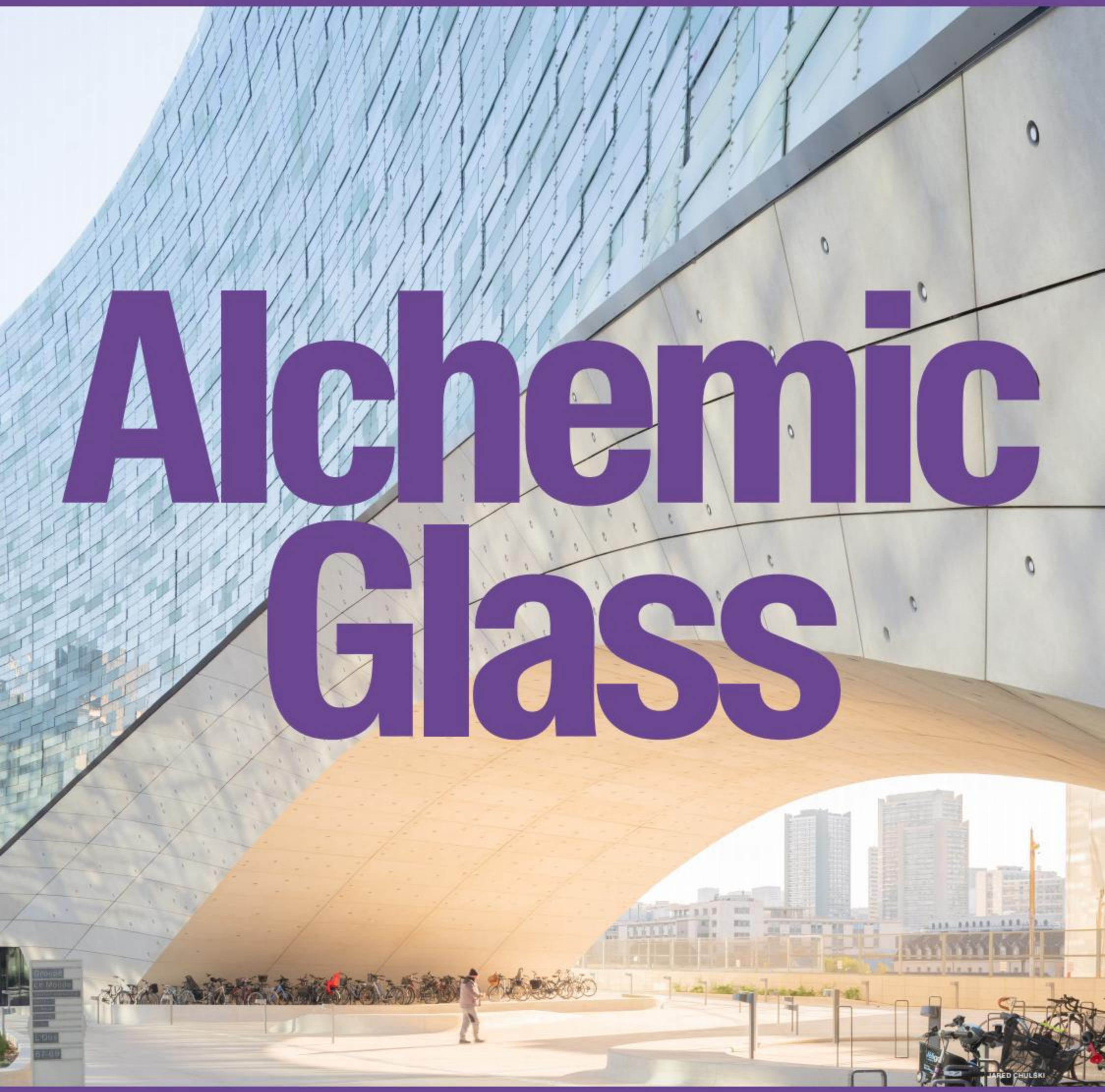
# Alchemic Glass

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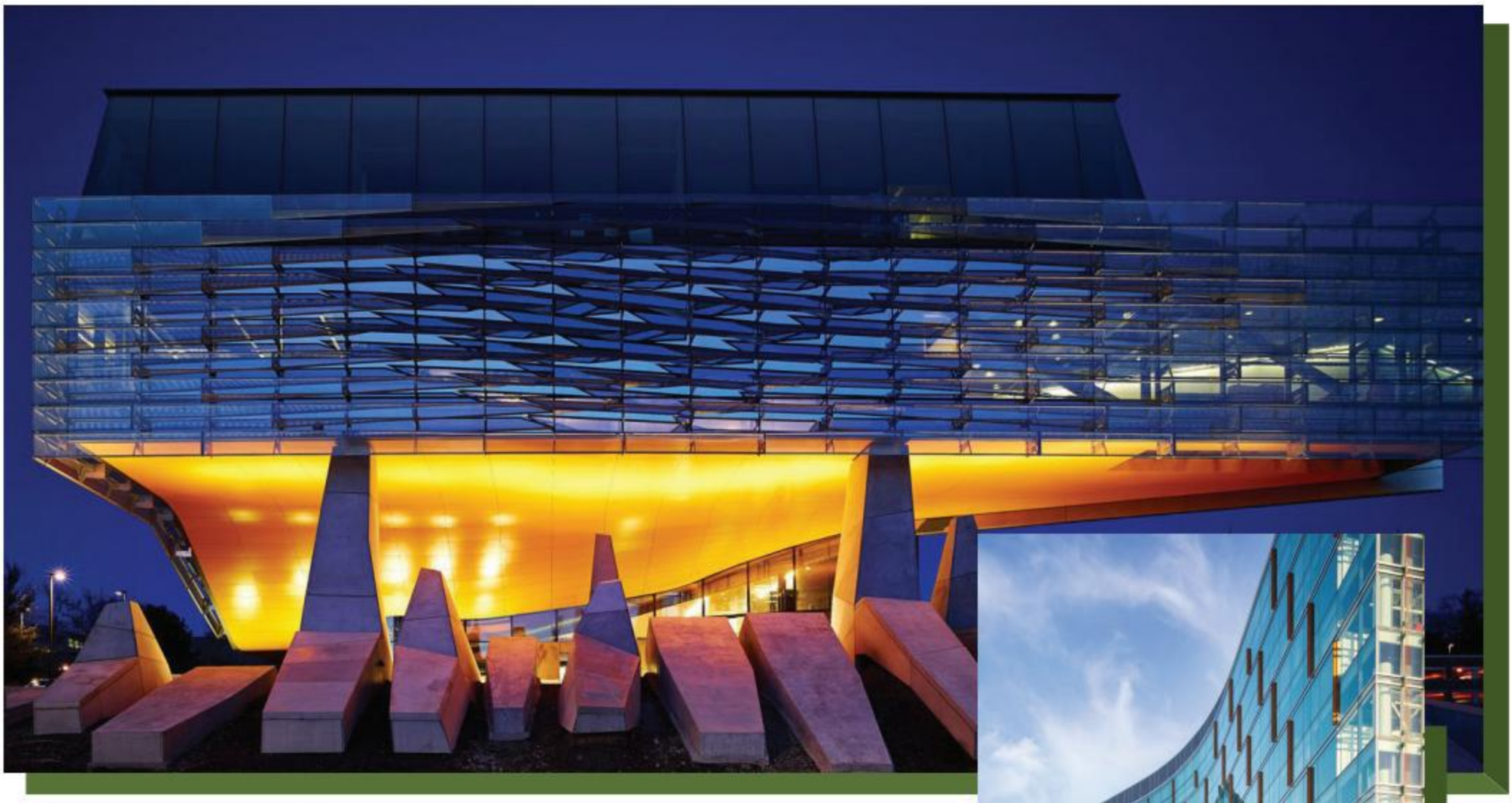

*Gates Hall at Cornell University - Ithaca, NY*

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# Curved reflections

## Advances in the manufacturing and treatment of float glass are enabling ever more flexible, ethereal facade expressions. Matthew Marani

Up until the mid-20th century, the incorporation of glazing into any project was an exorbitantly expensive decision and potentially fraught with error due to the irregularity of manufacturing processes. The development of float glass through the Pilkington process, which can be roughly described as rolling molten glass over a tin bath, has enabled continually growing limits in glass sheet dimensions. Advances in the manufacturing process have occurred in conjunction with developments in treatments—such as annealing, lamination, fritting, and employing interlayers—that promise greater geometrical flexibility and aesthetic customization. The growth in capabilities of both manufacturing and treatment is now coming to fruition globally and across building scales in the form of ever more ambitious curved glass facades.

### Tsai Center for Innovative Thinking at Yale
### Weiss/Manfredi


ALBERT VECERKA/ESTO

The Tsai CITY at Yale features 22-foot-tall mullionless structural glass panels.

Weiss/Manfredi's Tsai Center for Innovative Thinking at Yale (Tsai CITY) is one such project currently pushing the boundaries of large-scale curved structural glass. The cross-disciplinary hub is located on a formerly forlorn concrete courtyard sandwiched between Marcel Breuer's Brutalist Becton Engineering and Applied Science Center and the Neo-Tudor dean's office. To magnify the context and conform to a narrow site, the architects opted for an elliptical plan enclosed with 72 convex-and-concave structural glass panels.

The geometry of the curved panels was developed in collaboration with facade consultant Front, which helped create a Grasshopper script capable of toggling radii of the panels at different positions along the ellipse, and Weiss/Manfredi further utilized the script to generate digital models for curvature analysis. "The elliptical geometry posed a challenge; a circular geometry is easy to divide into equal panels because the radius is consistent but the curvature of an ellipse changes continuously, so it needed to be simplified into a series of four different arcs," said Weiss/Manfredi cofounders Marion Weiss and Michael Manfredi. "The four arcs allowed the ellipse to be divided into consistent panels that are approximately 5 feet wide, which minimized the variation in panel sizes."

Each of the panels is also approximately 22 feet tall and has an 8-foot radius; those at the ends of the ellipse were adjusted by several feet to maintain a constant sinusoidal wave. Chinese manufacturer NorthGlass, which has developed global expertise in this area, produced the glass for the project, and Weiss/Manfredi and Front visited its Tianjin facility to verify tolerances and edge flatness, among other characteristics, prior to shipment to the United States. Connecticut-based facade contractor Fabbrica fabricated the facade system and produced 4-foot-tall mock-ups for review by the design team. Notably, the curvature of the individual panels provides sufficient lateral stability to avoid the use of mullions or girts. Each panel weighs several hundred pounds, and they were craned over the tops of surrounding buildings to be dead loaded onto curtain wall anchors and a curved metal channel; a similar channel ring is deployed at the roofline.

### Denver Art Museum Welcome Center
### Machado Silvetti & Fentress Architects


ERIC STEPHENSON/COURTESY THE DENVER ART MUSEUM


JAMES FLORIO PHOTOGRAPHY/COURTESY THE DENVER ART MUSEUM

At the Denver Art Museum Welcome Center (top, above), Machado Silvetti and Fentress Architects deployed scalloped structural glass panels vertically supported by triple-laminated low-iron glass.

