have made it their domain.** This transfer of authority has been achieved in a clever way by calling their city smart—and by calling it smart, our city”—i.e., the city of the architect—“is condemned to being stupid.” He continued: “Because the smart city movement has been apolitical in its declarations, we also have to ask about the politics behind the improvements on offer.” Caveat emptor.

Mega-corporations such as GE, Intel, and AT&T have been charging headlong into the arena, and no wonder: A March 2018 report estimated that **the smart city market will grow to \$2.57 trillion by 2025. Will their visions verge more on utopia or dystopia?** The rise of a certain type of smart city—let’s call it the sensor city—could certainly be a formula for cleanliness and efficiency, but it could also lead to an exacerbation of inequality, expansion of state and corporate surveillance, and further erosion of privacy. **Engaged citizens are pushing back,** lobbying for a more inclusive, ground-up approach to the integration of technology with city building and management—one that respects individual rights, civic life, and the public purse.

Given that the majority of the world’s population now lives in urban areas, **how the smart city movement evolves will have untold significance for how we will live in the not-so-distant future.** In the following pages, as explored in case studies, a debate between leading visionaries, and other stories, we attempt to separate hype from reality, and demonstrate the key roles architects can play in this promising but ill-defined, and potentially even nefarious, landscape.



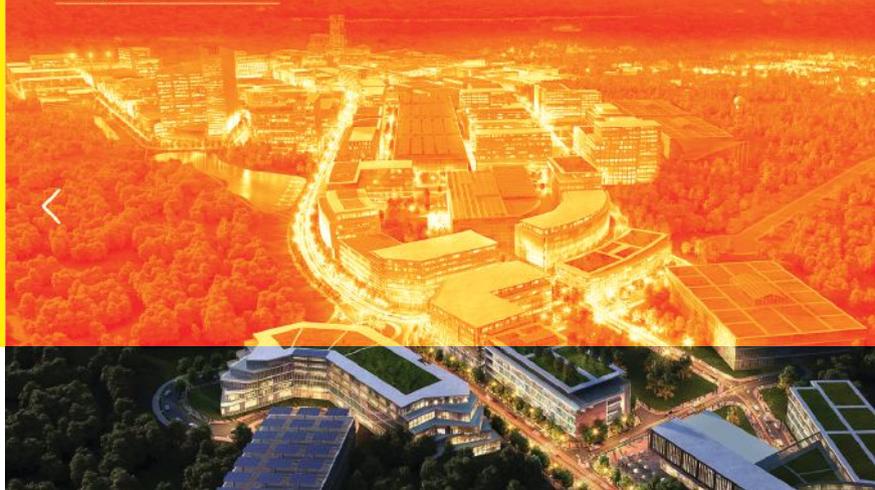
**Union Point,  
Weymouth, Mass.**

What is a Smart City?

# Marketing Spin

A massive mixed-use development near Boston was championed as a cutting-edge smart city. The reality has proven to be far different.

TEXT BY KARRIE JACOBS  
PHOTOS BY TOM MCMAHON



The rendering, by the Boston-based Elkus Manfredi Architects, shows a pleasing little city in the woods. It's a dense, amoeba-shaped cluster of mid-rise buildings, some sporting green roofs or expansive photovoltaic arrays. Maybe it isn't the most radical architectural vision, but it's a solid, forward-looking, optimistic one. The project is called Union Point, planned for what was once the South Weymouth Naval Air Station. During World War II, the base housed a fleet of blimps that patrolled the East Coast for German U-boats; like many such bases, it was decommissioned in the 1990s. More recently, for the past year or so, it's been repositioned as a smart city.

LStar Ventures, a Raleigh, N.C.-based developer that acquired the 1,500-acre site in 2015, aspires to attract technology firms and their employees to Union Point, where self-driving cars will rule the roads and residents can hack their lives with a series of apps. Or, as David P. Manfredi, FAIA, put it in a blog post more than a year ago (Elkus Manfredi drafted the master plan with Sasaki), Union Point will be "a connected urban environment that integrates multiple information and communication technologies to manage a city's assets, improve the efficiency of services, and meet residents' needs."

Every city lately, it seems, aspires to be smarter. Tech firms almost universally are eager to install sensors to collect every bit of data city dwellers generate as they go about their lives. They want to use that information for efficiencies large and small, to distribute electricity more effectively or monitor the availability of treadmills at the gym (a convenience touted by the developers of New York's Hudson Yards). Everyone feels compelled to optimize everything.

Most smart city projects in the U.S. involve retrofitting existing cities: setting up an energy-efficient electric grid in Boulder, Colo., or helping drivers find parking spaces in San Francisco. Smart cities built from the ground up tend to be in Asia or the Middle East, and when they are located here, such as the Bill Gates-backed Belmont outside of Phoenix, they tend to involve remote sites in the desert southwest. So it was a welcome surprise to discover that someone was planning to build a 21st-century city, from the ground up, on the stodgy East Coast. Once I got beyond the renderings, however, I soon realized that Union Point was more a case study in smart city hype outpacing reality.

### "Being the Future"

Unlike a lot of schemes that never get past the clickbait phase, Union Point, at first glance, is entirely logical. It's in greater Boston, home to MIT

and Route 128, a ring road that has become Silicon Valley East. Route 128 doesn't extend all the way to Weymouth, a blue-collar town about 12 miles south of center city, population 55,664, which saw its last major growth spurt when school desegregation plans in Boston in the 1960s and '70s triggered white flight. But that was the beauty of the Union Point plan: It promised to transfuse some MIT-inspired luster into Weymouth. As LStar's website puts it: "Union Point is where artful design meets green living, where the landscape inspires human potential, where life itself feels expansive." The website artfully blends renderings showing a lively pedestrian-oriented commercial district and photos of existing homes, the sort of faux-historic cottages that are common to New Urbanist influenced developments, as well as some unremarkable apartment complexes. "What makes Union Point distinctive? Urban technology partners, such as GE, Arup, and Optimus Ride, are working with our developers to build in resilient energy systems, sustainable design, and fuel-free transportation alternatives. Energy efficiency translates into cost savings and consumer approval. That's not getting ready for the future—that's being the future."

By the time I called Mayor Robert Hedlund of Weymouth in mid-November, reality had already intruded on that breathless sales pitch. About two months earlier, LStar had filed suit against Kyle Corkum, one of the company's own managing partners and the person directly in charge of Union Point. The mayor himself had just entered into the fray. "I just shut their water off," he told me—or at least he had on paper.

And so I drove up from New York to try and understand how the project had come undone. Union Point, accessible via a gateway decorated by a Navy jet mounted like a hood ornament, isn't especially smart. As it stands now, it's a somewhat disorganized cluster of residential subdivisions, with 1,200 units built so far out of a proposed 4,000. They were constructed by your standard production home builders, such as Pulte and Stonebridge, and sit tightly spaced, a nod to one of the most developer-friendly ideas from New Urbanism: smaller lot size. There are areas with narrow streets abutting town greens, and other areas with cul de sacs. One street is lined with triplex McMansions—three connected housing units, each with its own street-facing front door, and three shockingly wide garages. There are also a number of apartment complexes; the slickest is called the Mastlight, named for the beacon that used to guide the Navy's blimps home. It had a prominently placed bike rack out front, with a single bike-share bike docked there, and a strategically

positioned row of red Adirondack chairs that seemed like a beacon to lure young, hip tenants.

As for all that street life shown in the renderings, not to mention the green-roofed office complexes? Those have yet to materialize. The day I visited was cold and rainy, but still, there isn't really anywhere for pedestrians to go. The only occupied storefront is a bank. Even the recreation center, a massive white bubble that's become a destination for area sports teams, lacks a concession stand. "You have to drive 2 miles out of there just to get a Gatorade," notes Jessica Trufant, a reporter for the local paper, *The Patriot Ledger*, who's been meticulously tracking the development's progress.

The Union Point I discovered on the ground doesn't have much in common with the glittering city depicted in the renderings, which maybe shouldn't come as a surprise. LStar, since its founding in 2007, has done a solid business building and managing typical, somewhat upscale, planned communities, McMansions adjacent to golf courses. Managing partner Corkum told *The Boston Globe* that the company had "extensive experience building 'charming New England villages'" in places that were not New England, mostly in the south and southwest. The implication was that they'd be great at building a New England village on a site that was actually in New England.

Initially, things went well. Early news stories were largely positive. Corkum charmed the community by setting up a miniature version of Fenway Park for local children and turned part of the property into a backlot where filmmakers shot the finish line scenes in *Patriots Day*, the 2017 Peter Berg-directed movie about the Boston Marathon bombings. But then, as Corkum told me, community residents he met with convinced him they didn't want just another subdivision. They wanted something more like a city. "They were pretty adamant about it," he said. So the local governments rewrote the enabling legislation to remove zoning restrictions and give LStar a more flexible timetable.

Soon thereafter, Corkum's vision for the site began, much like a blimp, to inflate: At a Weymouth town council meeting in August 2015, according to a report published in *Boston Business Journal*, Corkum touted a "100-acre 'Discovery District' dedicated for up to 2 million square feet of office space for life sciences, biotech, technology, pharmaceutical research and R&D companies." He claimed that LStar was in negotiations with four companies that wanted to relocate their headquarters to the development. He promised the "town center would include up to 1 million square feet of commercial development; 1,941 luxury apartments,



Corkum went on an elevator ride with his architect to the loftier precincts of urban planning, absorbed the latest buzzwords, and won over the public, at least initially.



Existing residential development at Union Point, including the Mastlight and the aircraft hangar (right)

townhomes and condominiums; and 150,000 square feet of retail.” He claimed that “LStar [was] in negotiations for a 10,000-seat professional soccer and lacrosse stadium.” He promised a hockey rink, a movie theater, and grocery store. “These are all real things on the shelf right now that are being considered,” Corkum said.

### Like the Emerald City

More than three years later, those things—unless you count the sports fields as a stadium—have yet to materialize. A few days before Thanksgiving, I met with Mayor Hedlund and his director of planning and community development, Robert J. Luongo. We sat at a long table in the mayor’s office in a handsome 1928 town hall, a replica of Boston’s Old State House. The office had been newly decorated for the holidays by the

local garden club, whose members showed up, mid-interview, to have their pictures taken with the mayor.

Hedlund, who took office in 2016, after LStar had arrived, refers to Corkum as a “visionary,” framing the word with air quotes. He doesn’t have an issue with the smart city concept per se, although, as Luongo observed, “It’s a little scary when you look at [the renderings]. It almost looks like the Emerald City.” It’s just that they expected something more straightforward from the development. “Weymouth lacks a real downtown,” Hedlund told me. “The hope was that this would be our downtown eventually. This will be an entertainment center for the town, a commercial center for the town. ... The problem is to have a smart city you actually have to have a city, and not just a bunch of tumbleweeds flying down the old airstrip.”

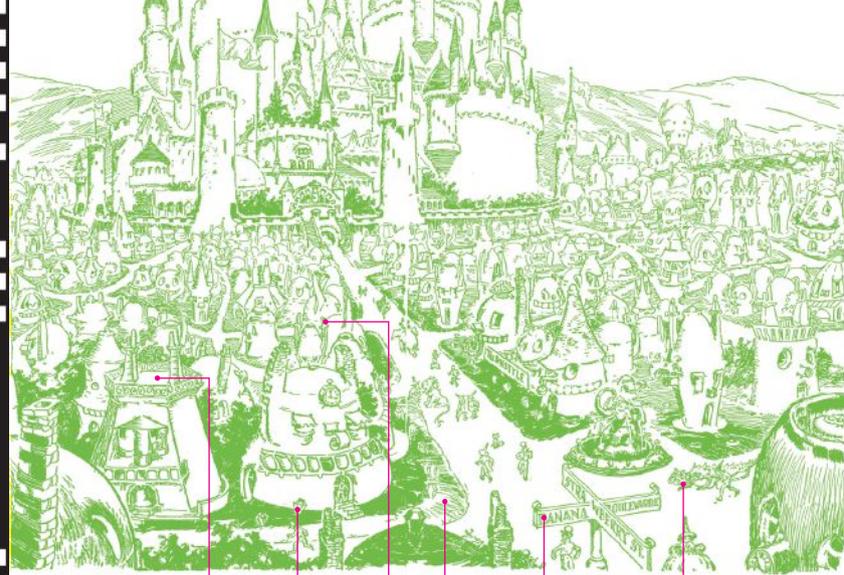
I asked whether the smart city vision had emerged from a planning process that included members of the surrounding communities or public officials like Hedlund. The mayor didn't think so. "It was more like Kyle would come here and wow us and take out the boards and overwhelm you," he said. "He latched on to this whole smart city concept," Hedlund continued. "There were all these high-tech elements. He talked about, in different presentations, heated sidewalks and autonomous vehicles picking up trash."

