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THE GLASS AND GLAZING AUTHORITY • APRIL 2021

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TECHNICAL GUIDE TO GLASS
FLOORS

ARCHITECTURE AFTER
COVID

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PERFORMANCE

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Lunaria Planetarium in Guadalajara, México, features Guardian Glass's extra clear 6-millimeter glass, fabricated by Mexico's Megaglass using Tecglass digital printing. The project features 1,380 different pieces of printed tempered glass, depicting the constellations visible in the city, according to Tecglass officials. Photos courtesy of Tecglass.





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LOOKING FORWARD
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EDUCATION
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By Max Perilstein,
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PROJECT NEWS



Featured in Glass Magazine Weekly and on [GlassMagazine.com](https://www.glassmagazine.com). To submit projects, write Norah Dick, ndick@glass.org. **Pictured:** One Young Street in Kitchener, Ontario, Canada, which features 16,000-square-feet of custom insulating glass units, fabricated by AGNORA, with 8,050 square feet featuring custom printing by Dip-Tech.

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NGA NATIONAL
GLASS ASSOCIATION
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1945 Old Gallows Rd., Suite 750
Vienna, VA 22182-3931
P: 703/442-4890 F: 703/442-0630

EDITORIAL

Content Director

Jenni Chase • jchase@glass.org

Associate Publisher, Editor-in-Chief

Katy Devlin • kdevlin@glass.org

Associate Editor
Norah Dick

Creative Lead
Cory Thacker

Senior Manager, Digital Media
Bethany Stough

Production Director
Beth Moorman

Web Editor
Wendy Vardaman

Circulation Manager

Jo Ann Binz

jbinz@glass.org • 843/388-3808

ADVERTISING

Executive Publishing Account Managers

Chris Hodges

chodges@executivepublishing.com • 410/459-8619

Mike Gribbin

mgribbin@executivepublishing.com • 410/459-0158

Tim O'Connell

toconnell@executivepublishing.com • 443/717-1425

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All That Glass Can Do



KATY DEVLIN
Editor-in-Chief
kdevlin@glass.org

Why glass? I posed this question recently to my colleague Urmilla Sowell, the technical and advocacy director of the National Glass Association. Sowell is a civil engineer with a technical background that prepared her for a career in any segment of the building industry. So, why glass?

"Glass is so versatile," she answered. "It is the only building envelope product that is as strong as steel in compression of force while also offering a window to the outside. ... You're able to do so many things with glass. It's not just for energy efficiency, not just for daylight. It's structural, it's impact. It protects you in your home and lets you live."

Sowell received both a bachelors and masters in civil engineering from Texas Tech University, where she focused on wind engineering. This led her to receive professional engineering licenses in Florida and to a position at a hurricane test lab in 2000. She became affiliated with glass industry technical leaders while working to develop a hurricane impact test at ASTM and joined the glass industry in 2007, working on the technical team at the Glass Association of North America, which merged with the National Glass Association in 2018.

"We have a product for any application, any need," she said. "Look back to Hurricane Andrew, which came across [Florida in 1992] and leveled homes. That's when the codes [pushed] to do something about buildings to protect them. The glass industry was able to say, we have laminated glass. ... The same thing has happened with blast mitigation and security."

Glass companies are also looking beyond code to achieve next-level performance, she said. "The industry is figuring out what else we can do with glass," Sowell said. "Companies are looking to harness solar power from our vision units, developing VIG for the retrofit market, looking at thin triples. ... We have even seen 3D printed glass. It changes everything we know about glass."

What excites Sowell most about glass, she said,



Urmilla Sowell, standing 1,353 feet in the air in the all-glass Ledge at Willis Tower in Chicago.

is its ability to connect people with nature and their surroundings in a new way. "With glass, you're able to go and have dinner at a lion exhibit. There are glass slides on the side of buildings. You can walk on a glass bridge," she said.

I reflected on this conversation as I prepared the final installment of Glass Magazine's six-part Glass & Metals Guide for architects and specifiers. In previous editions, I looked at protective glazing, interior glass, specifications for complex façades and more. So, for the conclusion of the guide, I follow Sowell's lead and offer a comprehensive view of all that glass can do. From performance to structure, and décor to protection, glass has the answer. Read more on page 40. ■



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NEW MEMBER RESOURCE: CODES & STANDARDS HELP CENTER

New in 2021, the National Glass Association's technical services team has compiled answers to tough technical codes and standards questions in an easy-to-use, online help center, made exclusively for NGA members. The NGA Codes & Standards Help Center has detailed answers to questions relating to safety glazing, energy, glass inspection, bird-friendly glazing and fire-rated glazing. Members can also submit a new question. Visit glass.org for more information. ■

NGA PUBLISHES NEW RESOURCE ON SCHOOL SECURITY GLAZING

NGA has published a new Glass Technical Paper titled School Security Glazing. This paper provides information on delayed forced entry security glazing options for windows and doors installed in schools.

"This GTP was written as a supplement to NGA's recent Security Glazing GTP. It contains an easy-to-read quick reference chart that will be of great help in narrowing the product choices based on the level of security desired," says Urmilla Sowell, NGA advocacy and technical director.