In 2016, Machado Silvetti and Fentress Architects were selected to lead the renovation of Gio Ponti's iconic North Building at the Denver Art Museum, as well as the construction of an entirely new welcome center to bridge museum's campus (it also includes a Daniel Libeskind addition next door) and the surrounding Civic Center area. That brief informed the design concept for the welcome center: an elliptical pavilion enclosed with a scalloped structural glass curtain wall. Multiple rounds of conversation with fabricators and installers ultimately proved the feasibility of the design concept, and Sentech Architectural Systems along with Harmon were brought onto the project to put all the pieces together.

Prior to construction, Sentech Architectural Systems produced full-scale mock-ups of the panels to test the plan prior to installation. Additionally, the mock-ups were subjected to strenuous weather testing, as well as exposed to vertical and lateral structural loads. Both informed revisions of the finalized design.

The panels measure 8 feet wide and 25 feet tall and have a curve radius of 10 feet. Most of the panels weigh approximately 3,200 pounds, and they were craned into position by a custom-designed suction cup lifter and mounted on the facade system of stainless-steel angles. In lieu of view-hampering mullions, the curved panels are vertically supported by triple-laminated low-iron glass fins and are tied back to the primary steel through custom stainless-steel fittings. The bottom pins of the fins support the entire dead load of the glass, while the connection at the roof provides lateral support and permits the roof to deflect up to one and a half inches under snow loads and to drift from side to side by up to two inches to accommodate wind loads.


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# Curved reflections continued

## Pendry Manhattan West
## SOM


LUCAS BLAIR SIMPSON/COURTESY SOM

The Pendry's unitized curtain wall system incorporates curved glass and black granite spandrels.

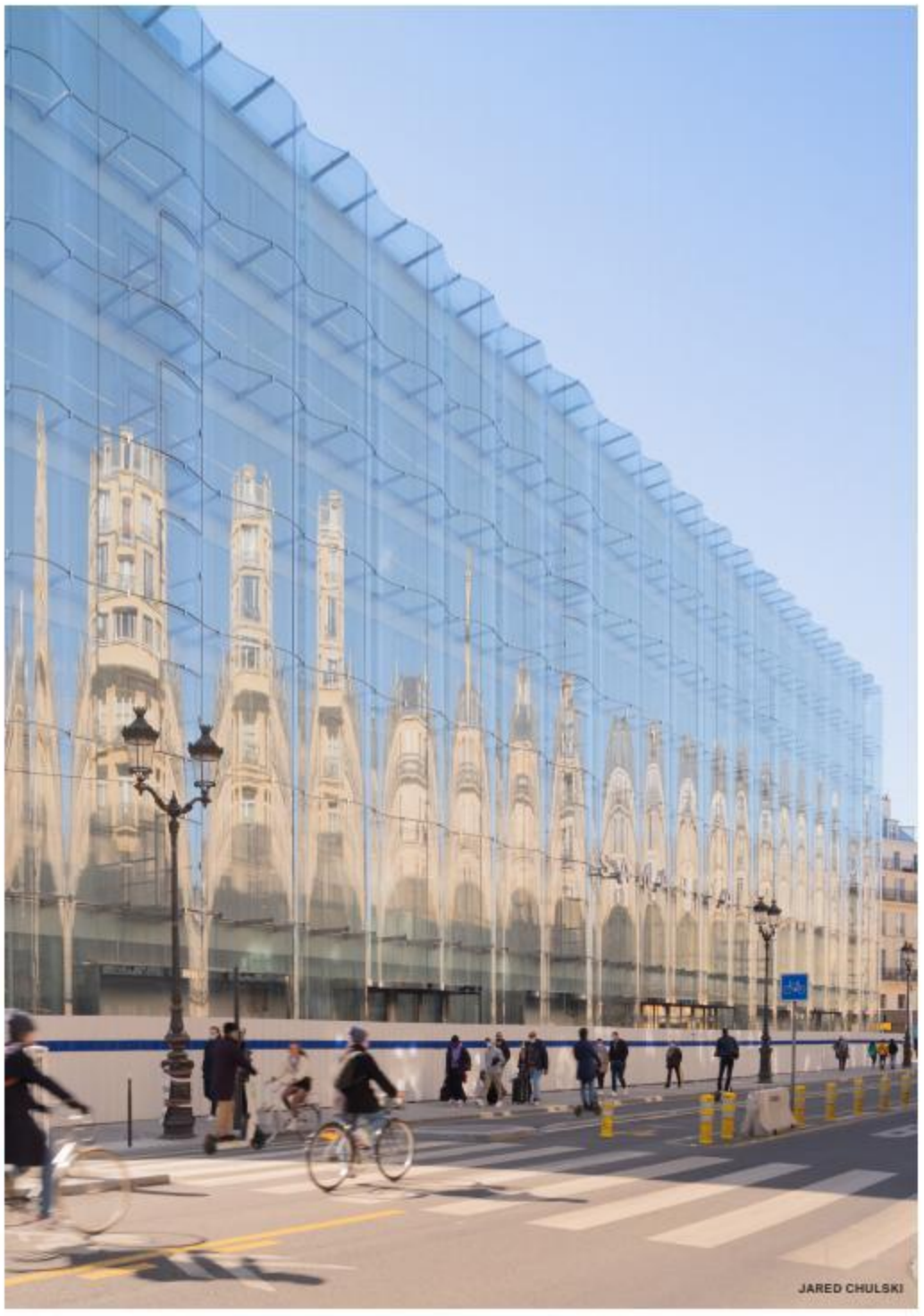
In New York, a similar trend is underway, albeit jostling upwards to greater heights. SOM's Pendry Manhattan West is one of the towers rising in Brookfield's Manhattan West development, and in contrast to its surrounding rectilinear peers, it is clad with a unitized curtain wall system of curved glass framed by ribbons of black granite spandrels.

A principal goal of the project's facade design was the elimination of unnecessary variables to establish both a streamlined design and a relatively straightforward installation process. In collaboration with Front, the design team opted for just three radius types around which the glass is bent. The tight radius for the curved glass, which is just under 5 feet, presented a challenge from a visual perspective due to distortion; highly transparent glass with shadow boxes at the spandrels, or a reflective glass coating, would have disrupted the intended uniformity of the facade. Ultimately, SOM selected a 5/16-inch tinted outer glass substrate that lessens the visual jump between concave and convex surfaces.

A greater performative challenge was found in the fabrication of the facade system's aluminum extrusions, where minor tolerance issues could cause significant weatherproofing problems. "To avoid those issues, a specialized curving process was utilized," explained SOM associate director Christoph Timm. "First, the straight aluminum extrusions were encapsulated in oversized aluminum sacrificial tubes, and the remaining voids were filled with a low-temperature-melting metal alloy. After the standard three-roller bending process, the assemblies were submerged in near-boiling water and the low-temperature infill metal was melted away. The outer sacrificial tubes were then discarded, and the curved aluminum extrusions were finally sanded down and coated."

The black granite stone was quarried in Quebec by A. Lacroix Granit, and it was structurally tested to determine how thin each panel could be cut prior to being directly framed into each curtain wall unit.

## La Samaritaine, Paris
## SANAA



JARED CHULSKI

In Paris, SANAA developed a wavy glass screen wall that is suspended off the primary structure.

The use of curved glass is not particular to the United States; if anything, experimentation abroad plays a crucial role in the growing adoption of the material here. Over the past decade, Japanese firm SANAA has led the way in this regard with high-profile projects such as the Rolex Learning Centre, Louvre-Lens, and Grace Farms. More recently, the firm wrapped up a comprehensive overhaul of La Samaritaine department store in Paris for luxury goods company LVMH, and the project includes an entirely new structure enshrouded in a curtain of undulating and fritted glazing.

The project is located on Paris's Rue de Rivoli, a storied commercial stretch largely composed of arcaded masonry buildings and symmetrical glazing bays. "The curves themselves were defined by analyzing the fenestration along the Rue de Rivoli: we assessed the patterns of neighboring fenestration and translated those rhythms into curves," noted SANAA partner Lucy Styles. "We then developed 23 different curved panels along the length of the wave facade, and our intention was to create the impression of a continuous free-curve, all the while optimizing the number of variations in geometry."

Spanish manufacturer Cricursa produced the undulating glass panels, which are of two sizes: approximately 11 feet or 14 feet tall, both nearly 8 feet wide. The curved panels form the outermost layer of the enclosure system, designed by German fabricator Frener & Reifer, and they are held at four points by stainless-steel brackets. Backing the curved glass is a secondary skin of flat glass heavily fritted with a white dot matrix screen print that can pivot to provide cleaning access. The innermost layer is composed of triple-glazed panels that bring the building up to the area's stringent fire rating standards.

"The facade design was driven by a synthesis of various parameters: we addressed environmental demands through the layered use of serigraphy; visual demands by means of introducing a gradient to this serigraphy; fire regulations by separating the facade into a series of layers, the innermost layer being firebreak and alleviating the demands on the wave facade itself," Styles said. "The greatest challenge was finding a balance between these many forces while maintaining the impression of an ethereal veil."