Which brings us to the water shutdown. The mayor's maneuver, which he hopes will help force LStar out of the project, didn't cut off the supply to those residents already living at the site. Rather, as Hedlund explained, LStar "had to bring in a dedicated water source. Long-term build out, we don't have enough supply. So in that long-term agreement we negotiated with them, they have a five-year timeline. ... They had a year to identify the source, feasibility. Another year to design it and another three years to actually build it. They're behind the time-line which gives me the ability to end the deal."

As a result, LStar no longer has a source of water to offer to subdevelopers who might want to buy into the project. There was also a similar arrangement with sewage: The town would handle it up to a point, and then the developer would have to supply its own infrastructure. LStar hasn't yet, nor did it seem interested in ordinary sewers, only smart ones. When asked about waste management, "Corkum would come in and say, 'We're going to put these pods all over the site that are like small waste pods that create energy,'" recalls Trufant, who identifies the overreach as an example of the larger problem: "There's self-driving cars out there, but not the basic things."

Compare that to how Manfredi outlined the project's infrastructure in his blog post: "The multinational professional services firm, Arup, has built a complementary and scalable infrastructure master plan to address Union Point's zero-carbon future and guide the stewardship of its natural water and energy resources. Solar collectors and heat pumps will be part of the power system. Storage batteries will save electric power for future uses, and streets will be designed for pedestrians and bicyclists, as well as our vehicular (autonomous) car future. At least 90% of the roofs without mechanical function, such as solar collection sites, will be green, planted to provide garden spaces that reduce heat-island effects and address storm water runoff, graywater re-use, and green wastewater treatment solutions."

Manfredi's message is clear: if you're serious about building a smart city, you're making a commitment



## Elements of a Smart City

### 1. Solar panels

The smart city is nothing if not green, and ideally net-zero or net-positive. Photovoltaic panels provide renewable energy, alongside wind turbines and other sources.

### 2. Trash bins

Fill-level sensors on smart trash and recycling cans transmit information to waste services in order to optimize collection routes.

### 3. Wi-Fi and 5G

Public Wi-Fi and superfast 5G networks enable connected devices to communicate and transmit data without a hitch.

### 4. Pavers

Smart pavers are equipped with a data transmitter and generate electricity from the kinetic energy of footsteps. Embedded lights allow road markings to change in a flash.

### 5. Streetlights

The Swiss army knife of smart city technology, a typical streetlight will incorporate devices such as surveillance cameras, sensors collecting data on traffic patterns, and gunshot detection systems that analyze audio signals to triangulate the location of gunfire and notify law enforcement.

### 6. Autonomous vehicles

The self-driving vehicle is the sine qua non of the smart city. Though there isn't anything particularly smart about an urban center jammed with cars—autonomous or not—many smart city projects have been quick to embrace autonomous vehicles. Mass transit, in the form of self-driving buses and shuttles, could help reduce congestion, carbon emissions, and human error-related collisions.

While the technology may seem like a *Jetsons*-esque fantasy, it is in fact becoming a reality. Since March 2018, commuters in Neuhausen am Rheinfall, Switzerland, have been able to travel on the electric-powered, self-driving Trapizio bus as part of an initiative launched by the Swiss Transit Lab. Last summer, Chinese tech company Baidu announced the production of its 100th 14-person autonomous minibus. (In October, Baidu signed a two-year agreement to test autonomous vehicles for the Ford Motor Co.) Meanwhile, the U.K. is investing approximately \$32 million in three trials with the promise of self-driving public transit by 2021. And Austin, Texas, is now home to what is being billed as the nation's "largest autonomous bus pilot program." This summer, the city tested six electric 15-passenger buses with plans for a second phase of trials that will include passengers.

—KATHARINE KEANE

to invest heavily in infrastructure. You're not just going to have a reliable water supply and effective waste treatment, but you're going to have the most sophisticated water distribution and waste treatment possible. In other words, the whole smart city concept is a sham unless there's infrastructure to support it. Or, as Hedlund frames it: "On one hand we've got Dubai here on the boards, and [then on the other] he's trying to get a water loop in for a fire hydrant or a curb cut in the right place. It's kind of funny."

### A Metaphorical Elevator Ride

Corkum insists that the requisite infrastructure deals had all been worked out, that the systems would have been in place within three or four years. He attributes the dissatisfaction of local officials to "naiveté" about how long these things take. Yet it's also clear that Corkum had never tackled a project of this complexity before. The term "smart city" wasn't even in his vocabulary until he began working with Elkus Manfredi (the firm declined to comment for this story). Of Howard Elkus, one of the firm's partners, now deceased, Corkum says, "Oh my god, he was like a second father." Corkum told me how Elkus had taken him on a metaphorical elevator ride to higher and higher levels and, over time, had introduced him to more and more exalted concepts, things like sustainability and the triple bottom line. With each ascent, the plan grew in its sophistication. "One day, someone on [Elkus'] team said, 'What you're doing is a smart city,'" Corkum recalls. "I had to look it up. I had no clue, and I got super excited. I said, 'Oh yeah. Technology!'"

And that was before Amazon entered the picture. In September 2017, a series of articles announced that Union Point, like 200 other cities, had joined the headquarters sweepstakes for the mega-retailer, proposing to build the company's \$5 billion home base. In an interview with *The Patriot Ledger*, Corkum said, "When you go down their list, everything they're asking for is here. A hundred acres, 8,000,000 square feet, mass transit, tech friendly and sustainable, that's Union Point."

The first news story featuring the futuristic Elkus Manfredi renderings appeared a few weeks later, when HuffPost trumpeted, "They're Building the Sustainable Urban Future Near Boston." From there, the rhetoric only escalated: There were announcements that a company called Optimus would be testing its self-driving cars at the complex (true) and that GE would become a partner to the development in the way that Cisco partnered with New Songdo in Korea (difficult to confirm). The most

impressive commitment, though, was from a Dutch robotics company called Prodrive that planned to build its U.S. manufacturing facility there on land donated by the developer (also true).

But within a year, the blimp had deflated. Corkum's version: The trouble began with the lender. LStar had to borrow tens of millions of dollars to execute a project more ambitious than any it had previously undertaken. Suddenly the bank balked. Corkum says his partners sided with the bank and said, "We should bail on as much of the vision as we have to make them happy." When Corkum refused, he says that they mounted a "smear campaign" in the form of the lawsuit.

That suit was filed in a North Carolina Superior Court in September by Steven Vining, formerly Corkum's business partner and now, since Corkum has been removed from his position, the "sole manager and member of LStar." It tells a different story. In a copy originally obtained by *The Patriot Ledger*, it's alleged that "Corkum not only mismanaged the project for which he was responsible but converted to his personal use or otherwise fraudulently obtained more than two million dollars of Plaintiff's money." The suit is a litany of bewilderingly unorthodox transactions and alleges, among other things, that "under Corkum's management, no budget or written business plan was ever prepared for the Union Point project," and also that Corkum's management of the project left LStar "\$70 million in debt." Corkum recently filed a counter suit, claiming that LStar executives defaulted on a \$2.5 million loan specifically to cause Corkum "financial ruin and damage to his reputation in the development industry."

All of which leaves South Weymouth in an unfortunate bind. "This town's clamoring for a branded hotel," Mayor Hedlund told me. "We know that a hotel isn't going to go in and plant their flag in a wasteland, but there are 23 liquor licenses up there. We're in the middle of a housing boom. We're in the middle of an economic boom. ... There have been inquiries made and lack of follow through. There are three potential developers now who have come to us and said, 'We've been trying to get in there for two years.' There was this disconnect. I don't know why, but there was. If in the middle of this boom you don't have one groundbreaking in all of 2018, there's a problem."

When I met him in November, Hedlund took some comfort from the fact that the site's one announced commercial tenant, Prodrive, was still planning to build its factory. That optimism proved fleeting. Soon after, Prodrive announced that it was pulling out, and then in early December, LStar was put on "notice of

default” by the Southfield Redevelopment Authority, the local board overseeing the project. According to *The Patriot Ledger*, the developer was accused of “failing to attract development, provide necessary infrastructure and meet its financial obligations.” LStar was given 30 days to respond to these considerable problems or have its agreement to develop the site terminated. (The 30-day period ended just after this article went to press.)

### A Serendipitous Turn

Adam Greenfield is a London-based urbanist and technology expert. In his 2013 book-length essay, “Against the Smart City,” published by Do projects, he dissected several leading examples of the form, critiquing Cisco’s role in New Songdo, where the company boasted of “intelligent road pricing” and advertisements that adjust in real time to better influence whoever happens to be watching. As Greenfield observed: “It’s as if someone took *Minority Report* as a shopping catalogue or a punch list rather than a vision of dystopia.”

I contacted Greenfield because I thought he might have a sense of whether it had become commonplace for developers of master-planned golf course communities to promote their projects as



smart cities. Is Corkum part of some larger trend? If he is, Greenfield didn’t know of it. But things took a serendipitous turn when Greenfield told me that, in fact, Corkum had contacted him last March, “out of the blue,” because he had written the book on smart cities. Corkum wanted Greenfield to “tiger team us, to tell us what’s wrong with our plan and how we might be able to do this better.”

Corkum flew him in, and Greenfield spent a few days inspecting Union Point and meeting with the concerned parties. As agreed, Greenfield wrote up a findings document, a detailed, granular critique that