The paper outlines the types of security glazing available based on the level of penetration resistance required. It also features a summary of active standards in use related to educational

facilities for glass-only testing as well as glazing system testing, including ASTM International, ANSI Z97.1, CPSC 16 CFR 1201, CAN CGSB, UL and FEMA's publication, Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings.

"The task group of glazing professionals recognized the importance of helping school communities understand the levels of protection glazing can provide," says Jen Daly, 3M and NGA task group chair. "We hope this guide is a helpful tool in educating those making decisions on their school security options."

Download the GTP at glass.org/store. ■

MARKET WATCH

THE STATE OF WOMEN IN CONSTRUCTION

Despite making up 50 percent of the workforce, women comprise just 10 percent of the construction industry in the United States, according to 2018 data from the Bureau of Labor Statistics. In Canada, the representation of women in construction is only slightly higher at 12.4 percent, according to a 2018 report from BuildForce Canada.

While women are underrepresented in construction, women in the sector do experience more pay parity. According to officials from the National Association of Women in Construction, "women in the U.S. earn on average 81.1 percent of what men make. The gender pay gap is significantly smaller in construction occupations, where women earn on av-

50% vs. **10%**

Percent of women in the workforce

Percent of women in the construction industry workforce in the U.S.

erage 99.1 percent of what men make."

In 2020, the National Glass Association announced an alliance with NAWIC. "The National Glass Association is proud to partner with NAWIC to support women in construction," said Nicole Harris, NGA president and CEO. "We know

there are barriers still, and we can all do more to remind everyone that it's good business to tap this underrepresented 50 percent of the population, especially now when everyone is so challenged to find and recruit talent." ■

In Market Watch, the NGA presents a quick glance at one indicator for glass industry leaders to track as they look to identify opportunities for growth and potential challenges ahead.



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GLASS ADVOCATE

NGA Glass Conference Spotlights Codes and GSA Building Requirements

The National Glass Association hosted its NGA Glass Conference virtually on Feb. 9, drawing more than 300 registered attendees. Topping the agenda were sessions that look at the future implications of the latest codes and standards development, including a unique perspective from the General Services Administration, one of the largest commercial real estate lessors nationwide.

Glazing design for GSA building requirements

The General Services Administration owns and leases over 376.9 million square feet of space in 9,600 buildings in more than 2,200 communities nationwide. During the conference, Lance Davis, program manager for design excellence architecture/sustainability at U.S. General Services Administration, offered an in-depth look at the glass and glazing requirements of the GSA, including applications for bird-friendly glazing, protective glazing, security glazing, energy and daylighting.

The GSA seeks multi-functional solutions from the glass industry, says Davis. He outlined an extensive list of performance goals for glass, as the GSA seeks products designed to achieve high thermal performance and meet building enclosure commissioning targets; to provide daylighting and views without glare; to meet security requirements and stand up to blast and sometimes ballistic threats; to offer biomimicry and bird-safe solutions; and

more. “The biggest GSA challenge is being able to provide all glass solutions in one product,” Davis said.

Technical and code review

NGA’s code and advocacy team provided an in-depth review of code updates to watch. Thom Zarembo, NGA code consultant and partner at Roetzel & Andress, offered a look at fire and security glazing codes, as well as updates to the requirements for glass in handrails and guards. (Read FAQs about glass railing codes in the March issue.) Meanwhile, Nick Resetar, Roetzel & Andress, NGA and GICC fire/structural and safety glass consultant, presented a closer look at bird-friendly glass requirements, new calls for daylighting and opportunities for tax breaks on energy-efficient glazing products.

NGA’s energy code consultant, Tom Culp, owner of Birch Point Consulting, offered insights on the increasing stringency of the energy codes. Culp expects the codes to continue incremental advancements. Meanwhile, he is watching for more aggressive performance requirements at the local level. Ahead on the energy efficiency and performance front, Culp noted the range of specific codes and standards to watch: California Title 24, the 2024 IECC, ASHRAE 90.1-2022, 2024 IgCC/ASHRAE 189.1-2023 green codes, Canada’s National Energy Code for Buildings and the NFRC’s new effort to develop a commercial rating system.

Advocacy and publication updates

The event included an NGA Advocacy Committee update from Paul Bush, committee chair and vice president, technical services and government affairs for Vitro Architectural Glass. Bush offered updates on flat glass EPD requirements in California and proposals for daylighting minimums in the codes. Bush also noted the new NGA technical publications, including bird-friendly glass design strategies.

NGA’s Fabricating Committee Chair Aaron Thompson, senior research engineer at Viracon, also presented an update of new glass fabrication resources. In recent months, the NGA released a guide for glass in personal protective barriers, an introduction to vacuum insulated glazing and a guide to security glazing.

Fun Run/Walk and volunteer celebration

The NGA Glass Conference also included two social and networking events for attendees. It kicked off with the annual Fun Run/Walk tradition, with attendees from across North America and even Europe participating in the morning event.

The conference closed with a volunteer celebration happy hour, where organizers presented awards to recognize volunteers’ virtual engagement over the past year. Michael Saroka, COO of Goldray Glass, received the Volunteer of the Year award. Longtime glass industry leader and technical expert Chris Barry received the C.G. Carney Award, intended to honor a volunteer who reflects passion for the industry and care for his or her peers’ development within the industry. ■



GLASS INFORMATIONAL BULLETIN

FIND MORE NGA GLASS INFORMATIONAL BULLETINS AND TECHNICAL PAPERS AT GLASS.ORG/STORE. CLICK BROWSE, THEN SEARCH KEYWORDS OR SORT BY TYPE.