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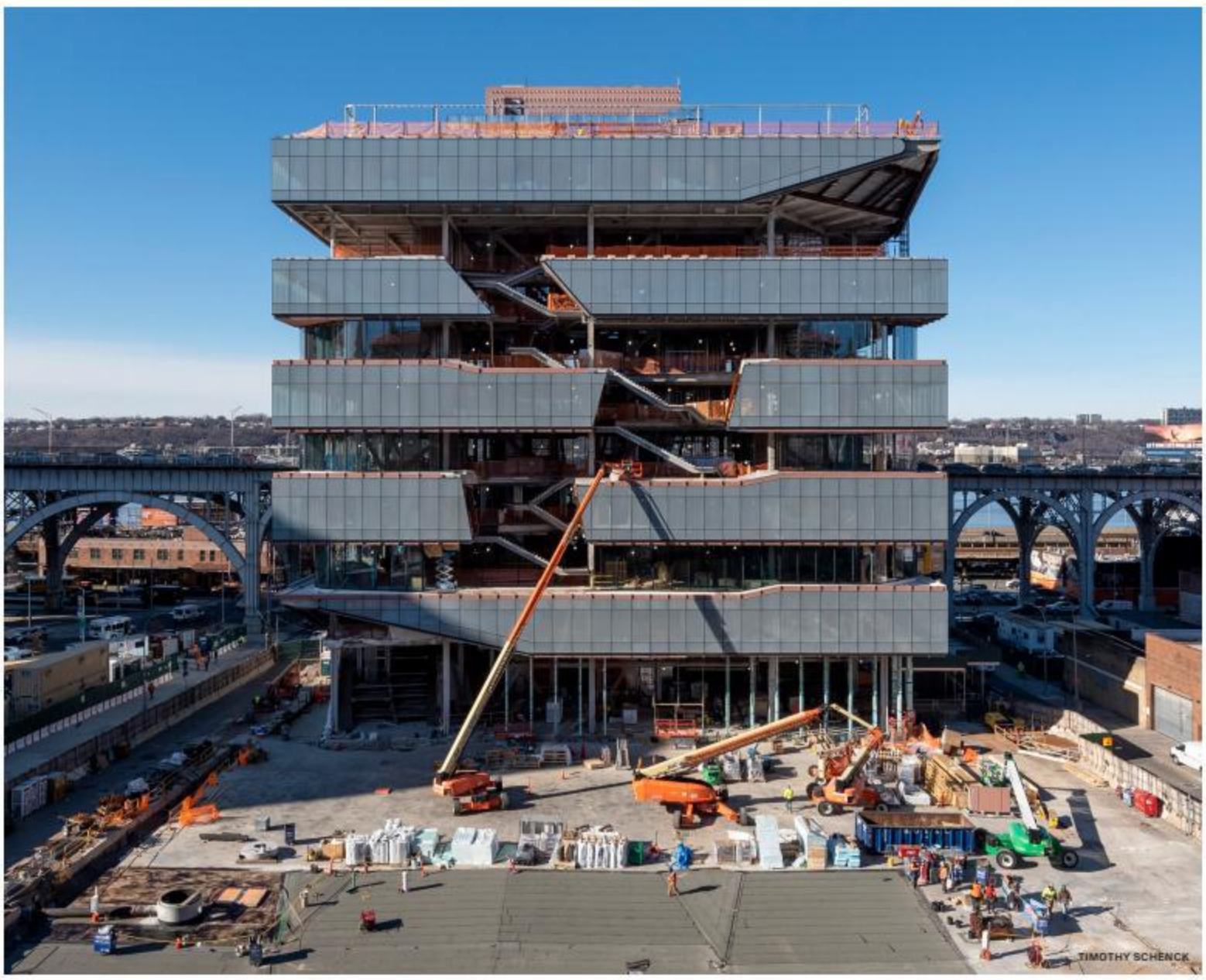
**Product:** Unitized Glass Railing System
**Developer:** J.H. Snyder Co. / Dreamscape
**Architect:** MVE + Partners
**Glazier:** Rountree Glass Co.
**Photo:** Chipper Hatter

# Columbia Business School




**Architects: Diller Scofidio + Renfro in collaboration with FXCollaborative**
**Construction Manager: Turner Construction**
**Exterior Enclosure Contractor: W&W Glass**
**Curtain Wall: AZA-INT Corporation**
**Glass: Sedak Glass, AGC Interpane Glass Germany, Cricursa Spain, Pilkington Glass**
**GFRG: IDA Exterior Systems and DKI/David Kucera Inc.–GFRG**
**Doors: Ellison doors and Crane revolving doors**
**Facade Consultant: Arup**

Columbia University's Manhattanville Campus expansion has ushered in a crystalline district of glass-clad buildings amid the masonry vernacular architecture of Harlem. The latest additions to the 17-acre, $6.3 billion campus, which was master planned by SOM, are two buildings designed by Diller Scofidio + Renfro (DS+R) in collaboration with FXCollaborative that provide a new home for the Columbia Business School. Set to open in early 2022, Henry R. Kravis Hall and the East Building rise 11 and 8 stories respectively and provide 492,000 square feet of classrooms, public space, and faculty offices.

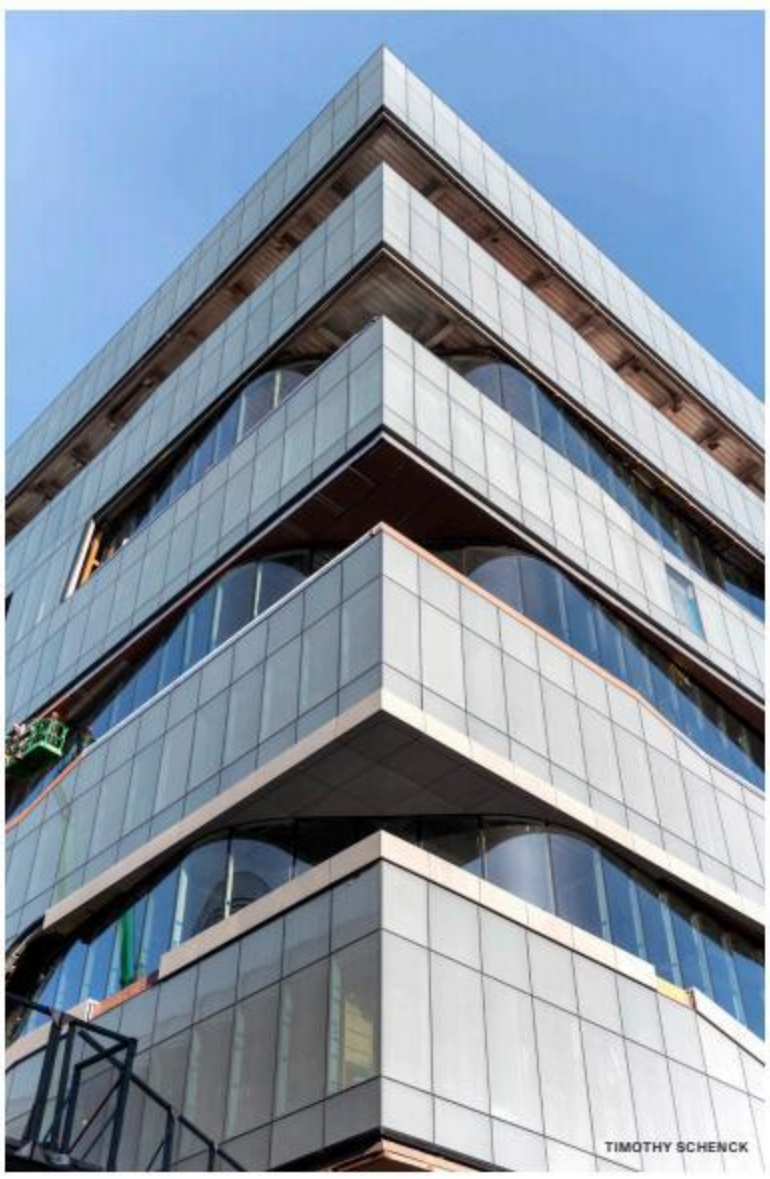
The buildings, which are connected by a public plaza designed by James Corner Field Operations, are more fraternal twins than mirror images. The Kravis facade translates the alternating stack of program by denoting faculty offices with frosted frit glass and student space with clear glass walls that are inset from the edge of the floor plate. The glass envelope of the East Building, on the other hand, is treated with a gradient from opaque to transparent—each panel having a bespoke and carefully calculated frit pattern. In both buildings, GFRG slabs slice through the mineral textures of the frit, breaking up the massing.

By making the circulation visible from the outside, the architects play on notions of openness in answer to many local residents' expressed views that the new campus is an unwelcome encroachment on their neighborhood. "We were tasked very clearly from the start to make sure that everyone felt like they owned both buildings, that it wasn't the ivory tower model," said Miles Nelligan, associate principal, DS+R. This idea carries through to the relatively column-free interiors of the student spaces in Kravis Hall, which are supported by box trusses that comprise the faculty offices and by 28-foot-tall glass panels that span three levels at a stretch, allowing deep views into the heart of the structure.

This model of weaving transparent and translucent elements evolved directly from the Roy and Diana Vagelos Education Center, which DS+R completed for Columbia's medical campus in 2016. The business school, however, showcases an advance in glass technology. The 28-foot panels were achieved through close collaboration with Arup. Chimeric mock-ups were made, re-creating many of the conditions of the design—edge masking, frit, gaskets, and broken trusses—to not only perfect the movement of the glass but also coordinate with Turner Construction and the many international manufacturers involved.

The success of these buildings will ultimately be seen in the collaborative pedagogy and high-tech innovation that is expected to arise from the school. In the meantime, they will likely inform further experiments in translucency/transparency as phase 2 of the Manhattanville expansion commences.

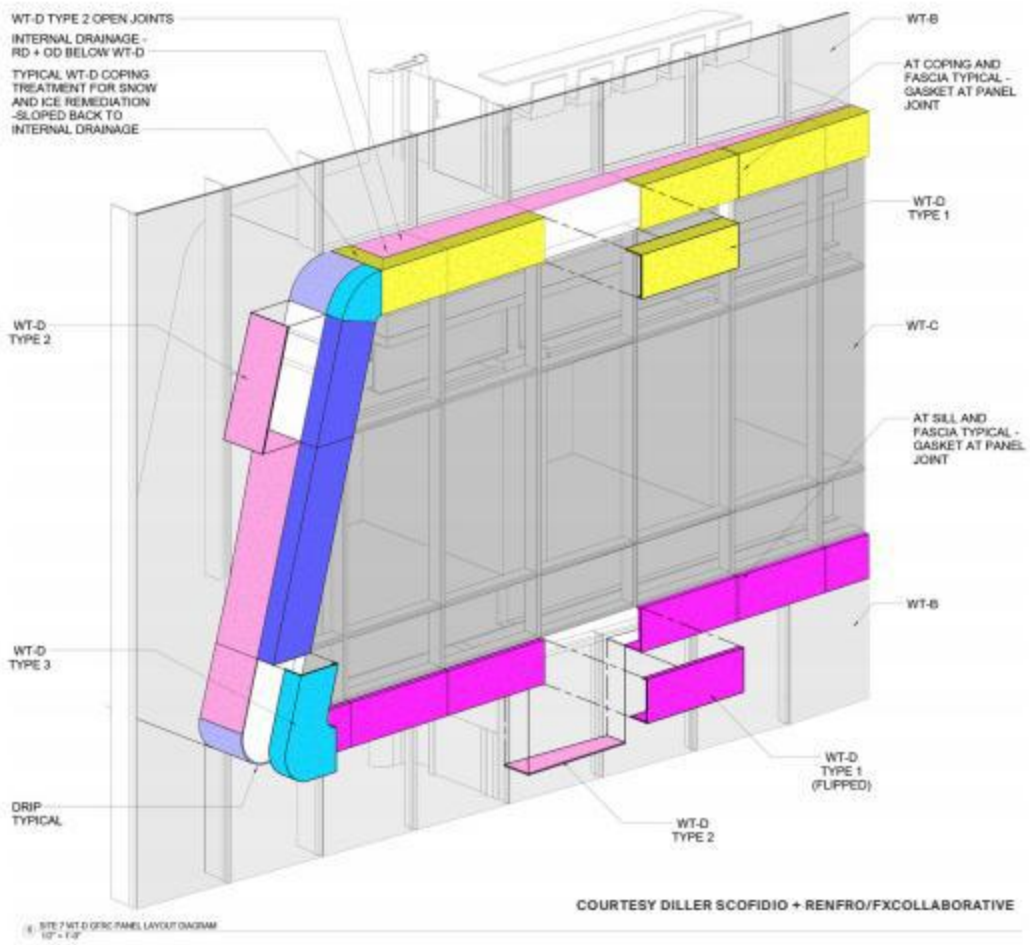
**Katie Angen**


**Top:** Columbia Business School's new Manhattanville digs span approximately 490,000 square feet across two buildings, Henry R. Kravis Hall (pictured) and the East Building.