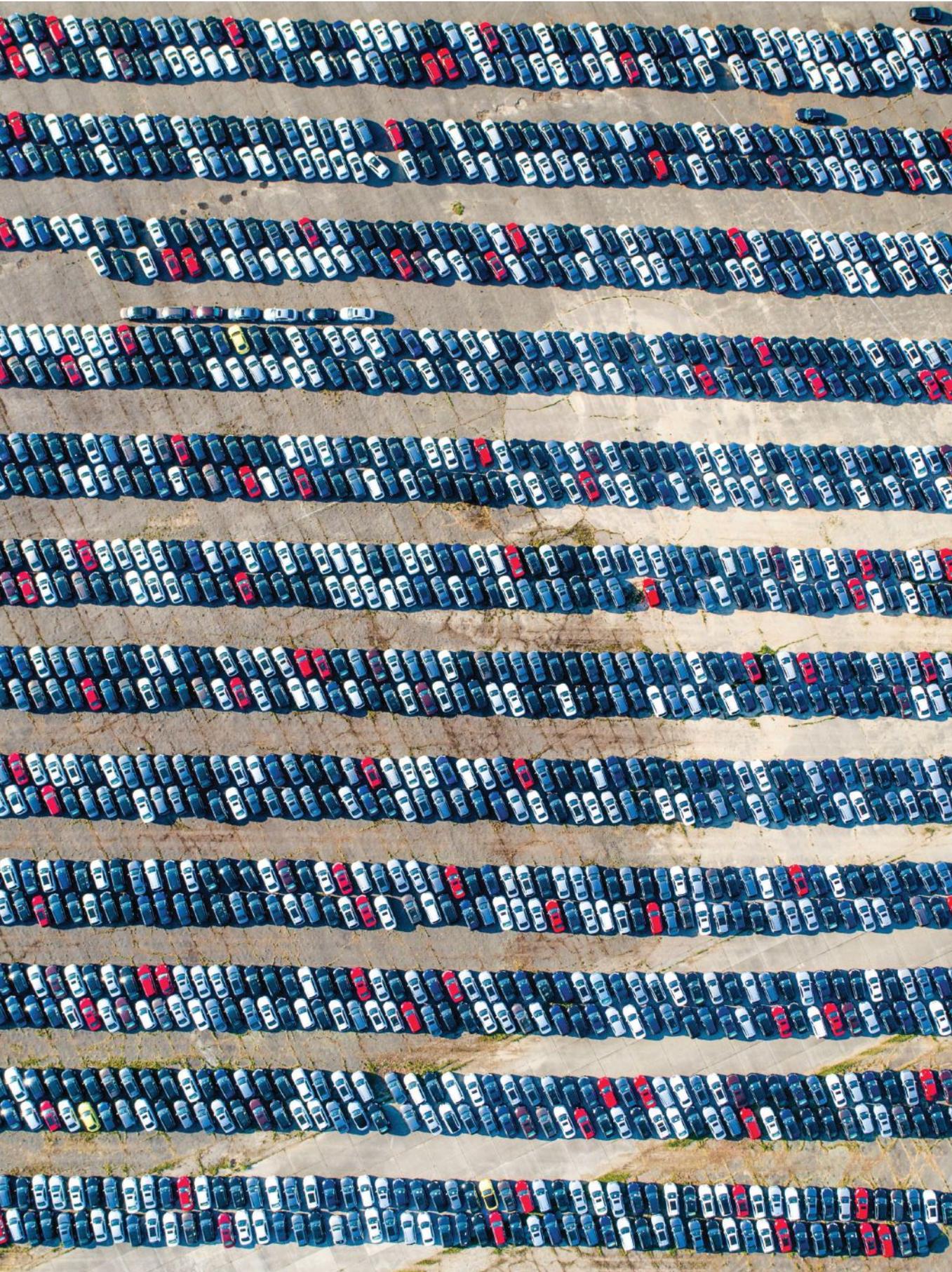
touched on numerous issues such as traffic—specifically how to prevent the site, when fully built out, to be overwhelmed by cars—and the lack of affordable housing. Greenfield sent the document off and didn’t hear anything for almost a month. Eventually he got a thank you email from Corkum, who said he was passing the findings along to one of his assistants. Greenfield read it and thought, “If he’s delegating everything to them, it’s the end of the engagement.” Which it was. Greenfield says he still hasn’t been paid.

If there’s a lesson to be learned, it’s that talking a good game is far easier than building a technologically advanced city, or any city for that matter. Corkum went on an elevator ride with his architect to the loftier precincts of urban planning, absorbed the latest buzzwords, and won over the public, at least initially. The smart city concept is endlessly captivating (“Oh yeah! Technology!”), but the realization of that vision remains stubbornly elusive.

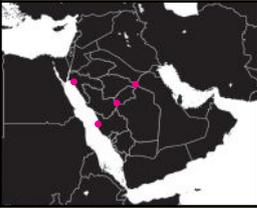
On my visit to Weymouth, I spent an hour driving around Union Point with Hedlund and Luongo. They made sure I noticed the empty storefronts and pointed out oddities like the pile of mammoth buoys that the still-extant Coast Guard base on the site had gathered for reconditioning. But the strangest thing they showed me was a sweeping field full of cars. As it turns out, the site’s one commercial tenant of any consequence is Volkswagen. Union Point, hypothetical smart city, is the current home to the automaker whose diesel cars were recalled because they were designed to cheat in emissions tests.

An LStar executive told *The Patriot Ledger* in 2017 that Volkswagen’s presence was “a temporary circumstance and short-term use of the land to add activity to the site.” But the VWs were still there when I visited. The failed smart city as refuge to cars equipped with computers programmed to lie—this requires a literary reference far more dystopian than the Emerald City. Greenfield had one at the ready: “It is the most [J.G.] Ballardian thing I’ve ever seen.”

Aerial view of Union Point’s residential lots and parking lot of decommissioned Volkswagens



What is a  
Smart City?



**Multiple  
Locations,  
Saudi Arabia**

# A Billboard of Progress

Saudi Arabia and other authoritarian states are using smart cities to transform their economies—with mixed results.



TEXT BY ELIZABETH EVITTS DICKINSON

Since the 1930s, Saudi Arabia has dominated the world's oil supply, but as crude prices began dropping in 2014 and budget deficits and unemployment rose in the kingdom, the young Crown Prince Mohammad bin Salman, or MbS as he's known, charted a brave new course for the country. In 2016, he unveiled Saudi Vision 2030, an 84-page document announcing a sweeping strategy to diversify private business, attract foreign investment, and support education and entrepreneurialism beyond the oil industry. Key to that vision: transforming hundreds of square miles of desert into smart megacities.

King Abdullah Financial  
District near Riyadh,  
Saudi Arabia

At the center of the new vision is Neom, a staggering 10,200-square-mile project that will rise along virgin coastline of the Red Sea. Estimated to cost \$500 billion, this “blank slate,” as the Saudi government describes it, calls for a “new generation of city” that runs its “opulent buildings” on solar and wind power, has streets supporting automated cars, and city services run by artificial intelligence and robots. No official master plan has been released—the first phase is scheduled to be completed by 2025—but a promotion video that aired in 2017 claimed that “this is the blank page you need to write humanity’s next chapter,” and depicted a progressive lifestyle, including leotard-clad women stretching into a yoga asana. The development would be an independent economic zone running under its own laws, taxes, and regulations, intended to attract a knowledge-based economy of international companies as well as tourists to its beaches.

Vision 2030 is, in fact, just the latest in a decades-long attempt to diversify and develop Saudi Arabia. In 2005, the kingdom went public with another smart city development, King Abdullah Economic City, a 65-square-mile project outside of Jeddah on the Red Sea coast that was master planned by a team led by Skidmore, Owings & Merrill (SOM). The King Abdullah Financial District (KAFD), located north of Riyadh, was announced a year later. The Danish architecture firm Henning Larsen did the master plan for that project, a highly sustainable financial hub with clusters of high-rise office and residential towers designed by the likes of SOM, Gensler, and Foster +

No official master plan has been released, but a promotion video that aired in 2017 claimed that “this is the blank page you need to write humanity’s next chapter.”

Partners. The 80-story PIF Tower by HOK, which is under construction and expected to earn LEED Gold, aims to be one of the most high-tech skyscrapers in the world, with a façade that includes high-performance enclosures incorporating solar shading and photovoltaic solar collection. KAFD will be connected by a new metro system, one of the many new public transit systems planned across the kingdom, with one station designed by Zaha Hadid Architects now under construction. Also announced in 2006: the Knowledge Economic City in Madinah, which included plans for four new neighborhoods with retail, office space, mosques, and over 1 million square feet of housing. In 2018, the project got a boost when a new high-speed railway opened, reducing travel time between Madinah and Makkah, the two holy cities.

But this initial round of smart city developments has largely failed to fulfill its initial promise. According

## A Provisional Who’s Who of Smart City Architects and Planners (Plus a Critic or Two)

**Maria Aiolova, ASSOC. AIA**  
CO-FOUNDER, TERREFORM ONE

An architect, educator, and urban designer who holds 18 technology patents, Aiolova co-founded Terreform One, a design research nonprofit in Brooklyn, N.Y. The group looks to technology, design, and synthetic biology to develop sustainable, localized solutions for transportation, infrastructure, waste treatment, food, water, energy, and other concerns.

**John Bachmann**  
VICE PRESIDENT, AECOM

Bachmann manages the master planning for Visakhapatnam, India—one of 100 such plans that the country has in the works. Vizag, as the effort is known, aims to create a sustainable smart city in a coastal region that is already home to 4 million residents, employing data-driven strategies that can be overlaid on existing infrastructure rather than building from the ground up.

**Alison Brooks**  
PRINCIPAL AND CREATIVE DIRECTOR,  
ALISON BROOKS ARCHITECTS

London-based Brooks uses cultural research to inform community-centric design. She believes that single-use buildings are a thing of the past, and advocates for architecture that can serve a variety of roles. For her Audi Urban Future Initiative research, Brooks explored the intersection of densification of cities and ride-sharing using connected devices.

**Dominique Davison, AIA**  
FOUNDING PRINCIPAL,  
DRAW ARCHITECTURE + URBAN DESIGN

Kansas City, Mo.-based Davison is a classically trained cellist, punk bass player, and architect who leads a team that employs data visualization, processing, and analysis to improve understanding of cities’ environmental impact. That research became PlanIT Impact, a startup that aims to increase planners’ ability to realize net-zero cities. The company’s software analyzes the impact that energy, water, and transportation have on building performance.

**Jan Gehl, HON. FAIA**  
CO-FOUNDER AND SENIOR ADVISER, GEHL

Based in Copenhagen, Denmark, the revered architect and urban planner helped transform that city into one that prioritizes pedestrians, cyclists, and public space. A critic of the current concept of smart cities, he has expressed concern that the strategies employed will not improve resident quality of life.

to press reports, as of April 2017 no financial institutions had agreed to lease space in the KAFD development. Construction and development on other projects has stalled. “We are aware that the economic cities of the last decade did not realize their potential,” the Vision 2030 states, and part of their plan calls for revivifying these district plans.

But that was before the murder of journalist Jamal Khashoggi. Plans to fund Vision 2030 were based, in part, on partially privatizing the state-held oil company Saudi Aramco, but the IPO has been delayed because of the political fallout from the killing. Advisers to Neom, like Norman Foster, HON. FAIA, have since backed out of the Neom project, while other Western CEOs, architects, and planners have also detached themselves from development projects in Saudi Arabia. “Neom is in doubt for sure,” one private sector consultant told *The Financial Times* in December. Even before the Khashoggi killing, in August, *The New York Times* had warned that MbS “will need to curb his economic ambitions.” What MbS calls, in the foreword to his 2030 report, “an ambitious yet achievable blueprint,” others now see as a pipe dream.

It is a reminder that even for a centralized or authoritarian government, which may not be faced with the internal political divisions or land-use issues that can plague projects elsewhere, the smart-city concept is not a magical elixir. Without good planning and the right political and business climate, these projects may very well fail, as so many others already have.

**Toni Griffin**  
FOUNDER, URBAN PLANNING FOR THE  
AMERICAN CITY

In addition to leading initiatives such as the Detroit Future City plan, Griffin is an urban planning professor at the Harvard Graduate School of Design. There, she founded the Just City Lab, which promotes integrating social justice into the planning of future cities. “We’re also interested in the distribution of non-material goods, such as power, rights, and decision-making. You have to think about representation, and accountability, empowerment, and trust,” she told *CityLab* last summer. “And those are ... not something you can sit at your desk and get quantitative data on. These [things] have to be measured qualitatively, which means using the experience of people on the ground as data points.” The lab’s Just City Index weighs planning against 12 resident-centric tenets, such as resiliency, democracy, and mobility.

**Rem Koolhaas, HON. FAIA**  
CO-FOUNDER, OMA

The Dutch architect has been a vocal critic of smart cities, notably in his 2014 presentation at the Brussels Smart City conference. “We are fed cute icons of urban life, integrated with harmless devices, cohering into pleasant diagrams in which citizens and business are surrounded by more and more circles of service that create bubbles of control. Why do smart cities offer only improvement? Where is the possibility of transgression?”

**Keiichi Matsuda**  
DESIGNER

A designer and filmmaker based in London, Matsuda explores the effects of augmented reality on the average citizen. In his 2016 film, *Hyper-Reality*, Matsuda presents a futuristic city where individuals utilize virtual interactive interfaces to engage with the physical environment.

**Margaret Newman, FAIA**

PRINCIPAL, ARUP

As a principal in Arup’s New York office, Newman’s focus is on urban design, public space, and multimodal network development. Her prior experience as chief of staff to Janette Sadik-Khan at the New York City Department of Transportation and as executive director of the Municipal Art Society of New York have informed her focus on creating sustainable, integrated urban design that promotes economic growth, resiliency, and diversity.