Glass floors and stairs

Glass floors and stair treads, found in both residential and commercial settings, are growing in popularity because of their aesthetic appeal as well as for the daylighting benefits they provide. While there are manufacturers that offer engineered and tested flooring systems, most glass floor and stair projects require the input of a structural engineer to provide load calculations and glazing details. It is also recommended that an experienced glazier review the support conditions and waterproofing system for exterior applications.

Combining loads

The load requirements for glass walking surfaces are taken from the applicable building code or from the American Society of Civil Engineers (ASCE) Standard 7 - Minimum Design Loads for Buildings and Other Structures, depending on the jurisdiction. The glass is subject to static uniform loads which may include live, snow, dead loads and point loads. These are usually prescribed by the jurisdiction and are particularly necessary when designing floors, stair treads and other special situations. Careful consideration should be given to unusual loading, or dynamic impact in conditions such as dance floors.

Typically glass floor or stair treads are designed to support the applied loads with any one layer of the glass assembly broken. Glass is, by



nature, a brittle material and surface damage can occur by impact from hard objects, which can greatly reduce the load-carrying capacity. Redundancy and suitable safety factors must be used in the design of glass flooring. Glass floors are typically supported on all four sides. Stair treads are typically supported on two sides. The edge support conditions need to be understood to determine the load-bearing capabilities of the glass.

Testing

ASTM E2751 Standard Practice for the Design and Performance of Supported Glass Walkways contains calculation and testing methods for laminated glass walkways. This standard assists the designer in better understanding the

elements related to performance, design, and the safe behavior of glass walkways that include interior and exterior walking surfaces constructed and intended for pedestrian use, including floors, ramps, sidewalks and stair treads.

Choosing the glazing

Laminated glass products are typically used in floors and stair treads. Laminated glass is defined as two or more pieces of glass bonded together with an interlayer. The glass may be annealed, heat-strengthened, chemically strengthened or fully tempered.

Providing slip resistance

Slip resistance of a walking surface is an important safety consideration. The

GLASS INFORMATIONAL BULLETIN—GLASS FLOORS AND STAIRS

Occupational Safety and Health Administration (OSHA) requires a minimum slip resistance, expressed as a static coefficient of friction, of 0.50. ASTM E2751 also notes a minimum static coefficient of friction of 0.5 for walking surfaces under dry conditions. However, special situations such as dance floors, sloped walkways and wet conditions may require a different level of slip resistance. Using a dynamic coefficient of friction that reflects an object in motion is typically more appropriate for these situations.

Processes designed to roughen the top surface of the glass to provide slip resistance include sandblasting, acid-etching, ceramic frit, embossing and others. It is important to note that sandblasting may reduce the strength of the glass by as much as 50 percent. Therefore, glass flooring with surface treatment should be accounted for in the engineering analysis.

Modesty

Modesty becomes an issue when glass floors are found on upper levels and inappropriate lines of sight are created from spaces below. When modesty is a concern, it may be necessary to incorporate acid etch, a ceramic enamel finish, a decorative or translucent interlayer, or glass material to create obscurity.

Installation

Any sealant or caulking used must be checked for compatibility with the glass flooring. The framing and supports for glass floors composed of laminated glass must provide drain holes or weep systems to avoid the possibility of water or cleaning fluids building up in the system. Sealants used in a flooring installation should consider the size of the joint, size

Measuring slip resistance of glass floor and stairs

There are a variety of recognized test methods that measure slip resistance using specific test equipment under dry or wet conditions.

ASTM E2751 - Standard Practice for Design and Performance of Supported Laminated Glass Walkways

ASTM F609 - Standard Test Method for Static Slip Resistance of Footwear, Sole, Heel or Related Materials by Horizontal Pull Slipmeter [HPS]

ANSI/ASSP TR-A1264.3-2007 - ANSI Technical Report: Using Variable Angle Tribometers (VAT) for Measurement of Slip Resistance of Walkways

ANSI A137.1 Tile Slip Test

ANSI A326.3 Tile Slip Coefficient Test

UL 410 Standard for Safety for Slip Resistance of Floor Surface Materials

Other industry standards address the safety issues of walkway surfaces from a more general point of view.

ASTM F1637 Standard Practice for Safe Walking Surfaces

ASTM F1646 Standard Terminology Relating to Safety and Traction for Footwear

tolerances of glass, the expansion and contraction of the support system, caulking requirements, moisture management and other site-specific conditions.

Fire resistance

While glass floors are not typically fire-resistant, fire-rated glass suppliers offer special flooring systems with up to 2-hour fire-resistance ratings for interior and exterior applications. Fire-rated glass floors block radiant and conductive heat and provide a barrier to fire and smoke. The walking surfaces are tempered, laminated glass combined with fire-resistance rated glass, supported by steel fire-resistant structural framing.