**Left:** Construction is underway at Kravis Hall. The design of the facade highlights the interwoven program and exploded structural core.

**Right:** Alternating bands of transparent glass and fritted glass correspond to the building's various academic and social zones.




COURTESY DILLER SCOFIDIO + RENFRO/FXCOLLABORATIVE

**Above:** The Kravis Hall facade comprises uniquely sized glass fiber reinforced gypsum, or GFRG, panels, whose tops slope back for internal drainage.

COURTESY COLUMBIA UNIVERSITY

**Right:** Located directly opposite Kravis Hall, the East Building presents a more transparent front to Manhattanville.

# Insulated Glass

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By Adrian Madlener

## Heat Mirror IG
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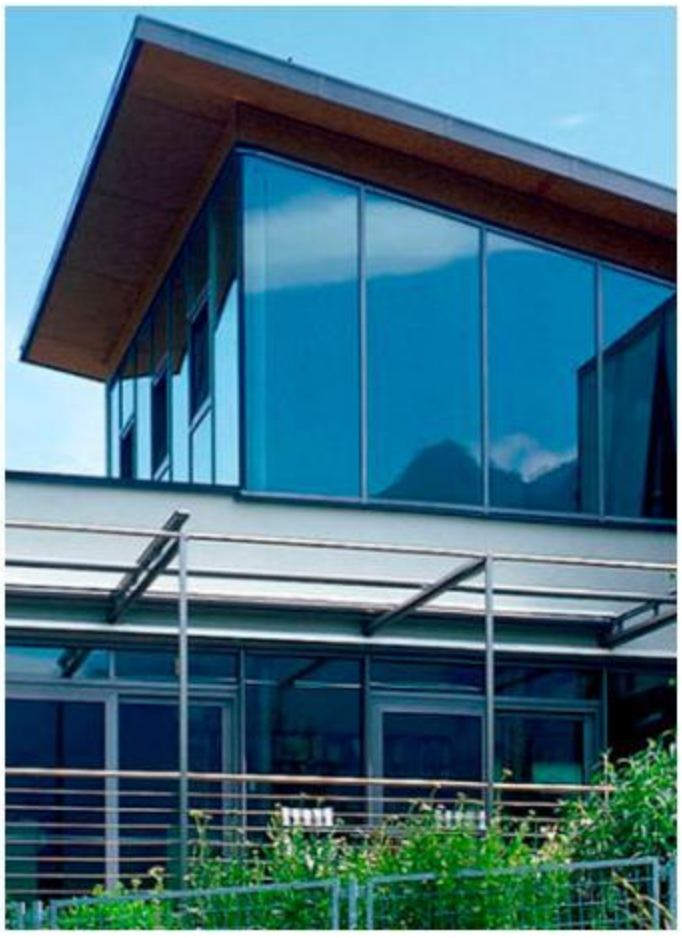
eastman.com



## Iplus 3C
AGC Interpane

Comprising three panes of thermal insulation glass, the Iplus 3C easily outperforms older, uncoated alternatives and Ug-values down to 0.5 W/(m²K), which helps minimize heat loss. This low-E glass product hits the mark in terms of both performance and aesthetics.

interpane.com

## Insulated Glass
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In line with the latest trends, GGI's Insulated Glass comes in double- and triple-glazing variants. A dual-sealed version—ideal for commercial use—features Super Spacer T-Spacer warm edge technology as well as air- and argon gas–filled options to ensure greater indoor comfort.

generalglass.com

## XL Edge Glass
Cardinal

These durable Cardinal IGUs meet the most exacting industry demands by incorporating two seals and a thin stainless steel desiccant gauge spacer. Filled with argon gas, the IGU leaves absolutely no way for heat to escape. Additionally, it greatly reduces unsightly condensation beading.

cardinalcorp.com

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## Insulpour Thermal Entrances
Kawneer

Fitted out in 250T narrow, 350T medium, and 500T wide stile variants, Kawneer's Insulpour Thermal Entrances achieve an optimal thermal break. The robust door-and-frame system features a new three-pane composition and can accommodate a wide variety of hardware.

kawneer.com

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# The Menokin Exhibition and Conservation Center

**Architect: Machado Silvetti**
**Facade Consultant: Eckersley O'Callaghan**
**Preservation Consultant: John Fidler Preservation Technology**
**General Contractor: Consigli Construction**
**Archaeology: DATA Investigations**
**Client: The Menokin House Foundation**

Historic preservation in the United States has often been cast in absolute terms: Structures and monuments are either subject to campaigns of complete restoration (which may entail partial reconstruction) or maintained as sublime ruins stabilized to withstand the ravages of time. A novel conservation scheme for an 18th-century plantation house on Virginia's Northern Neck peninsula threads the needle between these approaches.

The Boston firm Machado Silvetti is overseeing the project, which will partially enclose the dilapidated Menokin House in structural glass. "The 500-acre plantation is surrounded by notable other estates in North Neck that have been fully restored," said Machado Silvetti principal Stephanie Randazzo Dwyer. While those projects followed traditional restoration methods, Dwyer noted that her client, the Menokin Foundation, "went for this innovative approach that uses contemporary materials like glass and steel to represent parts of the ruin that could not be recovered."

Menokin was the ancestral home of Francis Lightfoot Lee, a signatory of the Declaration of Independence. Lee died heirless in 1797 and the property—a handsome piece of Georgian architecture—passed through the hands of multiple generations of tenant farmers, who left the original details largely intact, though poorly maintained. Still, the house stood tall until the 1960s, when it was severely damaged by a falling tree. The Menokin Foundation, established for the express purpose of restoring the erstwhile home, acquired the site in 1995 and began the arduous process of ruin stabilization. Intending to reopen the grounds as an exhibition center, the group had the idea of rebuilding with glass and brought Machado Silvetti onboard in 2010.

The $7 million project has unfolded slowly, with the stabilization—carried out in collaboration with John Fidler Preservation Technology—ongoing. The work consists of strengthening existing elements, which were analyzed through point cloud scanning, by repairing masonry and shoring up the structure with steel columns. Further segments of the facade are composed of reconstructed stone and rubble found on the site. The remaining void is decked over with a system of structural steel armatures, aluminum extrusions, and cables that mimic the original post-and-beam construction, to which the structural glass will later be fastened.

Although a decision on the contractor and glass manufacturer has yet to be finalized, the present plan developed by facade consultant Eckersley O'Callaghan calls for the use of SGP-laminated single-glazed panels measuring approximately 4 feet-1inch by 19 feet-6 inches and weighing 1,050 pounds each. (The width of the units aligns with those of the panels in the glass roof.) The glass walls will


MACHADO SILVETTI


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be backed by a fabric scrim layer chosen to approximate the original plaster surfaces and the thickness of the masonry construction.

"This transparent layer is a flame retardant woven fabric that is installed in tension within a custom stainless-steel track at the top and bottom of each floor level," said Dwyer. "The scrim's transparent finish not only offers effective glare and sun protection with optimized exterior views but, where it meets up with the original stone walls, its transparency allows one to see the many layers of the rubble wall construction."

Above the cornice line, the design team intends to rebuild a section of the former hipped roof with wood framing, truss, and shingles and will fill out the remainder with low-E coated double-glazed units that will likely include an embedded honeycomb interlayer as a further shading measure.

"In general, the main challenge in the design of the glass systems on this project was to ensure that they were visually as minimal as possible so that they do not compete visually with the restored ruin," said Eckersley O'Callaghan associate Karine Charlebois. "For this reason, at the lower level, no structural members are provided along the vertical edges of the glass. At the upper level, some laminated glass fins help control the deflection under wind loads and keep the glass panels as thin as possible."

If all goes well, the Menokin Exhibition and Conservation Center will open in 2023.
**Matthew Marani**



**Facing page, top:** The Boston-based architecture firm Machado Silvetti has been working since 2010 to restore an 18th-century Georgian-style plantation home on Virginia's Northern Neck peninsula.

**Facing page, bottom left:** The Menokin House was badly damaged by a falling tree in the 1960s. Using structural glass and steel, the architects plan to make the house whole.

**Facing page, bottom right:** Apart from stabilizing the existing masonry (currently underway), the restoration strategy hinges on a new steel armature capable of supporting a glass roof, enclosure, and even floors.

**Top:** The Menokin House was still in good condition a century ago.

**Above:** Although the damage to the house was extensive, the situation was not as grave as it would seem. Restorers were able to recover 80 percent of the original building materials.

# Decorative Glass

**Function isn't all there is to glass. Used to make a statement, express a mood, or match an aesthetic, these customized or serial-produced glass components add depth, detail, and texture to otherwise bland expanses or backdrops.** By Adrian Madlener

## Josiah J
Nathan Allan Glass Studios

Crafted by Nathan Allan artists and suitable for multiple applications, the Josiah J collection offers deeply textured cast architectural glass patterns with evocative names (Molten, Thick, Iceberg) to match. In addition to texture, the series offers boldly rendered colors, including the iridescent hues of the Fusion series.

nathanallan.com

## Textured Glass
Bendheim

Bendheim's Textured Glass collection of partition and wall surfaces allows designers to mix and match textures or customize material attributes (like adding a mirror interlayer or back-painting). In addition, the product can be mounted using the manufacturer's proprietary TurnKey, Wall-LH, and Wall-F systems.

bendheim.com

## Creanza
Cristacurva

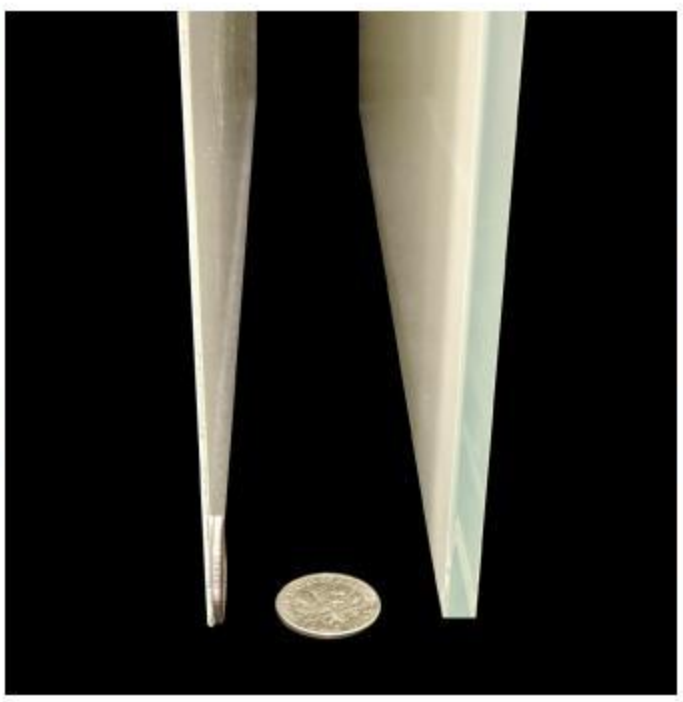
Pitched at the high-end interior market, Cristacurva's Creanza family of decorative glass products offers endless opportunity for customization. Users can realize their designs in glass by means of printing, silk-screening, interlaying, etching, and more.