**Zenon Radewych**

PRINCIPAL, WZMH ARCHITECTS

Radewych is a principal at Toronto-based WZMH Architects. The firm’s development of an Intelligent Structural Panel, with plug-and-play infrastructure that allows wireless control of building systems made it the first architecture firm to participate in Microsoft’s global Internet of Things Insider Labs accelerator.

**Carlo Ratti**

DIRECTOR, MIT SENSEABLE CITY LAB

Also the founder of Turin, Italy–based practice Carlo Ratti Associati, Ratti is a professor at the Massachusetts Institute of Technology, and the director of MIT’s Senseable Cities Lab, which investigates how layering technology and data on urban environments can create what it terms a “real-time city.”

**Adrian Smith, FAIA, and Gordon Gill, FAIA**

FOUNDING PARTNERS, ADRIAN SMITH +  
GORDON GILL ARCHITECTURE

In addition to designing Masdar Headquarters outside Abu Dhabi, United Arab Emirates—which targeted being the world’s first energy-positive building—the duo’s Chicago-based practice has used smart city strategies in further master planning projects, such as the 28-building Astana Expo City 2017 complex in the Kazakhstan capital.

**Ben van Berkel, HON. FAIA**

FOUNDER AND PRINCIPAL ARCHITECT,  
UNSTUDIO, UNSENSE STUDIO

Van Berkel is the founder and principal architect of Amsterdam-based architecture firm, UNStudio. It’s offshoot, UNSense—launched in March 2018—explores integrative for the built environment to improve the efficiency of cities, and the quality of life of their residents. The independent startup/innovation platform focuses primarily on sensor-based technologies for cities, individual buildings, and interiors “in order to humanize architecture,” according to the firm.

**James von Klemperer, FAIA**

PRESIDENT AND DESIGN PRINCIPAL, KOHN  
PENDERSON FOX ASSOCIATES (KPF)

Von Klemperer led the team that created the master plan for New Songdo City, a 1,500-acre development in Incheon, South Korea, which combines classic urban amenities such as a 100-acre park with innovations such as a pneumatic waste collection system. The firm’s KPF Urban Interface uses data analytics to inform future city design.

What is a  
Smart City?



Quayside  
Toronto, Ontario

# A Question of Privacy

Government is partnering with Google sister company Sidewalk Labs to pilot smart city technology in Toronto. Residents have their doubts.



TEXT BY ALEX BOZIKOVIC

This smart city of the future first appeared in cutesy sketches. Drawn in a cheerful palette were a kayaker paddling in a harbor, a dad pulling a little one in a bike trailer, children running hand-in-hand through a carless streetscape. There were gondolas and pergolas, and underground robots carrying waste. And, vaguely, in the background, there were also buildings.

This was the vision for Quayside, a new waterfront neighborhood in Toronto conceived by “Sidewalk Toronto,” a partnership between a local public agency and Sidewalk Labs, a New York–based unit of Alphabet, Google’s parent company. “By leveraging technology and combining it with really smart, people-centric urban planning,” Sidewalk Labs CEO Dan Doctoroff said at the time, “we could have really dramatic impacts on quality of life.”

Sidewalk Toronto was launched in October 2017. A year and a few months later, the vision for Quayside remains only slightly less vague than those initial drawings. The 3 million-square-foot project promises to include many of the hallmarks of smart-city ventures: “dynamic streets” designed for autonomous vehicles, “radical-mixed-use” buildings featuring “power-over-Ethernet,” and a novel approach to retail and service space that prioritizes pop-ups over long-term leases. The project also promises to inspire meaningful innovations in construction and real estate practice. “We’re putting forward new technologies that have not been integrated before,” says Karim Khalifa, a mechanical engineer who is the director of buildings innovation for Sidewalk Labs. “The project includes prefabricated mass timber at a scale that has never been attempted.”

Perhaps most importantly, Quayside promises to generate endless streams of data—from buildings, road sensors, traffic signals, and other sources—with the promise that they will make the development more efficient, safe, and pleasant. Local resistance to the plan has mounted, however, as residents of various political stripes have raised a provocative series of questions. Who will control that data? What does a tech-inspired, Google-affiliated city mean, technologically, socially, economically, and politically? What, exactly, is Sidewalk trying to build?



A 2017 rendering of Quayside



### An Instigator, Not a Developer

Quayside is the first major project by Sidewalk Labs—a showpiece that the company hopes will define its reputation in the field of “urban innovation.” It’s one of the most prominent examples of the tech industry’s newfound ambition to disrupt urban planning. As Khalifa says, “We’re not a real estate developer. We’re not a contractor ... you could call us an instigator or a catalyst in this space.”

The company was founded under the leadership of Doctoroff, the former CEO of Bloomberg LP and a deputy mayor of New York under Michael Bloomberg. Staffed heavily by Bloomberg administration veterans, the firm was seeking a site to test new approaches to mobility, construction technology and, most contentiously, the use of data from traffic and building systems, as well as personal data. They found their venue in Toronto, a city of nearly 3 million that is Canada’s financial, cultural, and tech capital.

Their partner? Waterfront Toronto, a public agency controlled jointly by the city, the province of Ontario, and the federal government. The agency was created in 2001 to redevelop 2,000 acres of Toronto’s port lands on Lake Ontario, a former industrial zone just a mile east of the city center. Waterfront Toronto has made considerable progress, building quality parks and public space, collaborating with public agencies and developers to create new mixed-use projects, and improving the site’s flood protection. Two years ago, it broke ground on a nearly \$900 million project

to reshape the flood-prone Don River. Designed by Michael Van Valkenburgh Associates, the project will also create 200 acres of new parks along the river’s “renaturalized” mouth.

In 2017, when the agency released an RFP looking for a developer and “innovation partner,” almost no one noticed; my column in the *Globe and Mail* discussing this news made few ripples. But when it became clear that Sidewalk—or, as it was widely reported, Google—was the innovation partner, things suddenly heated up. This wasn’t simply a question of designing smart building automation systems or streetlamps, but something bigger and potentially more nebulous, even nefarious. Sidewalk, after all, has professed interest in the healthcare industry and even voting machines. Commentators, some of them wary of an American company imposing its will north of the border, painted the project as a fearsome corporate takeover or as a techno-utopia in the making. “Sidewalk Toronto is not a smart city,” wrote Jim Balsillie, a former chairman and co-CEO of Research In Motion (now BlackBerry) in an op-ed in the *Globe and Mail* published in October. “It is a colonizing experiment in surveillance capitalism attempting to bulldoze important urban, civic, and political issues.”

Waterfront Toronto was unprepared for this storm. The agency, then headed by urban designer and real estate developer Will Fleissig, can do little without the agreement of all its public masters, and it had always prized a methodical, consultative approach.



Quayside will rely on “radical zoning” that will mix a variety of uses, including short-term pop-up retail

Sidewalk Labs, with few local staff and limited political connections, also seemed unprepared for the blowback. The company’s initial message, with those sunny drawings, was vague but cheerful. “We want to mix technology and cutting-edge city planning, and bend the curve on quality of life in cities,” Doctoroff told me before the launch. He also said: “We’re humble. We know how to listen.”

Those qualities have certainly been put to the test. One problem was the deal’s unusual structure. The two partners began working together to create policy around “digital innovation,” and the resulting public outreach seemed to blur Waterfront’s public agenda with Sidewalk’s spin, raising questions about who exactly was driving the agenda. It didn’t help that the agreement called Sidewalk an “innovation partner” for much of the port lands beyond Quayside—750 acres—without spelling out exactly what this would mean. And then there was the question of data. How would information from Quayside be collected, how would it be stored and used, and who would have access to it and for what purposes? Would a resident’s movements, captured by cameras or geolocation data, truly remain private? And would Sidewalk be able to extract huge economic returns from its intimate knowledge of the community? Critics panned the initial public meetings for being unreasonably vague about these questions. One of Waterfront’s board members and two members of its digital strategy advisory panel have resigned in recent months, unhappy with Sidewalk’s handling of

data and privacy concerns and the way the public-private partnership was operating.

**A Vision in Timber**

Meanwhile, Sidewalk has been working to translate its vision into actual development. The company has been reluctant to release designs in a coherent way, and in December, when it revealed specifics of its Quayside master plan for the first time, the drawings remained frustratingly vague. Designed by a team including Neil Kittredge, AIA, a partner and director of planning and urban design at Beyer Blinder Belle in New York; Toronto-based urban design consultancy Urban Strategies; and urban planner Ken Greenberg, ASSOC. AIA, the scheme is a mix of mid-rise and low-rise buildings between five and 30 stories tall. It’s meant to support 3,900 new jobs and house about 5,000 residents, 40 percent of them in some form of affordable housing. A pedestrian-only street runs through the middle of the block, and the site features a “water plaza” designed by emerging Toronto landscape architect firm Public Work that connects the development to the waterfront. “There is this really interesting geography of where the downtown meets the lake,” says Jesse Shapins, Sidewalk’s director of public realm. “And so from an urban design perspective, we’re looking to blend as much as possible the relationship between land, water, and buildings.”

As for the buildings themselves, they are what Sidewalk is calling “radical mixed-use,” with



residential, office, retail, and light industrial alongside each other in loft-like structures—a plan that would require significant zoning changes. Inside the buildings, one of the innovations will be the use of power-over-Ethernet, which Khalifa’s team is working on with consultancy Interface Engineering. This technology supplies low-voltage DC current through Ethernet cables, which can be run inside the cavity of an interior wall and then easily moved when there’s a change in tenancy or use. Early sketches of the project featured fourth-floor workshops alongside apartments; more recent iterations had separated residential and office spaces into different floors.

One thing that has remained consistent is Sidewalk’s commitment to mass timber. As Khalifa argues, cross-laminated timber panels and glue-laminated beams especially are less carbon-intensive than steel or concrete; they are lightweight and relatively easy to transport long distances; and they lend themselves to off-site panelization or prefabrication. He says that Sidewalk is planning to “invest in the supply chain” of mass timber in Ontario, to make it easier for the Quayside project and future development to rely on the material. The company has partnered with Michael Green Associates Architecture (MGA), whose principal Michael Green, AIA, has become a leading proponent of mass timber. In an interview last year, Green said that he has designed a “kit of parts” for the project that can be manipulated to “allow for the changing way we all want to live”—a

solution “that is, on the one hand, not complicated, but on the other hand it’s quite complicated when you try to get into structural and programmatic details.”

Who will work with that kit of parts, in addition to the architectural expression of the buildings themselves, remains undecided: Sidewalk executives haven’t yet revealed who the architects will be, but they have engaged Snøhetta and Heatherwick Studio to explore possibilities. “We’ve asked them to test the model, and see whether it can be used to create beautiful architecture,” says Andrew Winters, Sidewalk’s chief operating office for development. “And the answer is yes.”

Perhaps the most difficult part of the project revolves around fire safety and code compliance in wood buildings. In Ontario, as in most jurisdictions, in order to achieve an adequate fire rating for homes, the wood structure must be covered by drywall or other materials whose fire-separation capacity is well understood. Sidewalk is attempting to solve this issue, Winters says, with a fire-resistant finish that can be applied to the surface of the wood. Still, regulatory challenges remain: the local building code forbids wood structures taller than six stories, although two groundbreaking wood projects in the city (10 and 14 stories high) are currently seeking approval.

If Sidewalk does secure the necessary permits, its timber architecture could frame an unusual sort of public life. The company’s master plan for Quayside allots almost all of the 400,000-square-foot ground floor



to what it calls “stoa” spaces—semi-enclosed “flexible envelopes” where retailers or restaurateurs could build climate-controlled structures or set up kiosks that would lend themselves to pop-ups. Although short-term tenancies aren’t typically favored in a developer’s pro forma, they seem less and less risky financially as retail is increasingly disrupted by e-commerce. Shapins acknowledges this, and adds: “We want to drive a really integrated vibrant expanded public realm that moves between the buildings and the streets and the plazas.”