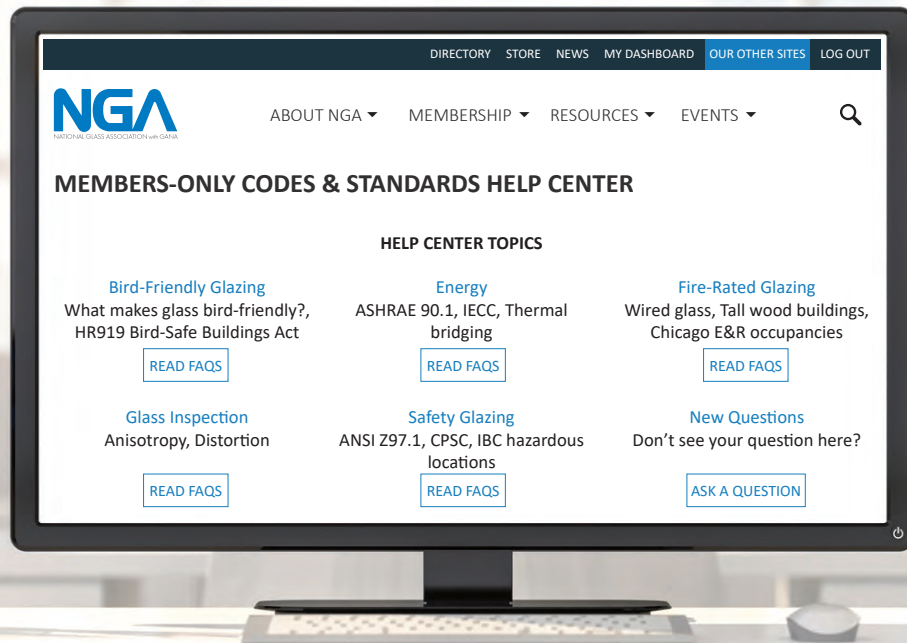
Fire-rated glass floors are safety impact rated, load-bearing, and can be made opaque using decorative frits or sandblasting without affecting the fire rating.

Maintenance

Glass floors should be regularly inspected for damage, as impact from hard objects can crack the upper surface. Any damaged glass should be replaced as soon as possible. Cleaners, polishes and other materials used for the adjacent floor surface maintenance may change the coefficient of friction or damage the caulk or other sealants. Contact the manufacturer or fabricator for compatibility testing and cleaning instructions. ■

Members-Only Codes & Standards Help Center

Have Questions? Get Answers.



Glass is complicated — NGA is here to help.

Exclusively for NGA members, we have compiled answers to nearly 40 tough technical codes and standards questions in an easy-to-use, online help center. *Didn't find the answer you were looking for?* Just click the Ask a Question button in the help center to submit a request to NGA's technical services team.

Read FAQs on: • Safety Glazing • Energy • Fire-Rated • Bird-Friendly • Glass Inspection
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Oldcastle BuildingEnvelope Acquires Certain Assets of Graham Architectural Products

Oldcastle BuildingEnvelope, a CRH company, announced it has completed the transaction to acquire certain assets and liabilities of Graham Architectural Products Co.

Graham Architectural Products, based in York, Pennsylvania, serves the Midwest and Northeast regions of the U.S., according to OBE officials.

Graham Architectural Products is a manufacturer of engineered, commercial, window, door and window wall systems specializing in energy-



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efficient, historical, blast protection and high-performance products and solutions, which is a strong complement to OBE's existing product offerings ranging from fabricated glass, architectural hardware and metal systems, according to OBE officials.

Xinyi Glass Canada Says it will Suspend Plans for Stratford Float Plant

Xinyi Glass Canada released a statement on Feb. 15 saying that it would suspend its plans to build a float plant in Stratford, Ontario, Canada, "indefinitely." The statement outlined



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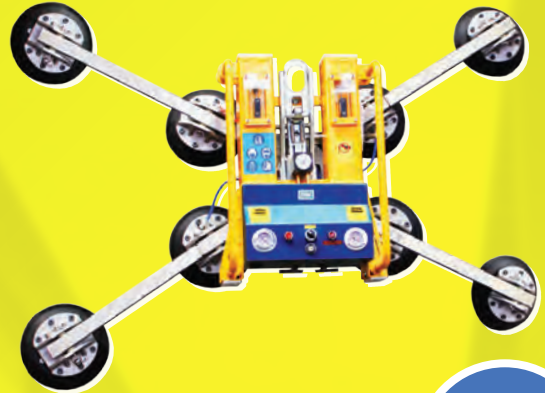
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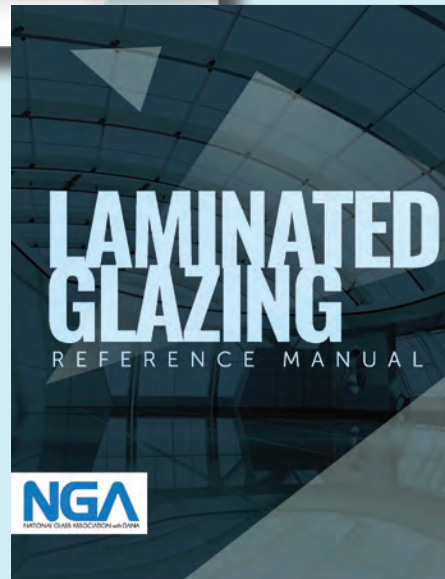
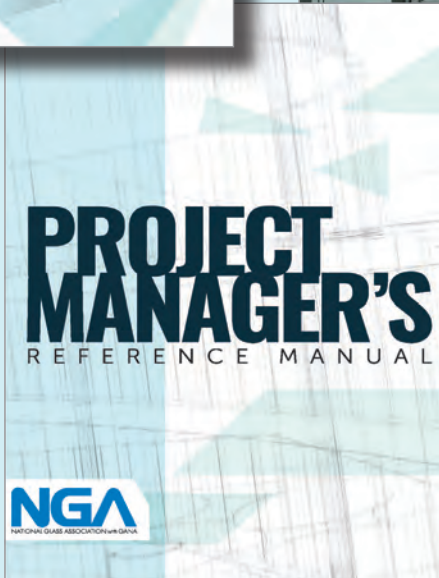
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the potential benefits the project could have brought to the area, and cited local pushback and the city council's decision to defer action on the project as contributing to this move. "Xinyi Canada is greatly disappointed that as of Feb. 15, 2021, Stratford City Council remained unable to provide approval of the Cost Sharing Agreement between the City of Stratford and Xinyi