cirstacurva.com

## Textures
Walker Glass

The Textures collection relies on acid-etched glass to withstand years of use and exposure. The durable material comes in four different opacities, including translucent satin, and as many tints, including an elegant bronze.

walkerglass.com



## DermaGlass
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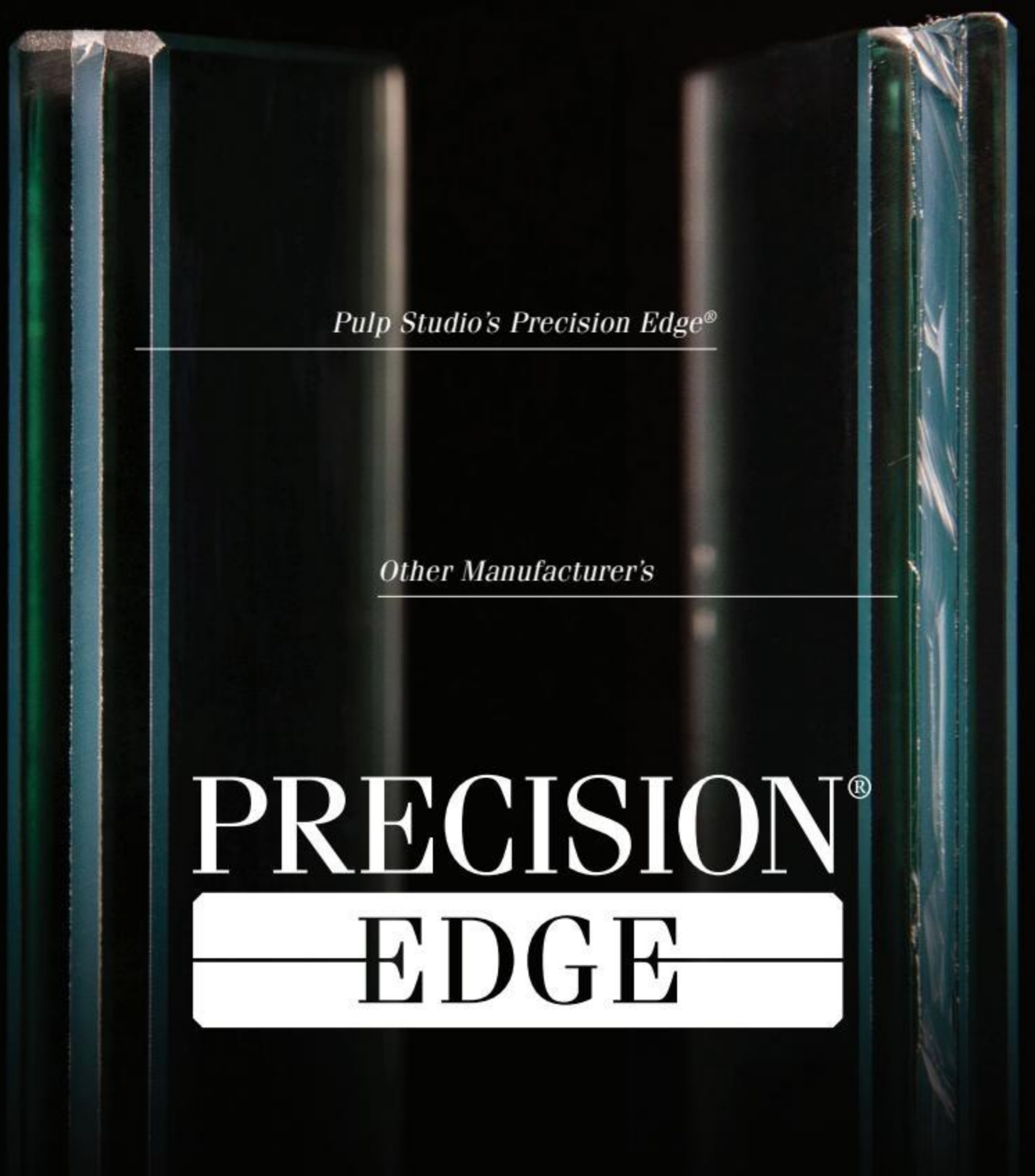
With a thickness comparable to that of a dime, products in the new DermaGlass range from Pulp Studio are more durable than they look. The malleable heat-treated glass can be used to cover and even wrap various architectural elements and is available in a wide variety of finishes and colorways.

pulpstudio.com


## Tapestry
Lasvit

The new Tapestry art wall connection draws on the rich tradition and craftsmanship of Czech glassblowing. The modular striped, draped, and grid components can be fastened together with flexible metal anchoring solutions.

lasvit.com



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# Case Studies in Brief

## Hurricane Maria Memorial

New York, New York

**Architect: Segundo Cardona**
**Artist: Antonio Martorell**
**Designer: Pulp Studio**
**Product: Pulp Studio Custom Printed Glass**

My Cry into the World, a new art installation at the Hurricane Maria Memorial in Battery Park City, honors the victims of the Category 5 hurricane that struck Puerto Rico in 2017.

Designed by Pulp Studio, the memorial features monumental glass walls ascending to 16 feet, their curvilinear shape echoing the whipping winds of a tropical storm. The glass was manufactured through Pulp Studio's D2G process for ceramic application, where high-resolution images are fired onto each pane of glass using brightly colored ceramic inks. The glass is then bent, laminated, and tempered before being installed on-site.

When exposed to sunlight, the glass casts vivid blue, orange, and red beams onto the site. Colors seem to flow from the sculpture like streams of fire, rain, and tears. Text by Puerto Rican poet Julia de Burgos is superimposed on the imagery, adding to the overall effect: The organic shape of the calligraphy nods to the island's rolling hills and natural landscape.


KEVIN P. COUGHLIN/COURTESY STATE OF NEW YORK

## Museum of the American Arts and Crafts Movement

St. Petersburg, Florida

**Architect: Alfonso Architects**
**Contractor: Gilbane Building Company**
**Fabricators: Cristacurva**
**Glaziers: AMG and MG McGrath**
**Manufacturer: Guardian Glass**
**Products: Guardian SunGuard SNX 51/23 Coated UltraClear Glass**

The new Museum of the American Arts and Crafts Movement mingles textures and hues in a way that draws on the stylings of the eclectic collection it holds. The five-story building, by Alfonso Architects, employs a mixed material palette, including bronze accents and coated glass, to celebrate the historic era in a contemporary way.

Alfonso Architects specified SunGuard SNX 51/23 coated glass, which offers benefits of solar control. Its high light transmission enhances interior daylighting and reduces air conditioning demands, while also imparting a subtle blue hue to the facade. MG McGrath's glass and glazing team helped install the glass systems for the museum, including the curtain wall and skylights on the exterior and storefront systems on the interior.


BRENNAN PHOTO + VIDEO

## McMaster University, Peter George Centre for Living and Learning

Hamilton, Ontario, Canada

**Architect: Diamond Schmitt**
**Engineer: Buro Happold**
**Fabricator: Oldcastle BuildingEnvelope**
**Glass (Acid-Etched): Walker Glass**
**Glass (Solar Control): Vitro Architectural Glass**
**Products: Vitro Solarban 67 Glass, Vitro Solarban 70 Glass**

Uniting classrooms, food, and housing under one roof, the 335,000-square-foot Peter George Centre for Living and Learning at McMaster University in Hamilton, Ontario, functions as a microcosm of campus life.

Designed by Diamond Schmitt, the multifaceted student hub includes a 650-seat auditorium, a skylit atrium, and a U-shaped block of daylit residential and study spaces. The architects used high-performance glass from Vitro Architectural Glass throughout the building, including Solarban 70 for the atrium skylight, which offers protection against glare, and Solarban 67 on the facade, which helps to reduce cooling and heating loads. Acid-etched glass from Walker Glass was added to the curtain wall as decoration, bringing motion and variety to the large panes by imposing a subtle pattern on them.


DIAMOND SCHMITT

## Santa Monica City Hall East

Santa Monica, California

**Architect: Frederick Fisher and Partners**
**Civil Engineer: KPFF**
**Structural Engineer: JAMA**
**Contractor: Hathaway Dinwiddie**
**Curtain Wall: Walters and Wolf**
**Facade Engineer: Buro Happold**
**Manufacturer: Viracon**
**Product: Viracon VNE-53 Triple-Coated Performance Glass**

Designed by Frederick Fisher and Partners, the new Santa Monica City Hall East merges multiple civic departments, which for years had been scattered across Los Angeles, into a central location that borders the historic 1939 City Hall. The resulting addition is beautiful, efficient, and functional, as well as discreet enough to not clash with the existing architecture.

Motivated to meet the Living Building Challenge, the highest green-building standard in the country, the design team elected to use high-performance triple-coated glass from Viracon on the facades. The silver-blue glazing has an impressive balance of visible light transmission and solar heat gain coefficient, without sacrificing aesthetics. The glass reflects its richly landscaped surroundings, and a ceramic frit behind the glass lightens the building so that it matches the stucco of City Hall. Operable windows that allow cross ventilation add a dynamic quality to the building design.