In order to support that objective in Toronto, with its bitterly cold winters and hot summers, Sidewalk is pursuing something called microclimate mitigation. Local architecture firm Partisans and engineering firm RWDI are working on a series of freestanding shelter structures and “raincoats” for the buildings—adjustable soft surfaces that make the extremes of wind and rain more tolerable.

There is a coherent urbanism here: mutable, mixed, and fine-grained. But the project’s most controversial aspect, at least from an urbanistic perspective, could be what it does with public streets. One of Sidewalk’s first specific proposals was for “dynamic streets,” which would feature a system of paver units containing sensors and lighting components. The lights would signify which lanes are available to pedestrians and vehicles and could be altered depending on the time of day or for special events. Sidewalk hopes to limit traffic by building an “urban consolidation center,” where packages would be received and routed to their

## The New Gold Rush

Given trillion-dollar projections for the smart city market, it should come as no surprise that the world’s largest tech companies see it as a major growth opportunity. Legacy players such as AT&T and Honeywell are in competition with giant upstarts such as Amazon and Alibaba, offering a host of products, systems, and services to governments, utilities, and other potential clients. Market research firm Compass Intelligence’s A-List in Smart Cities Index ranks the top companies in the space, those that provide solutions for “energy, transportation, real estate, management systems, device connectivity, data capture, video analytics, lighting, public safety, public health, crisis management, and automation.”

1. General Electric
2. Intel
3. AT&T
4. Microsoft
5. Amazon (AWS)
6. Honeywell
7. IBM
8. Google
9. Cisco
10. Dell
11. Ericsson
12. Qualcomm
13. Huawei
14. Verizon
15. Schneider Electric
16. Siemens AG
17. Nokia
18. Oracle
19. Apple
20. SAP
21. Johnson Controls
22. Hitachi
23. ABB
24. HPE
25. Deutsche Telekom (T-Mobile)
26. Nvidia
27. Samsung
28. SoftBank
29. Itron
30. Alibaba
31. Sprint
32. InterDigital/Chordant
33. Facebook
34. Baidu
35. Tencent Holdings
36. ST Engineering
37. OSIsoft
38. Alstom (by GE)
39. Eaton
40. DNV-GL

Even as the physical picture of Sidewalk's master plan has filled in, local residents haven't seemed to care much. A substantial and novel development project has been largely cast as a Trojan horse for "surveillance capitalism."

The project aspires to connect the city to the waterfront and turn it into a destination

destination through robots in underground tunnels, which would also be used to transport garbage in the opposite direction, eliminating the need for delivery or garbage trucks. And parking capacity would be shared between different buildings, with autonomous vehicles providing a valet service. "We are designing with an autonomous vehicle future in mind," says Rohit (Rit) Aggarwala, the company's head of urban systems. "There are huge implications for architecture. ... If you think about the curb pattern at a major airport, you have multiple curbs to handle pickups and drop-offs." Accordingly, the company is reimagining a major street—Queen's Quay—as a one-way, with a large pickup and drop-off zones that can be defined by street furniture that moves itself into position.

### **A Novel Development Ignored**

All these plans—the radical mixed-use idea, the wood towers, the dynamic streets—remain hypothetical. The





entire scheme still needs to be approved by Waterfront Toronto before city officials actually start to consider it, a process that won't formally begin until the middle of this year. In a city where development approvals can typically take four or five years, it seems unlikely that any aspect of the Sidewalk plan will take shape anytime soon.

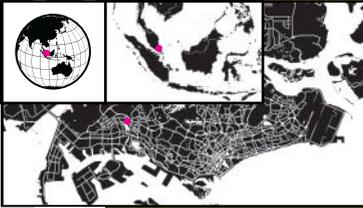
If it ever does. Most critics agree that Sidewalk's main goal is to gain access to data, as a resource to be mined and leveraged. Saadia Muzaffar, one of the advisers who stepped down from Waterfront Toronto's digital strategy board, complained in an open letter about the "blatant disregard for resident concerns about data and digital infrastructure." She wrote that public meetings were spent "talking about buildings made out of wood and the width of one-way streets" and other "things no one has ... expressed material concern for in this entire process."

That last point is an unfortunate reality of the

project. Even as the physical picture of Sidewalk's master plan has filled in, local residents haven't seemed to care much. A substantial and novel development project has been largely cast as a Trojan horse for "surveillance capitalism." It's hard to tell whether the government will—or even can—respond adequately to this challenge. After all, Sidewalk is trying to change so many things at once: privacy law, construction technology, retail strategy, logistics, mobility, the housing market. Its ambitions and its assumptions in each field aren't clear—even, I think, to Sidewalk itself. It will take years to assess how the project will actually take shape or who benefits.

Which ought to come as a lesson for Sidewalk: Tech might move at a lightning pace, but development moves much more slowly. In trying to combine the two, the company is learning just how hard it is to build a real-life community.

## What is a Smart City?



### Jurong Lake District, Singapore

# Future Proofing

For a new business district in Singapore, technology is a tool for achieving sustainability and resilience.

TEXT BY ELIZABETH EVITTS DICKINSON

As urban areas expand, the old central business district model becomes less, well, central. Many global cities are designing additional districts outside the city center as a means to attract emerging business and new residents. Madrid, for instance, hopes to entice companies leaving post-Brexit London to relocate to its Madrid New North project. Singapore, meanwhile, is planning a second central business district called the Jurong Lake District. An 890-acre mixed-use development located near the country's newly consolidated container port operations, it is primed to capitalize on a future Kuala Lumpur–Singapore high-speed rail system. The district calls for 20,000 new homes and room for up to 100,000 jobs in a dense and sustainable, 24/7 area that includes a revived national garden park along the water. According to the website for Singapore's Urban Redevelopment Authority, the project will "demonstrate how technology can enable a livable and sustainable urban environment," using big data and sensors to create real-time feedback that will "enable facility managers to diagnose and fix problems in a timely way."

Just don't call it a "smart" city, at least not to its architects. "I don't use that word actually, because I think it's too inflated," says Kees Christiaanse, founder

and partner of Rotterdam-based KCAP. Christiaanse, along with Arup and other partners, helped plan the district with the redevelopment authority after winning the commission a few years ago. He prefers to think of the design, which was released to the public in 2017, as future-proofing the city. Future-proofing "means that you create a condition of public places and street patterns and building typologies that are resilient for change in the future and can accommodate unexpected events," Christiaanse says.

One way to future-proof is to create flexible zoning. The Jurong Lake District is using a grid system—called "white zoning"—that is meant to give developers and businesses maximum leeway to change how a building functions as their needs evolve. Meanwhile, the infrastructure for subways, rail, roads, and other city services is "designed in such a way that it doesn't interfere with the street pattern and the plots of the neighborhood," Christiaanse says. Residential neighborhoods won't be disrupted as infrastructure goes in, or in the future when it needs updating. The plan, for instance, puts the corridor and entrance for the future high-speed rail station along a park, so that city streets and residents won't be disturbed when construction starts.

As Christiaanse notes, many smart city concepts call for a large common service tunnel underground, where infrastructure bundles are mounted and tracks are installed for delivery vehicles and waste disposal. But with accelerated tech development the way it is, “it makes no sense to dimension a common service tunnel on, say, a pneumatic waste conveyance system, because after 10 years, there is going to be another system,” he says. “Common service tunnels are huge and not flexible.” Instead, “we created a small common service tunnel where most of the pipes can be accommodated, and then we created a layer on the streets where you can embed things for flexible infrastructure.”

The design of the Jurong Lake District also differs from most central business districts in that it doesn’t strive for a variegated skyline punctuated by pinnacles and towers. In Singapore, the footprint of new buildings must be offset by an equal amount of green surface, and this has spurred the development of new building typologies, such as “shelf buildings”—groups of towers connected by an elevated shelf, like an oversized skybridge, that provides green space, jogging tracks, or even a pool. (The most notable example may be Moshe Safdie, FAIA’s Marina Bay Sands hotel, which opened in 2010 near the existing central business district and made an appearance in the 2018 film *Crazy Rich Asians*.) In the new district, KCAP dictated that all the buildings be the exact maximum allowable height of 115 feet and include a flat green roof, in effect creating what Christiaanse calls “a floating garden.”

Other natural assets take a nod from Frederick Law Olmsted and his “emerald necklace” concept in Boston; here, a series of public spaces will be connected in a “Green Loop” of parks, bike paths, and greenways stitched throughout the district.

The redevelopment authority began the planning for the Jurong Lake District in 2008 around the existing metro system, but updated the plan when the high-speed rail became viable. “There is a little political turmoil between Malaysia and Singapore with the high-speed rail and the plans are getting delayed,” Christiaanse says. “That’s why our approach was to create a strategy of phasing in, where you do not create interdependencies too much,” he says. Construction hasn’t started yet on the district, but the redevelopment authority says that delays in the rail project won’t prevent it from proceeding. Which demonstrates how the development as a whole can keep moving forward, even if political bickering delays one aspect of it.

Turns out that a smart city, to be truly smart, needs to be based on thoughtful and strategic urban planning—an indispensable framework to accommodate the technology of the future.



Top: A rendering of the Jurong Lake District

Bottom: The proposed site in 2018

## Pullman Redux?

The failed company towns of the 19th and 20th centuries have long served as a cautionary tale against the paternalism of the manufacturing sector and utopian ideals of planned developments.

Consider Henry Ford’s 3,900-square-mile Fordlândia development in Aveiro, Brazil, which was constructed in the 1920s to house 10,000 workers to produce rubber for the Detroit-based company. After failing to both grow rubber trees and integrate with the local community, by 1934, the city was abandoned. Even earlier, in the 1880s, engineer George Pullman established his eponymous company town on Chicago’s South Side for the employees who manufactured his sleeping railcars. The town’s concept famously met its demise soon after an 1894 strike that left 34 people dead.

More than a century later, there’s a new twist on the company town: Instead of being an exclusive (and captive) place for a corporation’s employees to live, the new version is an information sponge built by a single company for the benefit of its database. The residents are employees in the sense that they contribute to the company’s bottom line—without actually working for the company itself.

Last year, billionaire philanthropist and Microsoft founder Bill Gates purchased 25,000 acres of land west of Phoenix with \$80 million from his Cascade Investment group. His vision: an 80,000-residence smart city that “embraces cutting-edge technology, designed around high-speed digital networks, data centers, new manufacturing technologies and distribution models, autonomous vehicles, and autonomous logistics hubs,” according to a statement from the project developers Belmont Partners.

One state away, near the Denver International Airport, Japanese electronics giant Panasonic is developing an almost 400-acre smart city. It will feature a solar-powered micro-grid, connected LED streetlighting, and an autonomous shuttle.

Given that the market for smart city technology and products is expected to exceed \$1 trillion within the next five years, it is no surprise that corporations, funds, and entrepreneurs are investing in such developments. But unlike company towns of the past, tech companies do not need to build and own the towns themselves. Instead, with their data-gathering capacities, all towns become company towns. —K.K.

What is a  
Smart City?



**Stockholm**  
**Royal Seaport**

# A Holistic Approach

Sensitive urbanism, smart technology, progressive architecture, and careful government stewardship make this 583-acre development in Stockholm a model for smart cities across the globe.





TEXT BY ELIZABETH EVITTS DICKINSON

Ah, Sweden. Amidst the over-promise and over-hype that has come to define so many smart-city developments, the Royal Seaport in Stockholm stands out as a project that's remained true to its word. Beginning in the early 2000s, the City of Stockholm envisioned transforming an industrial area outside the city center into a highly sustainable and tech-connected district with 12,000 new homes and 35,000 commercial and office spaces. By 2010, the Stockholm City Council had committed to making Royal Seaport an international example of sustainable urban planning, one that would also provide much needed housing for the city's growing population, which now numbers around 1.5 million. The development is taking shape around an infrastructure of information communications systems that will support smart homes and public transit access—a feature “just as

A rendering of the Royal Seaport development in Stockholm

important as having well-functioning roads, electricity, or water,” Staffan Lorentz, the head of development for Royal Seaport, said in a 2012 interview. Linking walking paths, bike lanes, rapid bus systems, and the metro using apps and wayfinding will help the district reduce its emissions. Ground broke on the project in 2011 with the goal of having the district complete—and running fossil fuel free—by 2030.