Canada, which is critical for the timely development of the proposed float glass facility," officials say in the statement.

The float glass plant was first proposed in November 2020, and received pushback from local residents. The City of Stratford had decided to defer action on the plant in early January, citing COVID-19 lockdown measures, according to reporting in the Stratford Beacon

Herald. Stratford Mayor Dan Mathieson said the city had not been notified of the company's plan to suspend the project.

AIA Consensus Forecast Predicts 2021 Decline for Nonresidential, 2022 Recovery

The AIA Consensus Forecast, an economic report compiled by the American Institute of Architects and based on eight industry-related economic forecasts, predicts a mid-single digit percentage decline in 2021, but a healthy recovery in 2022. The decline in construction spending this year is projected to be just under 6 percent, with a steeper 7 percent decline for commercial facilities, 4.5 percent for industrial buildings, and 4 percent for the institutional sector.

NSG Group Plans to Cut 2,000 Jobs Globally

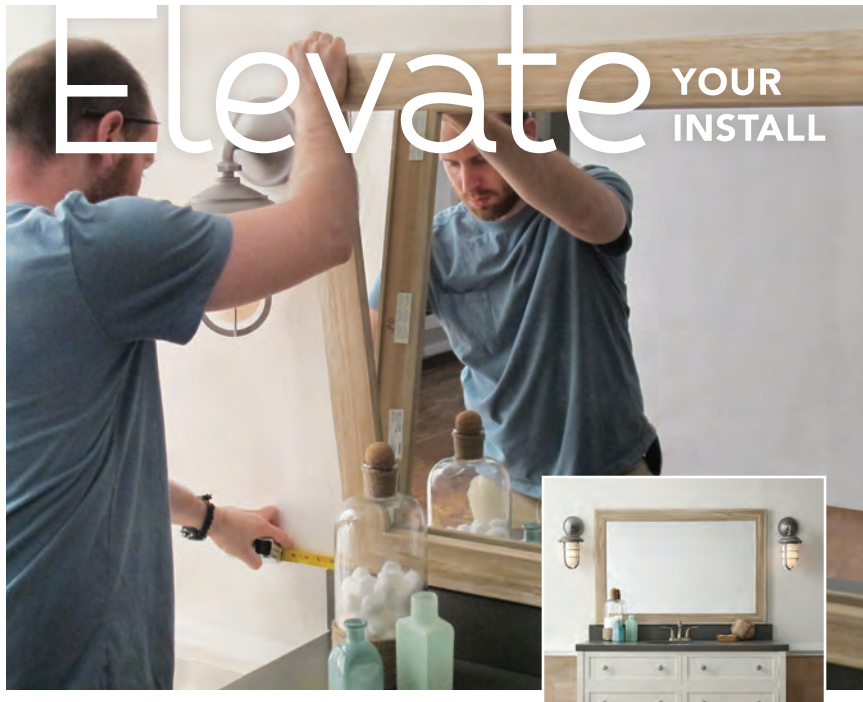
According to NSG Group's third quarter financial results report, the company, which owns glass manufacturer Pilkington, will "reduce more than 2,000 employees globally." The report says the company plans to do so through both layoffs and retirement programs. The goal of the measures is to "ensure a meaningful net profit in [fiscal year 2022]."

Banner Solutions Acquires Wholesale Division of Seattle-Based Company

Banner Solutions, backed by private equity firm Tailwind Capital, acquired the wholesale division of Builders' Hardware & Supply Co. based in Seattle, Washington.

Merging Builders' Hardware's wholesale customers and product offering into the Banner Solutions platform will enable a greater level of service in a growing market, say officials. ■

**From Feb. 2 to press time Feb. 24. Read these stories, and others, in their entirety at GlassMagazine.com.*



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TRENDHUNTER

ARCHITECTURE AFTER COVID

Green building and occupant wellness shape post-pandemic commercial building

BY NORAH DICK

Insights were gathered from a survey sent to the glass industry, as well as an interview with Randal Froebelius from the BEC Presents episode series from the National Glass Association; the webinar “Future Trends of Glassmaking,” hosted by Glass International, with guest presenter Özlem Vergon; and the presentation, “Inspired Design Trends for Commercial and Residential Construction,” hosted by the Fenestration & Glazing Industry Alliance as part of its 2021 Virtual Annual Conference, with guest John Peterson.