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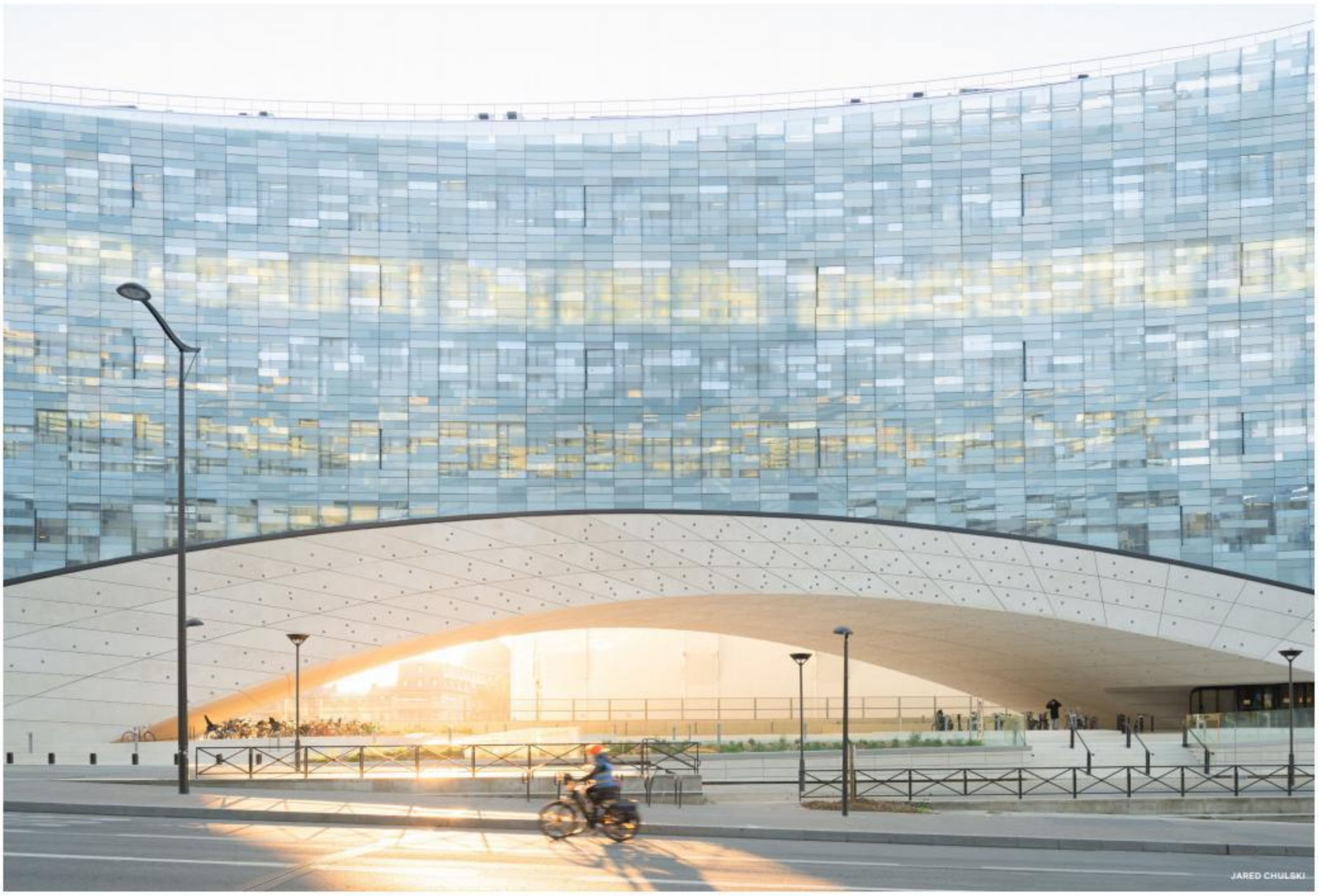
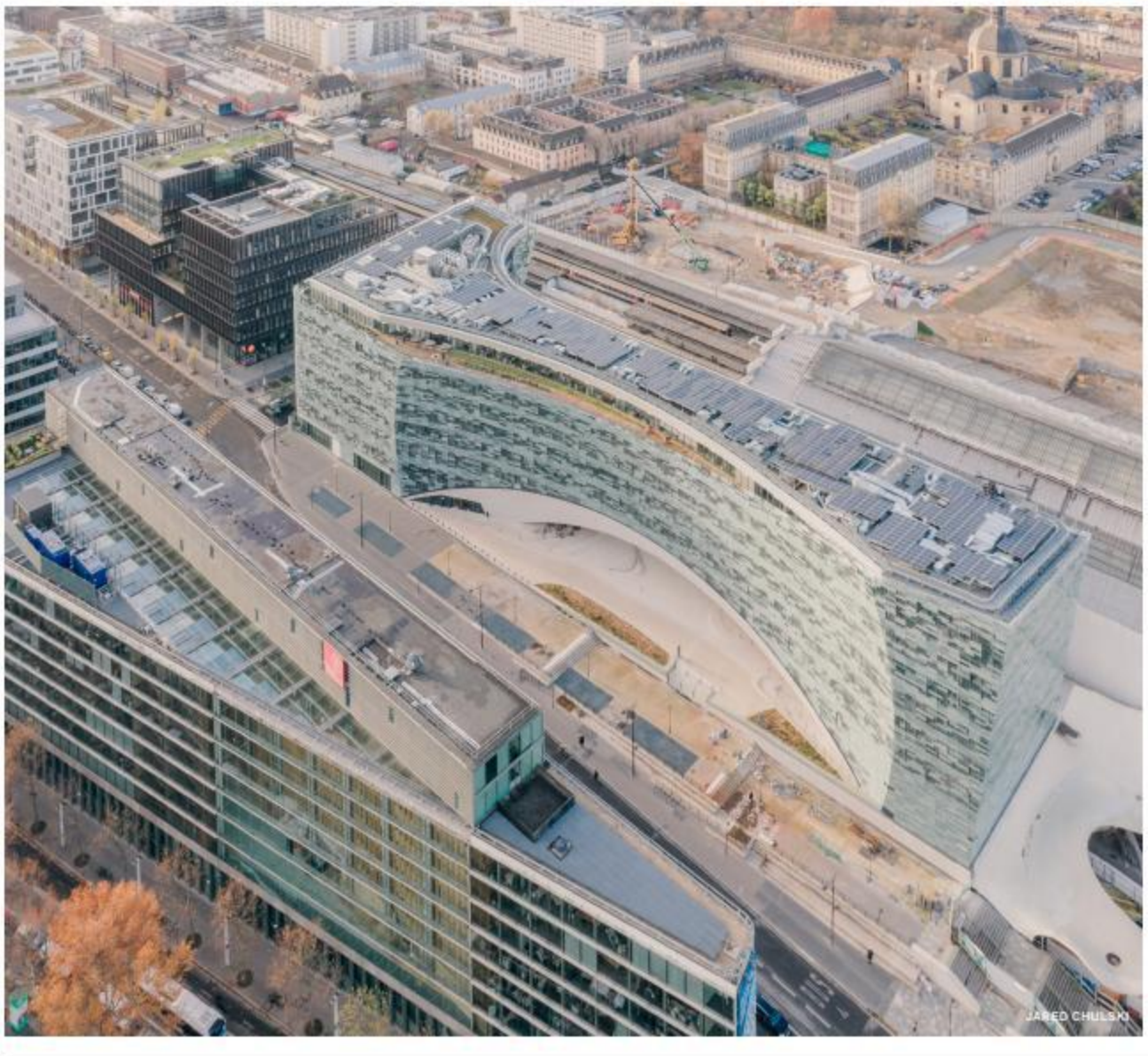
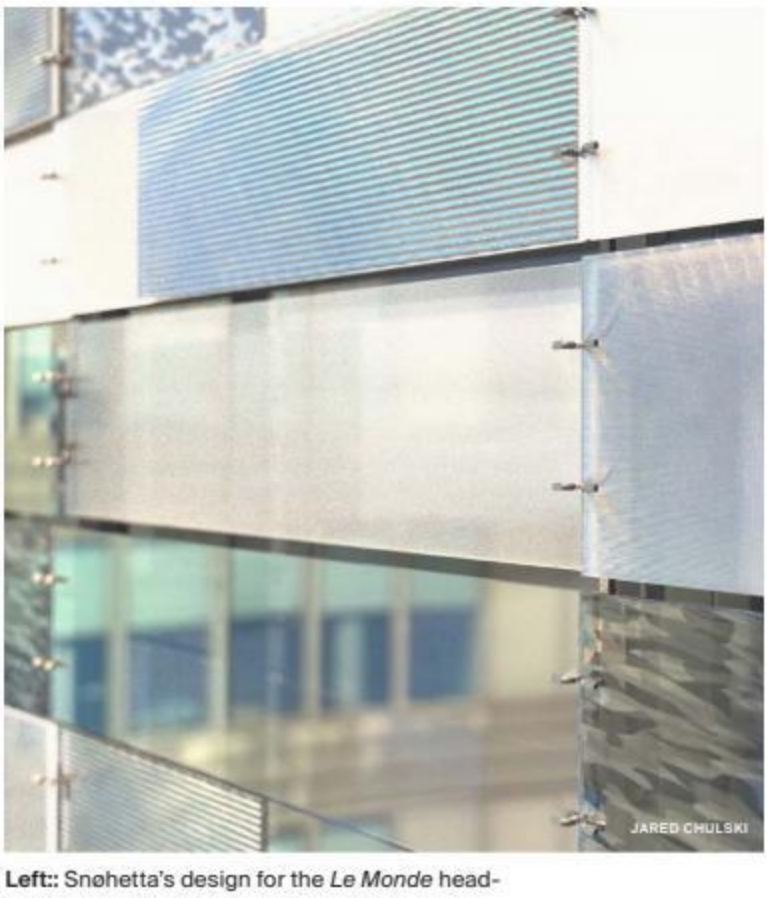
# Le Monde Headquarters


JARED CHULSKI


JARED CHULSKI


JARED CHULSKI

**Left::** Snøhetta's design for the *Le Monde* headquarters presents an interesting massing to Paris's 13th Arrondissement.

**Top:** A wide concrete arch, engineered like a bridge, supports a vitreous multistory volume.

**Above:** The intricate, paper-thin facade assembly comprises 20,000 variegated glass elements connected by individually bent clips.

**Architect: Snøhetta**
**Associate Architect: SRA Architects**
**Facade Engineer: Arcora**
**Structural Engineer: Khephren Ingeniérie**
**Environmental Consultant: Green Affair**

The first thing to notice about the new *Le Monde* headquarters in Paris's 13th Arrondissement is what it *does*. Designed by Snøhetta, the building straddles a former rail yard along the Seine, not unlike the nearby Pont d'Austerlitz. In doing so, it hoists up enough office space for all the French news conglomerate's 1,600 employees while creating a sheltered plaza at grade for pedestrians.