There’s a bit of irony in that carbon neutral goal, considering the 583-acre district—one of the largest urban development areas in Northern Europe—runs along a waterway historically used to transport coal to the city’s gasworks factories. In fact, one of the key architectural symbols of the district, designed by Herzog & de Meuron, pays homage to an original, round gasworks building. The 295-foot-tall tower, expected to open in 2022, features a variegated, v-shaped exterior and will house 317 apartments. “Its floor plan opens like the pages in a book to the surrounding city and landscape, maximizing sun exposure and offering a variety of views,” is how Jacques Herzog, HON. FAIA, described the project.

Sun exposure is critical during the dark Scandinavian winters, and the sensitivity to this design issue also helped the Danish firm Adept and the Stockholm-based Mandaworks earn the opportunity to master plan a key portion of Royal Seaport. The two firms won a 2015 design competition for a 43-acre section located near the city’s metro system. Known as Kolkajen-Ropsten, it reconnects the historic gasworks area to the waterfront through a new central axis leading to a shoreline park they call a “water arena.” “We proposed to build out a new island in the water that would turn the northeast facing shoreline to a south facing promenade” with housing and ground-level public retail, says Martin Laursen, founding partner of Adept, “so that the area would be more attractive in terms of daylight.”

Another key feature of their master plan is access to public transit and bike infrastructure (Royal Seaport is just 10 minutes from the city by bike). There will only be short-term parking in the area, with long-term parking for residents and workers in a nearby central garage. Not every apartment gets a place to park, according to Laursen: “You might have to share one spot between three or four apartments,” he says. “The new area aims to push future inhabitants to use other more sustainable forms of transportation than a private car.”

Adept and Mandaworks have spent three years finalizing the plan, and this year the city began conducting architecture competitions for plots. “We did a design book for the area for architects and

builders to follow,” Laursen says, which highlights the already established sustainability requirements for all of the buildings in Royal Seaport, such as encouraging green roofs and photovoltaics. The main corridor that connects the historic center to the water calls for closer blocks and higher buildings to help define the axis. Along the waterfront, however, where there is a park and a canal space, they lowered the scale to create “an Amsterdam feeling,” as Laursen describes it, with row houses and a mix of building materials. “It underlines a more intimate and calm public environment,” he says, and is meant to emulate an organic city grown over time, as opposed to one born overnight, by designing in a “diversity not only in ways of living, but also in ways of using a mix of materials in different urban spaces.”

To that end, historic preservation has also been important to the project. In Europe, smart city projects are more often than not retrofits requiring sensitivity to existing context. In addition to restoring some existing buildings, Laursen and his team made sure to maintain a portion of the historic pier that harkens back to the days of the “Shouting Stone.” “Before they had bridges connecting the islands, if you wanted the ferry, you would go out to a rock and shout for it to come get you,” Laursen says. “Even though we will build a lot of new buildings, the whole history of the site is well preserved.”

Part of Royal Seaport’s success so far derives from its political cohesion and commitment to vision. According to the district’s website, property developers must all participate in city-run seminars at early stages of planning, to determine their competence and experience in achieving the rigorous sustainability targets. The goals will be achieved using high-tech strategies for monitoring buildings as well as through low-tech means, such as government-sponsored forums on sustainable solutions and recurring mini trade fairs that introduce developers and technical suppliers to one another and encourage discussion around sustainable products, services, and ideas.

Today, a portion of Royal Seaport has come to life, with more than 2,500 housing units occupied, and another 5,100 soon to open. Construction on the infrastructure for the Kolkajen-Ropsten district will begin next year. Several research and design studies have already been conducted, including a post-occupancy survey with new residents to ensure that the promises of the development are being realized. “Real-time follow up on how well the apartments and the area performs in energy consumption or traffic is important,” Lorentz said. “We need to constantly follow up to see if we’re making the right decisions.”



*Top:* A rendering of Herzog & de Meuron's Gasklockan tower

*Bottom:* The Technical Building, designed by U.D. Urban Design and Anders Ohlin, which houses both an electrical substation as well as pumps for a fountain in Norra Djurgården



What is a  
Smart City?

# We're Working on It

In a roundtable with ARCHITECT, three smart city experts trade opinions and insights on what the buzzword really means, why the world's largest companies want a stake, and how architects can step up to the plate.



EDITED BY WANDA LAU

**How do you currently define a smart city? I say “currently” because the definition has evolved as technologies have come and gone, and as experiments have failed or succeeded.**

*Lam:* I think of smart cities as a process because it’s a change in local context and improvements in technology. It’s not an end state. You don’t suddenly declare yourself a smart city and then forget about it.

You’re starting out with a challenge, problem, or mission and thinking about what hardware, research, and processes are available in the toolkit. But it’s not led by technology and it’s not some sort of shiny object to just purchase and think you’re smart.

*Townsend:* There’s been effort over the years to formally define smart cities by the British Standards Institution, a variety of U.S.–based organizations, and some consulting companies like Arup. To me, it’s a movement that’s about using digital technology to solve the timeless problems of cities—the same problems that mayors in Ancient Rome had to solve: How do you collect the trash? How do you secure the streets? How do you address chariot congestion in the center of the city? Now it’s Ubers, but it’s still ride for hire.

We have solutions for urban problems but often they’re too costly or there’s political gridlock that prevents the solutions we have from being implemented. And sometimes these new digital tools provide shortcuts.

*Doherty:* Smart cities are about the collision of industries [that hopefully leads to] a domino effect. My company takes an approach of innovations as ingredients to create recipes that are unique for a particular part of the world because there is no big silver bullet. But when we start to take a look at the data-driven ways of [collecting and analyzing] static data as opposed to kinetic data, that’s where the value proposition is.

The state of data—the accuracy, its authenticity, and its trust—is variable. It’s all over the place, and the hardest part of our job is figuring out what’s the authenticated data so we can start using technologies to understand what happens when you digitize a process that has not been digitized in the past. The biggest challenge to the profession is to anticipate needs that don’t exist right now.

**Paul Doherty** is a registered architect, the chairman and CEO of the international company The Digit Group (TDG), an honorary senior fellow of the Design Futures Council, and a fellow of the International Facility Management Association. His past ventures include Revit Technology and Buzzsaw (both purchased by Autodesk), and TRIRIGA (purchased by IBM). TDG is currently involved in numerous smart city plans and real estate developments around the world.

**Debra Lam** is the managing director of Smart Cities and Inclusive Innovation for Georgia Tech, and founder of the Georgia Smart Communities Challenge. Previously, she served as Pittsburgh’s first chief of innovation and performance, where she crafted the city’s landmark strategic plan, the “Pittsburgh Roadmap for Inclusive Innovation,” and she was a policy and urban sustainability associate and senior consultant at Arup. She sits on the MetroLab Network and Neighborhood Nexus boards.

**Anthony Townsend** is the founder of Bits and Atoms, a smart cities strategy consultancy and planning studio, based in New York, that works with industry, government, and philanthropy on economic development, digital placemaking, and technology forecasting. He is also the author of *Smart Cities: Big Data, Civic Hackers and the Quest for a New Utopia* (W.W. Norton & Co., 2013). In 2001, he co-founded NYCwireless, a pioneer in the community and municipal wireless movement.

## What are the benefits of smart cities for the public—for the users?

*Townsend:* That’s still an open question. The whole movement began with a bunch of claims mostly coming from a handful of big IT companies: IBM and Cisco framed it early on about efficiency largely delivered through better infrastructure and better operations that upgraded 20th-century hardware in energy, water, traffic, and security.

There was a lot of virtue to that. There was a lot of waste in our existing physical systems and the way they’re operated, and a lot of opportunities to interconnect and apply systems thinking. But in many ways it was oversold: It was never going to solve the systemic problems we’re facing—climate change, migration, security, sustainability.

A different vision has bubbled up—from citizens, civil society, small business, and entrepreneurs—that’s about the way we live, and the things that have been created by those people have a lot more to do with convenience, transparency, living cleaner and healthier, and connecting the natural environment back into the urban world. What a smart city can deliver depends on what your goals are. And what your goals are depend on the politics and social makeup, who is in the city, who has power and what they’re trying to achieve.

We’re seeing this play out right now in clear terms in Toronto with Sidewalk Labs and Waterfront Toronto trying to develop what’s probably the most valuable piece of waterfront property in North America as a smart district using everything the Alphabet family brings in terms of its ability to sense, manipulate, and influence the physical world through the analysis and transformation of data. And they have done it in a way that did not reflect what the community wanted.

I would take issue with [Doherty’s] comment earlier that the mission now is to come up with ideas for what we can do. People in cities know what their problems are and have a fairly decent sense of how they can be solved. What they need from technologists are solutions to the problems they identify.

## Debra, you were instrumental to developing the “Pittsburgh Roadmap for Inclusive Innovation.” Who did you find were the most necessary stakeholders in this process of smart city planning?

*Lam:* First, it’s not just identifying those stakeholders: It’s how you continue to engage with them and how you build their trust so they become active owners of this process as much as you are. And that’s the difficulty. You can put together a town hall, sure, you can do an introduction, but how do you sustain that communications process? How do you take out barriers that prevent people from joining and from continuing that conversation?

Smart cities are a lot about the technology and the infrastructure. Many communities are cognizant of the big infrastructure plans from the ’50s and ’60s that, in terms of transportation, actually divided a lot of neighborhoods. So we’re coming back to the same communities with ambitious goals to transform them with a lot of technology, data, and infrastructure, knowing that they were harmed by some of these big modernization efforts in the past.

It’s important to go into those communities understanding that history and knowing you are always actively working to build and maintain that trust in order to be successful in engagement.

*Doherty:* When I mentioned the collision of industries before, it’s also about the collisions and conversations that can happen between government and its constituents. We’re finding that those conversations are either very short and canned, or they’re forced down people’s throats—in totalitarian governments in particular—which is a much different way of viewing what is a high-performing urban environment.

The storytelling mechanisms we’re looking to collide involve Hollywood—not to create Disney World or, god forbid, another Dubai that has no context or soul behind it—but something that can be part of the ingredients to create that recipe. Why do you want to be in a pop-up city that’s never existed before—to raise your family, get a better education, to get better healthcare? The people do know what they want, but you also don’t want to implement a technology for technology’s sake unless you know what the ramifications are.

## Why are companies like Google, or Alphabet, and IBM interested in the smart city?

*Doherty:* Google is a machine, like a locomotive that needs coal to work. Its main goal is to have private-public people’s information as its coal. The Sidewalk Labs opportunity is a good idea—to boomerang innovations that may happen elsewhere into district-sized solutions so people start to adopt and change behavior, and see the results that it would scale.

The opportunity to also be that data-capturing mechanism is something a private company thrives for. We have a moral and ethical issue here because if Toronto acquiesces and says, “This is good enough,” we’re going to have this public trust entity that Google is going to feed so that anyone can come in, petition, and create apps and other smart city solutions over a period of time.

That sounds good, but the reason prominent Canadian privacy figures are resigning from the task force is that, at its essence, Quayside is capturing the fuel for Google. I don’t know how an American company can come in and take Canadian private information and think it’s going to be able to get away with that.

And the solution is cloudy. It's a \$1.1 billion investment by Google into the Quayside project. Who else is going to absorb that \$1.1 billion if Waterfront Toronto says, "No," and Google says, "Well, tough luck"?

This is the double edge of smart cities: How much do we want to maintain the anonymous way of living and working? [What can we] get back from these tools that will measurably increase of quality of life?

"[W]hen we're talking about the power of data and what it can do with a community, it's important to go back to basics: Who is the recipient, who is the end user and the input factor of data, and what does that all mean?"