Design and construction have been disrupted during the pandemic, and COVID-19 will almost certainly continue to shape the built environment post-vaccination. “COVID-19 will definitely affect how commercial space is designed and utilized,” says Ian Patlin, president, Paragon Architectural Products. “Planning will be majorly affected to accommodate the new health and social norms, and to provide a greater sense of surety, security and social responsibility.”

“Our challenge is creating an environment that’s safe but also one that makes people want to come back to the office,” says Randal Froebelius, president and general manager of Equity ICI Real Estate Services Inc. and vice chair of the Building Owners and Managers Association.

Representatives from across the building industry say post-COVID-19 design will focus on health and wellness in the shared environment, while accelerating the push for green building.

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Health and wellness

Ventilation. Though many employees are working remotely during the pandemic, many workers will return to the office post-COVID, which will require a consideration of employee safety and comfort, says John Peterson, director of sustainable design & building innovation, MJMA. Critical to employee safety is natural building ventilation and increased filtration systems, which will improve air quality and mitigate the risks of airborne disease, he says. This can include more operable systems, which may be automated, he says.

Touch-free environment.

Building owners are quickly moving to incorporate touch-free products, particularly at building entrances, says Froebelius. "People are expecting a touch-free environment," he says. To meet expectations, owners and landlords are "looking at touch-free door operators and making surfaces

“
OUR CHALLENGE
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TO COME BACK TO THE
OFFICE.
”

bio-resistant. They are changing accessibility paddles on doors to be touchless, wave technology, making light switches, elevator buttons, fans, all touch-free.”

Enhancing indoor/outdoor connection. In addition to safeguarding employees, it's important to ensure employee comfort, says Peterson, which will involve increased connection to nature and the outdoor environment even while inside. It will be important to create visual connections from inside to outside, he says, as well as to bring nature indoors, with something like a green growing wall.

Green building

Sustainability. While COVID-19 has certainly disrupted many industries, it will only accelerate the existing green building trend, says Özlem Vergon, chief strategy officer, Şişecam Group. "Sustainability has become much



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more important because everything [now] is about survival,” she says. Green building solutions, fueled by technological innovation, will also accelerate because of the stark increase of digitalization and virtual solutions that the pandemic necessitated, she says. Vergon emphasizes that the pandemic is accelerating, not creating, the demand for green innovation; outside of the pandemic, increasing

urbanization, which is estimated to see 60 percent of the world’s population living in urban areas by 2030, will bring air pollution and the need for green solutions, she says.

Passive house. Peterson says he expects the industry will move toward accelerated energy and thermal efficiency requirements such as those in the Passive House voluntary standards. Passive House is “predicated on the

idea of superinsulation, maintaining as much heat recovery as possible, and creating as airtight an enclosure as possible,” which will also require more testing of systems’ airtightness, he says.

Circular design. Building will also embrace the idea of the circular economy, says Peterson; this framework considers the lifecycle of the product from manufacturing, to installation, to demolition and reuse in what becomes a cycle of building. “Some of the best ways to reduce carbon is to try to understand durability and the effect of a product when it gets installed through to its end of life,” says Peterson. With the rise of prefabrication, building elements or even systems could be extracted and reused in another building cycle, or recycled, he says.

Performance technologies

Vacuum insulated glazing. Peterson also sees the rise in VIGs, which allow designers to achieve an inside/outside connection for occupants through use of glass, while also maintaining a performance closer to some of the opaque building elements, he says. “This innovation has been out for a number of years but has only really come to the marketplace for larger units and being implemented by some of the large [fabricators] like Viracon or Interpane,” he says. “[VIG] has made for some incredible performance gains and I think we’re going to see much more of it coming out based on the desires of clients, desire of people who are buying apartment buildings; you’ll see this coming out quite strongly in the marketplace.”

Photovoltaic glass. In addition to saving energy, glass will likely produce more energy as well in the near future. “Buildings are starting to need to generate power on sites so they can reduce the demand they have on the electrical grid and the natural gas grid,” says Peterson, and solar glass panels are one way to do so. ■

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ARE DESIGN ACTIVITIES COVERED BY INSURANCE?

BY MATT JOHNSON



The lines separating the concepts of design from trade work are increasingly blurry. While design-build jobs have been around for a long time, increasing project complexities have seen design work on small jobs fragment and push downstream to sub-tier trades like glaziers. When this happens, trades are often exposed to a risk that gaps in insurance coverage leave them directly exposed to significant losses.

Modern glass and glazing systems are critical architectural elements with imbedded design features for structural, weather and energy performance. Most glaziers attend to the risks arising from these features with commercial general



THE BOTTOM LINE

GLAZING FIRMS INCREASINGLY TAKE ON ADDITIONAL DESIGN WORK IN DESIGN-BUILD AND DESIGN-ASSIST PROJECTS. HOWEVER, DESIGN AND SPECIFICATION ACTIVITIES FALL INTO A REALM OF PROFESSIONAL SERVICES NOT USUALLY COVERED BY A COMMERCIAL GENERAL LIABILITY INSURANCE POLICY. RATHER, A PROFESSIONAL LIABILITY POLICY MAY BE REQUIRED.

liability, or CGL, insurance policies. This familiar line of coverage can help protect against property damage or injuries caused by the means and methods used in ordinary construction.