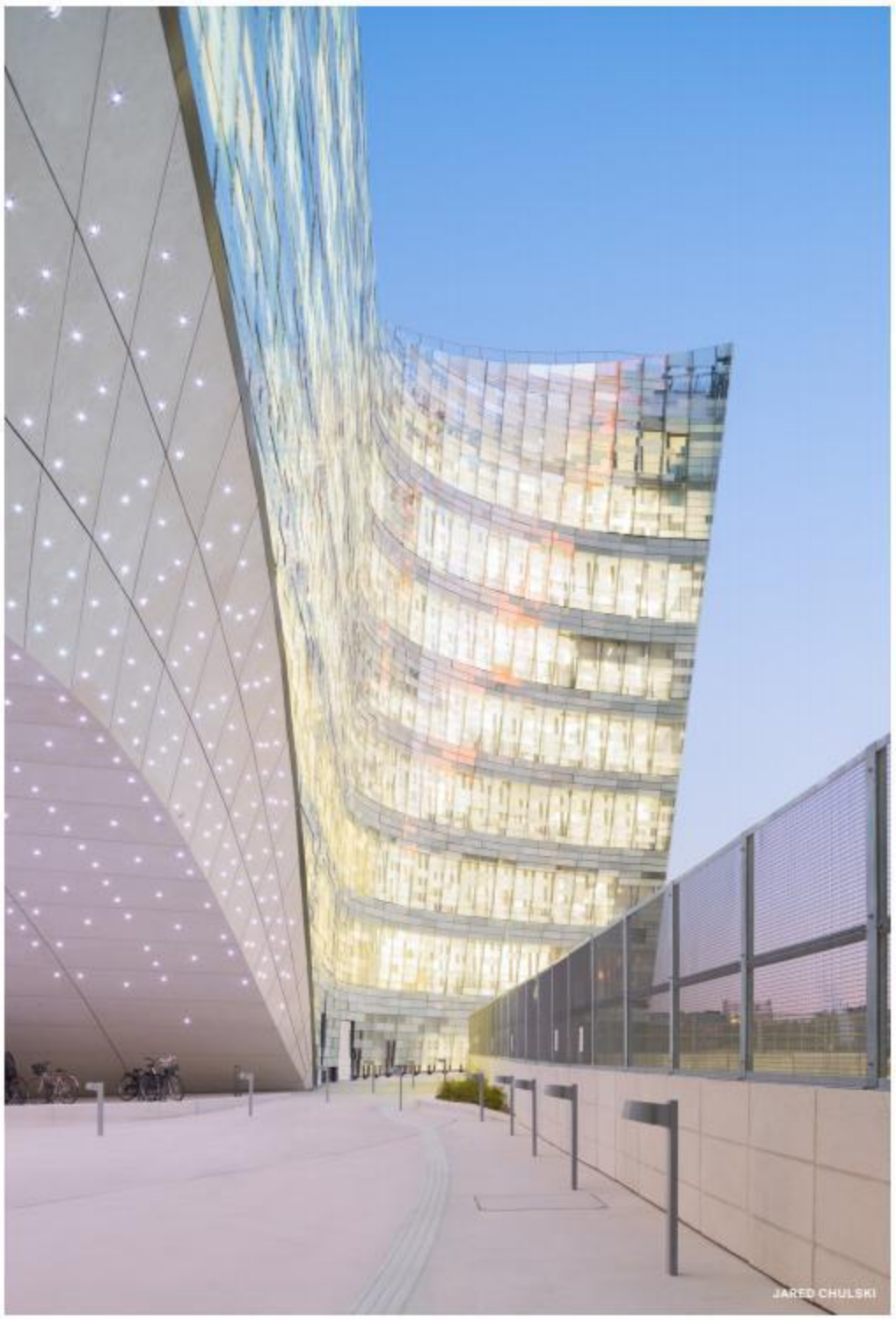
But the project is also notable for its variegated glass envelope, a paper-thin assembly that strikingly contrasts with the bulk of the concrete underbelly. The facade system comprises more than 20,000 glass elements, whose appearance changes throughout the day and under varying weather conditions, yielding compelling, often contradictory effects. (In certain places and moments, the building shimmers, while in others it seems to glow.) Snøhetta conceived of the small vitreous panels, which together have a surface area of 100,000 square feet, as pixels in a nod to the print media produced inside the building.

"The facade is a complex overlap of four different layers of information: four levels of opacity, two methods of positioning, four distinct textures, and varying degrees of reflectiveness," explained Frank Denis Foray, an architect at Snøhetta's Oslo, Norway, office.

Given the sheer number of possible combinations, the design team relied on Dynamo, an open-source visual programming language developed for Revit, to generate a legible configuration. Design goals, such as controlling daylighting intake and enabling views of Paris from select points, helped set parameters for the algorithm to run its course. Foray said the architects later made their own manual adjustments in places, giving the final iteration a more ethereal quality.

This remarkable attention to detail is also evident in the clips that tie each glass element to its neighbor, whose connection is nearly undetectable from the street. "They are bended one by one, giving them small variations," Foray explained. "A protection rubber was threaded onto the clips to protect the glass, while the clips within the vertical structure were developed to be as invisible as possible from both the outside and within."

These and other minute gestures across the facade open the interior offices to copious natural light while rendering the outlines of the glass panels nearly imperceptible, allowing the fast-paced news cycle to hold center stage. **Shane Reiner-Roth**




The architects conceived the small glass tiles as pixels, in a nod to the publishing processes that occur inside the news conglomerate's new headquarters.

# High-Performance Glass

**Thanks to smart thinking and surface treatments, the latest innovative glazing and glass products are helping to transform the inside and outside of buildings. These solutions can make all the difference when it comes to meeting new energy efficiency standards or controlling the amount of natural light that a space takes in. Some combat the threat of fire or even bird impact with style and grace.**

By Adrian Madlener

## Bird1st Etch
Guardian Glass

Hoping to prevent the all-too-common and tragic reality of bird collisions with glass buildings, the new Bird1st Etch product by Guardian Glass sports nuanced yet highly visible acid-etched motifs. Available in four variations, the glass offers flexibility for curtain walls and other facade applications.

guardianglass.com

## SuperLite II-XL 60
SaftiFirst

The SuperLite II-XL 60 transparent wall solution by SaftiFirst is fire resistant for up to 60 minutes. The customizable glass product—available in different glazing and opening applications and in the industry's largest dimensions—can withstand impact, radiant heat, hose streams, thermal shock, and pressure.

safti.com

## SkyFloor Walkable Skylights Series 2000
Glass Flooring Systems

The SkyFloor Walkable Skylights Series 2000 breaks new ground, being the first of its kind to receive an ICC certification. The flagship of Glass Flooring Systems, it is perfect for small spaces or structures that require additional exposure without giving up on the overall area.

glassflooringsystems.com

## Crystal Clear PVB
Saflex

If the aim of architectural glass is hyper clarity, then Saflex's new Crystal Clear PVB laminated glass succeeds. Perfect for premium applications and designs requiring low-iron glass, this aesthetic solution renders the glass necessary for insulation nearly invisible.

saflex.com

## AviProtek
Walker Glass

As the name implies, Walker Glass's AviProtek is designed to protect our feathered friends. Etched patterns on the outer layer of the glass ensures a better rate of detection and collision avoidance. Considering the facade in all its nuance, the product can be used in guardrails, rainscreens, or insulated units and comes with a ten-year warranty.

walkerglass.com


## Harmony
SageGlass

SageGlass's Harmony glazing solution affords large and small projects glare protection and daylight controls. Notably, the product incorporates a gradual in-pane tint transition system capable of producing stunning visual effects without obstructing views.

sageglass.com

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# Ballistic & Bullet Glass

**Comprising different soft and hard layers, ballistic and bulletproof glass is engineered to withstand the impact of one or more bullets or other projectiles. The following products ensure the safety of individuals inside a building or an enclosed room, or behind a barrier, even as they achieve a seemingly vulnerable transparency.** By Adrian Madlener

## BULLETBLOCK
Insulgard

Robust yet versatile, Insulgard's BULLETBLOCK can be used in the framing systems for doors, windows, and storefront systems. Meeting the highest UL 752 requirements, this material can withstand multiple assaults.

insulgard.com

## Forced Entry/Ballistic Resistant (FE/BR)
Viracon

Intended for interior use, Viracon's FE/BR line meets the highest Resistant Test Method standards. What's more, the triple-insulated, glass-clad, polycarbonate laminate can be integrated into several Viracon glazing systems.

viracon.com

## Bullet Resistant, ArmorResist
Oldcastle BE

Oldcastle BE's Bullet Resistant, ArmorResist product is a multi-ply laminated glass that is PVB bonded into a single component. Available in different colors, this economical product can be customized with various glass classifications in mind, including low-E, clear, low-iron, tinted, reflective, patterned, and wired.

obe.com

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## Ballistic Security Glass
TSS Bulletproof

Available in a range of acrylic, laminated polycarbonate, glass, and insulated glass variants, TSS Bulletproof's Ballistic Security Glass product line meets every need and protection level. Depending on the UL rating, the glass can be used in retail contexts or, at the highest rating of 8, federal and military buildings.

tssbulletproof.com


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# Barriers, Coatings & Sealants

**Want a seamless fit for your glass enclosure? Then you need sealants and barriers. Not only do they secure panels, windows, and doors in place, but they also help buildings control temperature and keep them energy efficient. Coatings and sprays offer even more protection.** By Adrian Madlener

## Great Stuff Pro Window & Door
DuPont

A cornerstone of DuPont's wide range of building products, Great Stuff Pro Window & Door is a super-strong spray-foam agent that works to bond construction materials like glass to encasements and other framing solutions. Filling in any gap, this adhesive provides a fast-grab tack and guarantees a long-term bond.

www.greatstuff.dupont.com


## WindowSeal
Poly Wall

Used to strip in or flash rectilinear window frames, Poly Wall WindowSeal self-adhering tape comprises waterproofed rubberized asphalt and laminated polyethylene film. It's a combination that provides excellent elasticity during installation while also creating a powerful bond.

poly-wall.com


## TremGlaze S500+
Tremco

Tremco's TremGlaze S500+ is a heavy-duty sealant engineered for a wide range of glazing solutions. Perfect for tough jobs, it also comes in numerous colors that match almost every standard building material.

tremcosealants.com


## Fast Tack Firestop Spray
STI Firestop

Specifically engineered for curtain wall systems, STI Firestop's Fast Tack Firestop Spray can withstand all types of weather, including below-freezing temperatures. It is notable for its auto-bonding feature and is very quick to dry.

stifirestop.com

## FOAMGLAS
Owens Corning

Thanks to its unique material composition, FOAMGLAS by Owens Corning is lightweight yet durable. Made of sealed glass cells, the insulation is noncombustible and offers exceptional compressive strength, not to mention moisture resistance.

owenscorning.com


## G3 Seal
Glasswerks

Available with a 20-year warranty, Glasswerks' G3 Seal is a flexible silicone foam warm-edge spacer developed for the most demanding glazing applications. It's far more effective at creating secure connections than traditional aluminum fixtures.