—DEBRA LAM, MANAGING DIRECTOR OF SMART CITIES AND INCLUSIVE INNOVATION, GEORGIA TECH

*Lam:* It's interesting how tech companies have evolved in this space as well. It was driven by sales at the beginning. You had a team of salespeople that were tracked in terms of their performance by the hardware and the software they needed to sell and push out.

And when you're driven that way, then you can't really think about the users' needs and appreciate the bigger factor that we're all outlined in. Where I think it is slowly and effectively making real purpose is to understand beyond just the sales of it: how technology can be that connector toward citizens because there is good in technology and it can be an empowering tool. It's a matter of changing the conversation and the dialogue so you're not driven by those types of metrics, but driven more by the impact that the technology can do in terms of transforming the lives of citizens.

And that's where we need to get into this next stage of smart city development.

*Townsend:* The online industry press tends to see [smart cities] in terms of clicks, eyeballs, and data. And there certainly is a lot of that at stake. But as an urban planner, you also have to look at it from the conventional land-grab aspect of it. What is the actual physical territory these companies are trying to claim?

Sidewalk in Toronto is a very good example where when we boil it down to what that project is really after: It's control of that land. If you look at Alphabet's broader financial portfolio, it's part of the diversification of that portfolio out of tech stocks, its own stocks, and other tech company stocks, and cash into real estate that it's been executing for the last 10 years. And Toronto is a nice, safe place to park a couple billion dollars in some waterfront real estate that isn't as susceptible to sea level rise as the other places along the coast that it's parked its money.

The distribution infrastructure Amazon Whole Foods is building out is a land grab. They're trying to establish a footprint that will allow them to essentially take out a large swath of the retail sector in the U.S. whenever they choose to execute that strategy as they have done online.

Uber's abrasive congestion pricing is basically a strategy to collude with local governments to set up a regulatory regime where it can afford to engage in a war of attrition with its competitors. It is the only one who has enough money to survive. And then it'll control what the price of the congestion is because it'll have the only vehicles on the road.

So all these companies are actually fighting. There's a lot of data, clicks, and abstract digital things floating around but they're really weapons in a war over urban territory. And we shouldn't forget that because that's where our skills and experiences as planners and architects and people in government are relevant even though we may not understand all the nuances of deep learning and data-sharing covenants.

*Lam:* [In Pittsburgh,] we implemented RFID tag sensors on our trash cans in a neighborhood thinking that it would be more efficient [for workers to] only pick up the trash when [the cans were] full rather than stop by stop, and therefore we could divert the sanitation workers to do other things in public works.

We thought that was an empowering way to look at data—we were informed by the trash fillage. What we didn't account for was the sanitation workers themselves. So if a sanitation worker takes pride in doing 50 trash cans each day, and [suddenly] you tell them to do less, then they weren't quite sure about what they saw as their job and what needed to be done. And this experience was meaningful because we thought we would be informed by the data. But we didn't account for the people that were involved at the heart of this project, how they would be affected by this project, and how to incorporate those needs.

Obviously there's a lot of talk about the privacy and security, and we can have individual [discussions] devoted to a lot of those issues and standards. But when we're talking about the power of data and what it can do with a community, it's important to go back to basics: Who is the recipient, who is the end user and the input factor of data, and what does that all mean?

### **What is an ideal scenario for data ownership and management? What should cities, communities, or facility managers be looking and asking for?**

*Townsend:* This is the one promising thing that has come out of Sidewalk in Toronto. The way Sidewalk has structured the conversation about data governance has not been ideal. But where it has gotten to is not that Sidewalk will keep all the data and license it, or



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share it or give it away under a corporate licensing structure or a traditional open data public sector model. The documents that Sidewalk has put out are a great start to a more nuanced data governance structure. It starts to break down what are the different levels of concern we should have: Who are the different stakeholders that overlap with these different types of data and different realms in which they're collected? How do we need to handle them? What are the risks associated with them?

Data trusts may not be the right way to govern it; there are other models, such as data collaboratives. The California Data Collaborative is hundreds of water utilities sharing their customer data in a closed yet open forum that allows them to tell stories with data about all the things that they've done to conserve water during this historic drought.

Cities will have to take a look at their founding documents and come up with a process that allows them to create a new foundation for managing information. I'm sure Debra has tons of stories about [how] every agency, every city, every level of government does it differently and none of them work together, and, as a result, we have huge inefficiencies. We have mistakes made, but we have lots of opportunities for innovation that are left on the table.

*Doherty:* New city charters should be built around these discussion points because there's not one universal answer that is a silver bullet that everyone should adopt. We focus as a business on three big areas: safety, security, and a measurable increase of quality of life. Can we create an environment that allows that city to take on its own personality, take on its own soul, and take on its own mythology so we can create urban environments that are [neither] *Blade Runner* [nor] utopia, but somewhere in between that [can] grow organically and actually create a safer, more secure, and higher quality of life around the world?

**Many members have withdrawn from the advisory board of Neom, in Saudi Arabia, due to the murder of *Washington Post* columnist Jamal Khashoggi. Meanwhile, Google employees are protesting the company's creation of Project Dragonfly, a censored internet for China. What are the ethical and moral obligations you must weigh when you consider working on smart cities in these countries? [Note: Doherty and his company, TDG, are currently a consultant to the Saudi Royal Court.]**

*Doherty:* What we're trying to aspire to deliver is to increase the human condition. If that is the overall goal, we have to weigh events and great challenges on a per project basis—you can't holistically damn an entire country and/or people when there is a direct need. So how do you start to balance [between] not rewarding

bad behavior [and focusing] on things that have meaning? Case in point is Saudi Arabia: We are focused on the Arab youth, the future of how that country starts to move forward with or without the current leadership.

The U.S. departments of State and Commerce have been great from a guidance aspect. In the case of China, we rely on our relationship with U.S. Ambassador Terry Branstad and his staff in Beijing along with the consulates in Shanghai and Guangzhou. Where we are constantly benchmarking ourselves against is, “Is this going to cause any issue from your perspective as the American government?” And we have to take two steps back and say, “What’s the perception, and what does it mean when we’re talking about such an aspirational way of looking at cities—which affects [everything] from supply chain to the inhabitants to the visitors to [how] it resonates globally?” It’s a responsibility. I’d be a liar to say we don’t stay up at night worried about this stuff because we don’t want to do the wrong thing [and] we know we do a lot of things right. So [we check in with our advisers] to understand what’s the real story, what’s the other side of the story, and then make choices to move forward or not.

In the case of Neom, it’s such a large project that any one event should not derail the overall aspiration for that project. I understand the immediate need of taking two steps back. Some people resigned, other people said we’re not going to participate at this moment with what we can deliver here, and I think that is a personal and/or a business choice that is needed for right now.

But if you’re playing the long game, we need to start rethinking why you would be an advisory board member to begin with. Is it that you have a skill set that is [useful] right now, or is [the project] something that actually has the aspiration in place so that the vision and mission become something that is looked upon rather than the immediate reaction to a political situation?

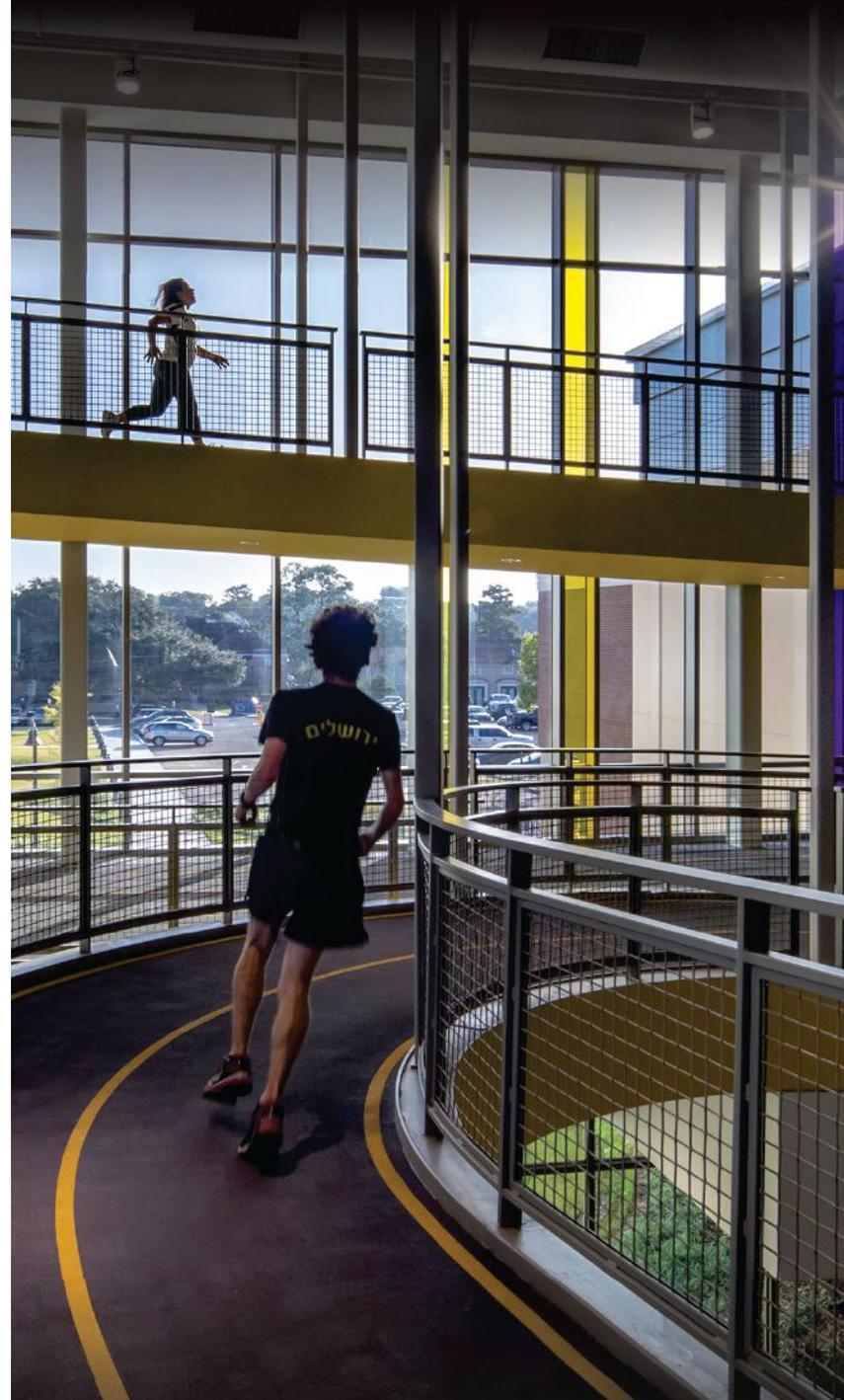
**What rules of thumb do you recommend in the approach to smart cities, and what often gets overlooked?**

*Lam:* I don’t think we figured it out yet, but I do think we are more cognizant of the problems that have arisen in the past and what damage could result. The biggest issue around smart cities right now [that also has] the biggest potential is around equity and [using the] agency [offered] with technology and data to address some of these critical equity issues with the community.

At Georgia Tech, we are looking at a smart community core where we’re trying to embed

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students and researchers into some of these communities to look at these issues and unlock some of those challenges.

Once you have that research in place, [you have] essentially what I'm calling the building blocks of a smart city development. And [then] you can layer on additional tools and partnerships that strengthen the foundation of a smart community development. Smart cities are about long-term engagement—infrastructure that's multi-generations. It's certainly important to have wins to keep motivated, but you are trying to embed community change, and that's not something that's going to be done within a budget cycle or an election cycle.

*Townsend:* What I think is often overlooked is planning. There's only a handful of cities around the world that actually systematically plan for their smart city strategy. And even [among] those, it's a small effort inside the mayor's office that often results in more of a political document than a serious operational document.

[Smart cities require] drawing upon all of the departments in government. It's often drawing

"There's only a handful of cities around the world that actually systematically plan for their smart city strategy. And even [among] those, it's a small effort inside the mayor's office that often results in more of a political document than a serious operational document."