Design and specification work is different. These activities fall into a realm of professional services not usually covered by a CGL policy. For example, an improperly specified glazing system can result in significant exposure to delay claims and third-party costs surrounding efforts to bring a building into conformance with code or design intent. These costs are not due to damages that fall nicely into a standard CGL policy, and thus the specifying glazier can be directly exposed. If the specification issue arose because of professional negligence, however, a professional liability policy may have an obligation to respond and offset those costs.

CGL vs. professional liability

Appreciating the distinction between these types of insurance coverage is essential. A CGL policy usually covers harm suffered by another, while a professional liability policy can cover harm surrounding the work itself. And with more and more glaziers extending into design work, the prospect for claims arising due simply to the work must be recognized.

But coverage is not where the differences between these two kinds of insurance stop. Another important distinction is that professional liability policies tend to be "claims made" policies. This feature requires that the negligent act take place and be reported within the policy period. Compare that to typical CGL policies that offer "occurrence" triggers that can cover damages years after the work was completed.

Professional liability policies also typically only cover the actions of the named insured when acting within their covered capacity. This means that the policy will only address damages caused by the actions of the entity to whom the policy was issued, and then only in connection with activities specifically defined within the policy. CGL policies, on the other hand, can offer expanded coverage to additional insureds and address damages suffered by another due to the actions of the insured without specific lists of covered activities.

Another important distinction is that the claim must arise from the unintentional professional negligence of the covered party. While most insurance policies already exclude intentional acts, in connection with professional liability policies the line of what is "intentional" can prove unclear. Claims are often denied where a carrier believes

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that the work performed was simply ill-advised rather than professionally negligent, making the actions intentional and the claim uncovered.

Errors and omissions

One additional complication: professional liability can be easily confused with errors and omissions coverage. E&O coverage can cover the cost to repair or replace faulty work. Professional liability policies cover the damages due to faults or errors in designing the work itself. Many damage demands can fall into a coverage gap between those types of policies where both are not in place.

Of course, options exist to address that potential coverage gap. Obviously, the simple answers are found in stand-alone policies. The scope of professional liability coverage can be flexibly tailored to account for in-house design teams, AIA delegation anticipated by A-201

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COVERAGE ASSESSMENT
CAN IDENTIFY GAPS IN
COVERAGE AND HELP
MINIMIZE THE POTENTIAL
FOR EXPENSIVE UNCOVERED
CLAIMS WHETHER RELATED
TO THE DESIGN,
PRODUCTS OR WORK
PERFORMED.

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and subcontracted design work. This flexibility can result in some reasonable premiums.

Professional liability coverage can also be issued by an endorsement to a CGL policy. These add-ons to CGL policies usually offer narrower coverage than a stand-alone policy. In addition, they can be difficult to obtain from carriers, or reach a point where the endorsement becomes cost-prohibitive.

Project coverage

For big jobs, project-specific coverage is also available. Owners or large contractors may purchase single source policies that address all losses arising out of a specific job. Enrollment, for a fee, can provide protection for certain professional activities. These policies do have their own limits and retentions/deductibles that can limit the usefulness of the policy. Careful review is required to ensure the coverage offered and purchased is sufficient.

Regardless of the options, glaziers do not need to be experts in the nuances of insurance claims that fall within professional liability, E&O or CGL coverages. Simply appreciating the risk for uncovered claims emphasizes that this is a matter to take to insurance brokers for yearly review. A comprehensive work-coverage assessment can identify gaps in coverage and help minimize the potential for expensive uncovered claims whether related to the design, products or work performed. ■

Matt Johnson is a member of The Gary Law Group, prgarylaw.com, a Portland-based firm specializing in legal and risk issues facing manufacturers of glazing products. He can be reached at matt@prgarylaw.com.



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SOUNDS ABOUT RIGHT

Balancing acoustic performance with the modern demands of glass **BY JOE ERB**



The hustle and bustle of urban living necessarily comes with a bit of noise. But that doesn't mean people want to bring it into their homes and workplaces.

We've seen holistic occupancy comfort become increasingly desirable in recent years. Part of achieving that ideal indoor environment involves limiting sound transmission from the outside in. This is a trend I've been hearing a lot about recently, especially in regions where developers are eyeing construction sites near train tracks or elevated lines or major freeways for new multifamily development.

The acoustic performance delivered by a range of different building materials is now being considered more closely. This all means those in the glass industry might have started to pay closer attention to things like Sound Transmission Class (STC) and Outdoor/Indoor Transmission Class (OITC) ratings,



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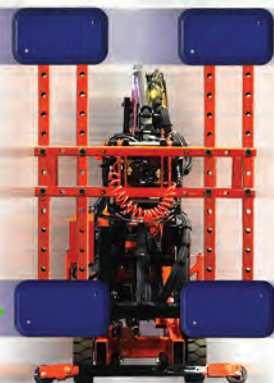
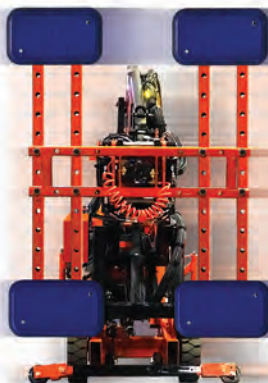
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which determine how much sound is transmitted through a window.