glasswerks.com

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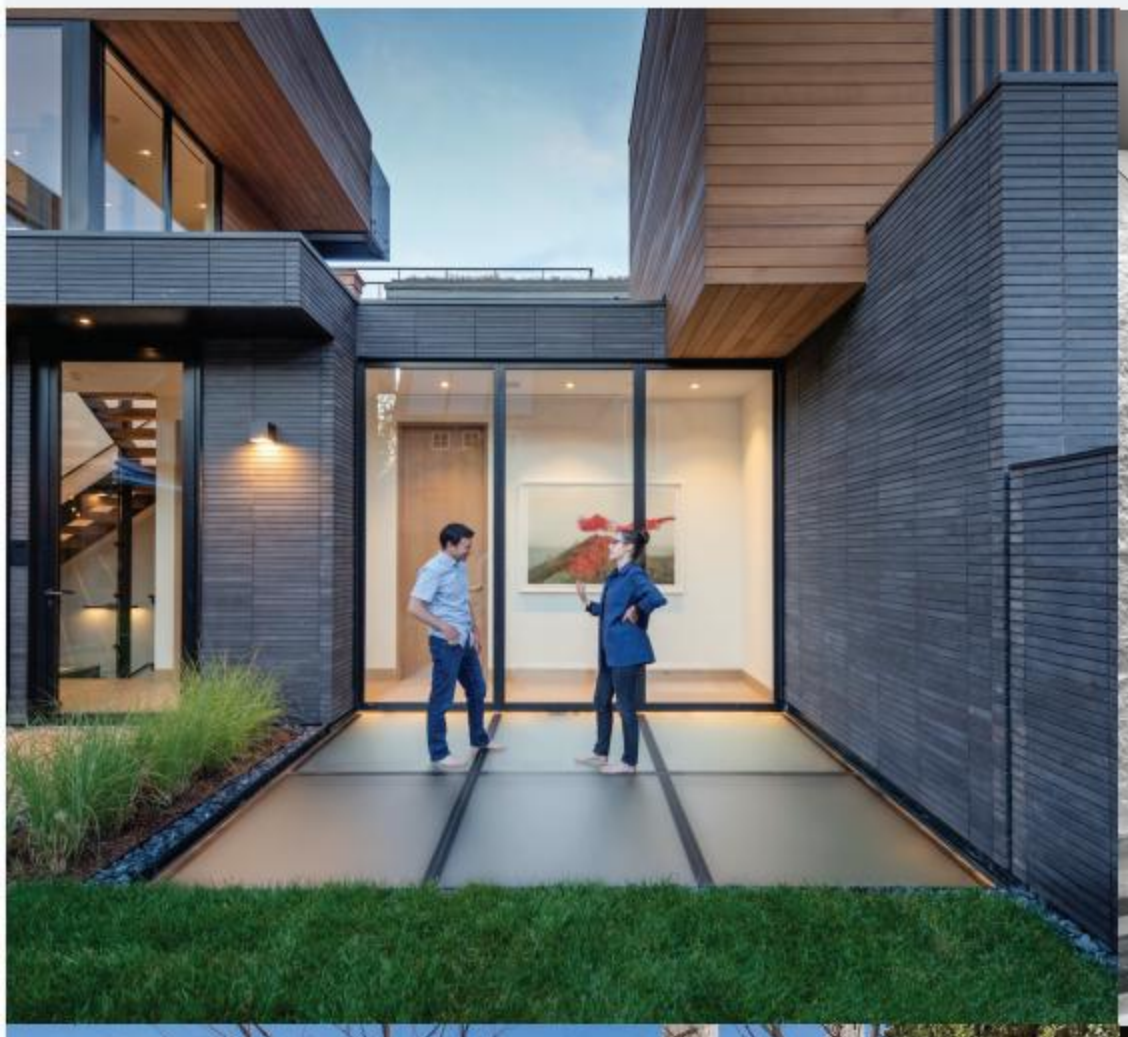

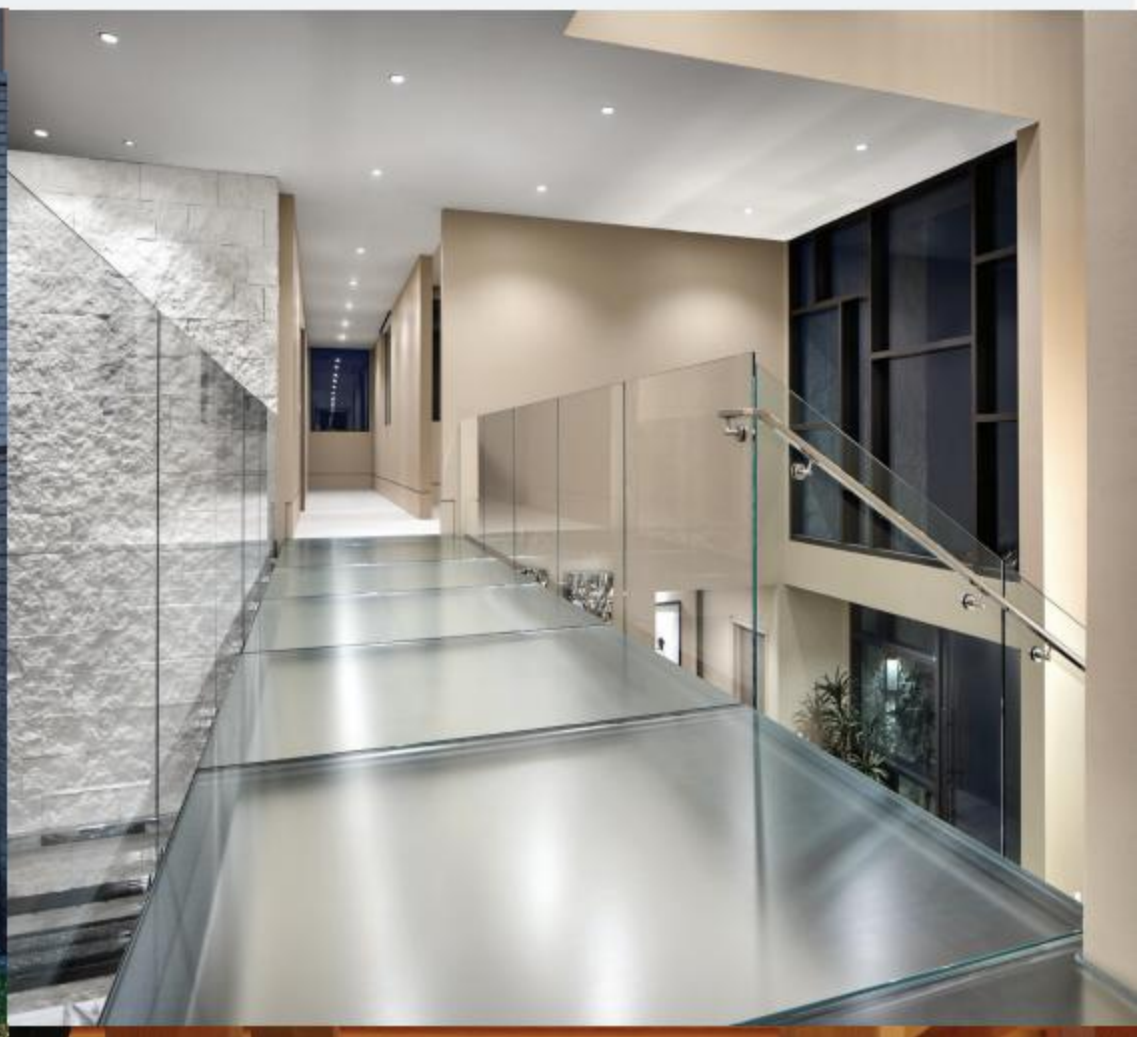

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# Resources

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ASSA ABLOY
assaabloy.com

Global Security Glazing
security-glazing.com

Insulgard
insulgard.com

Oldcastle BuildingEnvelope
obe.com

SAFTI FIRST
safti.com

School Guard Glass
schoolguardglass.com

Technical Glass Products (TGP)
fireglass.com

Total Security Solutions
tssbulletproof.com

Tubelite
tubeliteinc.com

Viracon
viracon.com

## Barriers, Coatings, & Sealants

DuPont
dupont.com

Glasswerks
glasswerks.com

Owens Corning
owenscorning.com

Pella
pella.com

Poly Wall
poly-wall.com

Saint-Gobain
saint-gobain.com

STI Firestop
stifirestop.com

Tremco
tremcosealants.com

Vitro Architectural Glass
vitroglazings.com

## Decorative Glass

3form
3-form.com

Bendheim
bendheim.com

CARVART
carvart.com

Consolidated Glass Corporation
cgcglass.com

Cristacurva
cristacurva.com

Daltile
daltile.com

Galaxy Glass & Stone
galaxycustom.com

Glas Italia
glasitalia.com

Glass + Mirror Craft
glassandmetalcraft.com

Goldray Glass
goldrayglass.com

Lasvit
lasvit.com

Lunada Bay Tile
lunadabaytile.com

Marazzi
marazziusa.com

Nathan Allan Glass Studios
nathanallan.com

Pulp Studio
pulpstudio.com

SCHOTT North America
us.schott.com

Walker Glass Company
walkerglass.com

## Performance & Insulated Glass

AGC Glass North America
agcglass.com

AZA-INT
aza-int.com
Cardinal Glass Industries
cardinalcorp.com

Eastman
eastman.com

Faour Glass Technologies
faourglass.com

GAMCO
gamcocorp.com

GGI
generalglass.com

Innovative Glass
innovativeglasscorp.com

Kawneer
kawneer.com

Kinestral Technologies
kinestral.com

Kuraray
kuraray.com

Northwestern Industries-Arizona
nwiglass.com

Pilkington
pilkington.com

sedak
sedak.com

Technoform
technoform.com

Tecnoglass
tecnoglass.com

TGP Fireglass
fireglass.com

Thermalsun Glass Products
thermalsun.com

YKK AP America
ykkap.com

## Smart & Specialty Glass

AGNORA
agnora.com

Aluflam
aluflam-usa.com

Alumil
alumil.com

Arnold Glas
ornilux.com

Cricursa Spain
cricursa.com

C.R. Laurence
crlaurence.com

Dlubak Specialty Glass
dlubakglass.com

GlasPro
glas-pro.com

Glass Flooring Systems
glassflooringsystems.com

Guardian Glass
guardianglass.com

Saflex
saflex.com

SageGlass
sageglass.com

Skyline Design
skydesign.com

Standard Bent Glass
standardbent.com

Vitro
vitro.com

## Windows & Daylighting

Accoya
accoya.com

Andersen
andersenwindows.com

Arcadia Custom
arcadiacustom.com

Crystal Window & Door Systems
crystalwindows.com

dormakaba
dormakaba.com

Duo-Gard
duo-gard.com

ESWindows
eswindows.com

EXTECH/Exterior Technologies
extechinc.com

Faour Glass Technologies
faourglass.com

HIRT USA
hirtusa.com

Jada Windows
jadawindows.com

JELD-WEN
jeld-wen.com

Kalwall
kalwall.com
Kolbe Windows & Doors
kolbewindows.com

LaCantina Doors
lacantinadoors.com

Marvin
marvin.com

Milgard
milgard.com

MI Windows and Doors
miwindows.com

Ply Gem
plygem.com

Reveal Windows & Doors
revealwd.com

Reynaers Aluminum
reynaers.com

Sapa
sapabuildingsystem.com

Schüco
schueco.com

Sierra Pacific Windows
sierrapacificwindows.com

Vitrocsa USA
vitrocsausa.com

Wausau Window and Wall Systems
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Weather Shield
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Western Window Systems
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