—ANTHONY TOWNSEND, FOUNDER, BITS AND ATOMS

substantially on the private sector. Ideally, it should draw upon NGOs both for problem identification, but also for implementation of big parts of the strategy.

It requires a lot of resources, work, time, and engagement. And it's not something that can be thrown together quickly by staff behind closed doors. And I think most cities fail to take that seriously.

Best practices are emerging and we've documented some of them. There are consultants that do this now, so cities have resources to draw upon when they need help. This idea of digital master planning or smart city planning might be here to stay in the same way, like 10 years ago, no one knew how to do a sustainability plan. Now, it's a bread-and-butter thing that cities do.

*Doherty:* I thought the point was well made that [smart cities] were [once] about selling product—routers and data centers and things like that. This is fast evolving into a much deeper meaning in the contextualization of what humans need, which then increases sales. If you can imagine the size of the projects we're working on, we're talking anywhere from a five- to 15-year build-out at billions of dollars.

When I'm talking about getting a kitchen inside of a home, I'm not talking about the sale of one refrigerator—I'm talking about 500,000 refrigerators. You start seeing why CNBC, Bloomberg, and *Forbes* are focused on our industry for the first time in a positive light, saying, "Wow, this is an economic driver because the world's population is moving into these urban environments." What are those urban environments like? And how can we start to see into the future so we can backtrack in a critical path to find out where we need to start spending our resources so we can deliver these urban environments?

What we're challenged with is how we can put our own viewpoint on this as we start to see the people wanting to have more.

In other words, stop taking a look at the city council and city departments as a place where you have to go for a building permit and hearings. Yes, that still has to happen, but I think the conversation is changing because they're also looking for help. And who are they going to? People like Cisco, Schneider Electric, IBM, and Huawei, who really don't have the instinctual knowledge of what we possess as built environment professionals. And then they have to come back to us.

Let's cut out the middle man and start having those conversations for real because this is the challenge of our lifetime. We need to have the academics and the consultants of the world also participate because we can all learn from each other. There is no one person doing smart cities—and that's "the only way" to do it.

By creating those environments of learning, we are now bringing in these collisions of groups—like the Wanda Groups, the Disneys, the Warner Brothers, the Sonys—because they have a conversation at this table as well. So this combination of how to pull together experts and deliver a project is no different than [that for executing] a single building [for] a typical AEC project. All we're doing is scaling that.

And I don't think there's any one profession better able to have that type of holistic view—but then also take a micro view to actually deliver things—than architecture.

This conversation has been condensed and edited for clarity.

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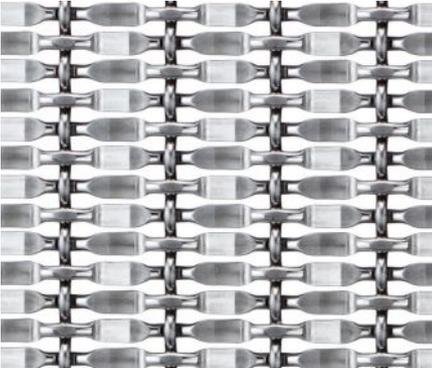
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Feelux Lighting	61	<a href="http://www.feeluxlighting.com">www.feeluxlighting.com</a>	678.668.7005
Georgia-Pacific	C4	<a href="http://www.DensDeck.com">www.DensDeck.com</a>	
Gordian	35	<a href="http://www.rsmeans.com/designcosts">www.rsmeans.com/designcosts</a>	
Hanover Architectural Products	96	<a href="http://www.hanoverpavers.com">www.hanoverpavers.com</a>	
Invisible Structures	20	<a href="http://www.invisiblestructures.com">www.invisiblestructures.com</a>	303-233-8383
Jesse H. Neal Awards	100	-	
Kalwall	20	<a href="http://www.KALWALL.com">www.KALWALL.com</a>	800.258.9777
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Metl-Span	5	<a href="http://www.MetlSpan.com/performance">www.MetlSpan.com/performance</a>	
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Ornamental Metal Institute of New York	8	<a href="http://www.OMINY.org">www.OMINY.org</a>	
Pabco Gypsum	33	<a href="http://www.QuietRock.com">www.QuietRock.com</a>	800.797.8159
Petersen Aluminum	13	<a href="http://www.PAC-CLAD.com">www.PAC-CLAD.com</a>	800.PAC.CLAD
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Seiho International	24	<a href="http://www.seiho.com">www.seiho.com</a>	626.395.7299
Simpson Strong-Tie	11	<a href="http://www.go.strongtie.com/mpbz">www.go.strongtie.com/mpbz</a>	800.999.5099
Sloan	31	<a href="http://www.sloan.com/cx-flushometer">www.sloan.com/cx-flushometer</a>	800.982.5839
Sloan	46-49	<a href="http://www.sloan.com">www.sloan.com</a>	
Steel Institute of New York	10	<a href="http://www.metalsinconstruction.org">www.metalsinconstruction.org</a>	
TCP Lighting	41	<a href="http://www.TCPi.com/Switch">www.TCPi.com/Switch</a>	
Vitro Architectural Glass (formerly PPG Glass)	2-3	<a href="http://www.vitroglazings.com/acuity">www.vitroglazings.com/acuity</a>	

# Editorial: A Bit Messy, and Better for It

TEXT BY NED CRAMER

Fun fact: Le Corbusier had a copy of *Don Quixote* bound with the pelt of his schnauzer, Pinceau. The dog died of natural causes first. But still, wrapping a book with your pet's fur is a disturbing act, to say the least—and that was likely the architect's intention, one of his periodic flirtations with Surrealism. Typically, however, Corb preferred to leave books the way he bought them, as honest artifacts of modern manufacturing. He himself was a major producer of books, using them to shape his public image and steer professional discourse; he generated more than 40 distinct monographs between 1912 and his death in 1965. (I recommend Catherine de Smet's excellent 2005 study *Le Corbusier, Architect of Books* for an overview.)

Like many architecture folk, my first deep exposure to Corb's buildings came via the magisterial *Oeuvre complete*, published largely during his lifetime, in eight neatly designed volumes with, thankfully, simple beige-colored cloth covers. While not produced by Corb, the series nonetheless reflects the architect's distinct sensibility, using photos and drawings provided by his office.

Many people have documented and interpreted Corb's work in the half-century since he drowned in the Mediterranean, but nothing has really supplanted the brand identity that the architect himself so carefully orchestrated. If for this reason alone—the overwhelming tenacity of Corb's self-representation—we have cause to celebrate the fresh, clear vision of *Le Corbusier: The Built Work* (The Monacelli Press), a new monograph of images by British photographer Richard Pare, with an introduction and project notes by French architect and historian Jean-Louis Cohen.

Pare's encyclopedic endeavor, to photograph every surviving structure that Corb designed and built, began as a commission for the 2013 Museum of Modern Art exhibit "Le Corbusier: An Atlas of Modern Landscapes," which Cohen curated. Under any circumstances, the pictures and resulting 480-page

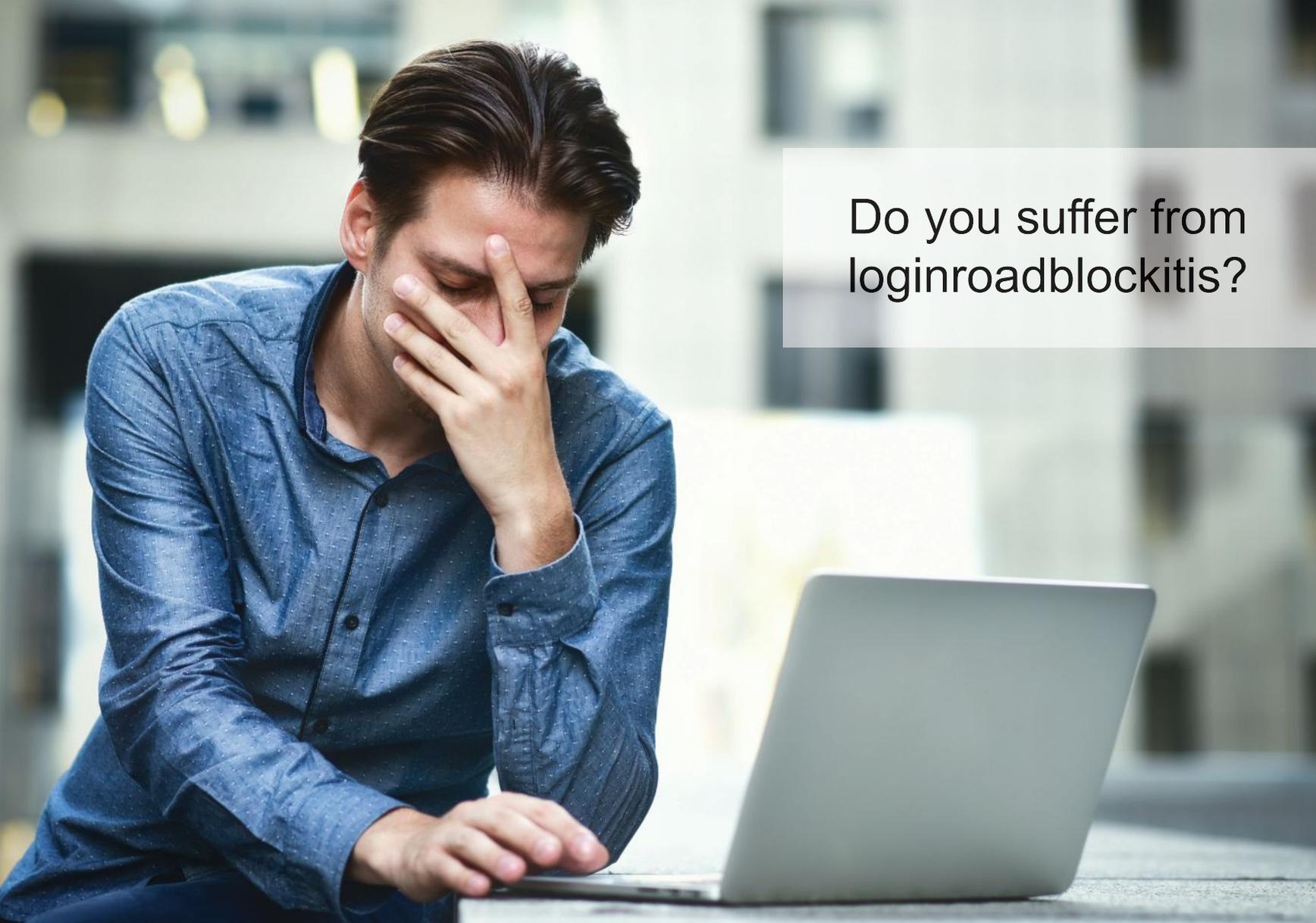


Le Corbusier's Château d'Eau water tower (at center) was erected in the French provincial town of Podensac in 1917 and abandoned in 1940.

book would be a major accomplishment, a scholarly and artistic enterprise with the scope and weight to alter long-received opinion; in our hyperactive digital age, its creation seems practically miraculous.

I thought I knew Corb's work fairly well, but the book held wonderful surprises, such as the elegant (though altered) Villa Le Lac on the edge of Lake Geneva, which the architect designed for his parents in 1923–24; an even earlier water tower and movie theater that rival Enlightenment Neoclassicists Boullée and Ledoux with their spare, Doric geometries; and the 1933 Centrosoyuz headquarters in Moscow, which was virtually inaccessible during the Cold War.

Discoveries aside, the power of Pare's photographs derives in large part from his decision to present Corb's work naturalistically: free of overt cropping, retouching, styling, and other forms of visual sanitization. A chain link fence bordering the Villa Savoye, cracks in the *béton brut* at Chandigarh, picnic tables in the courtyard of the Maisons Jaoul—Le Corbusier might have shuddered to admit such casual imperfections, but they are Pare's gift to his subject, counterintuitive proof of the buildings' enduring quality. Architects cannot count on perfectly controlled conditions. The oeuvre of a truly great master should flourish in common use.



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