As the broader commercial construction space continues to move in the direction of highly glazed buildings, the glass industry needs to prove our performance in this burgeoning area of need. The industry is able to deliver the right aesthetic benefits and outstanding thermal performance. Can it do the same with sound?

I believe that the industry can. It's about looking at the entire system holistically and putting together components that will reduce sound transmission while maintaining the thermal benefits.

Here are some considerations:

Glass and glazing configurations

Glass mass, asymmetrical insulating glass and multicavity glazing are all popular and effective choices to bolster acoustic performance in fenestration design. The mass law states that

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THE INDUSTRY IS ABLE TO DELIVER THE RIGHT AESTHETIC BENEFITS AND OUTSTANDING THERMAL PERFORMANCE. CAN IT DO THE SAME WITH SOUND?

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doubling the mass per unit area can increase sound transmission loss by 6 decibels. Increasing glass thickness on one or more lites of an insulating glass unit can impact acoustics.

The use of asymmetrical glazing (different thicknesses of glass in the same IG) can also improve acoustics by “breaking up” the sound waves. This can be accomplished using double- or triple-pane glazing design. The use of multicavity glazing will also make significant improvements in thermal performance and occupant comfort.

Laminated glass

There are many laminating glass interlayer options available to address performance requirements in security, impact and acoustics. These interlayer materials can be tuned to meet specific acoustic performance targets using various thicknesses and plies. The laminated glass configurations act as an acoustic shock absorber (dampening

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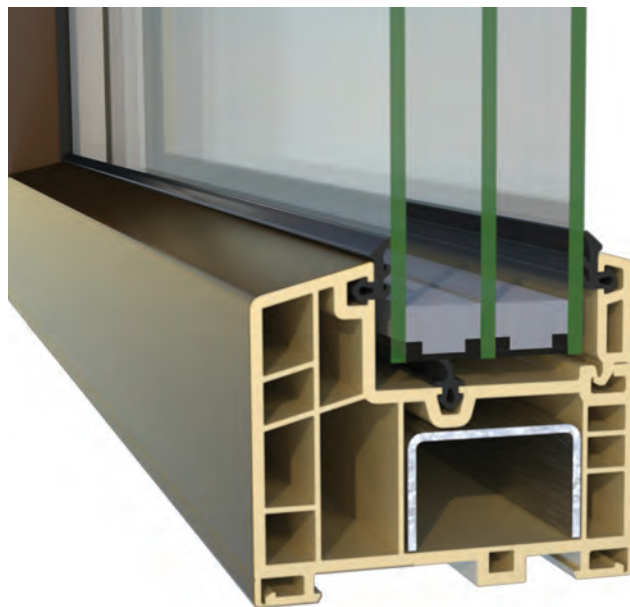
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material). Consult your interlayer supplier for specific design requirements.

Vinyl

Another area to consider closely is framing and how it contributes to both thermal and acoustic performance. While metallics have long been the standard choice in commercial applications, high-performance commercial vinyl and composite options have become increasingly attractive in recent years. The right choice can help drive down a commercial window's U-factor.

Those benefits translate in the realm of acoustic performance, too. The multi-chamber design of commercial vinyl extrusions can help dampen noise versus a metallic frame that can more readily reverberate. Of course, metallic framing can be designed to eliminate noise through the incorporation of dampening technology—but as with thermal breaks, this can make the design and manufacturing process a bit more complex.

Vinyl and composite framing can also mitigate some potential weak links where noise can enter an interior. Sound travels the path of least resistance and can transmit through even the smallest gaps in a window assembly, potentially reducing

the effective noise reduction capabilities of the window. Vinyl and composites which can be welded vs. mechanically fastened at corners have an advantage by eliminating those gaps or small openings for noise to travel through.

Take a holistic view

These are just a few ways you might improve acoustic performance in fenestration—and there are others that can have an impact, such as spacer choice, sealant materials, assembly methods and multicavity systems. When designing or specifying fenestration systems for acoustic performance, it is important to consider the system as a whole. Do not sacrifice thermal performance in the process.

When designing a window system for acoustic performance, it's also important to work with your component suppliers and an acoustic engineer to select the most effective solutions. In acoustic design, the system's performance is only as good as the weakest link. Physical testing is the only way you will truly know the impact of the materials and the assembly methods for your system. ■

Joe Erb is a commercial sales specialist for Quanex Building Products.



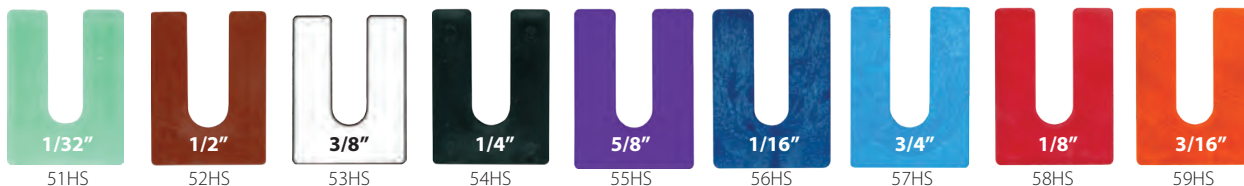
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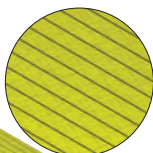
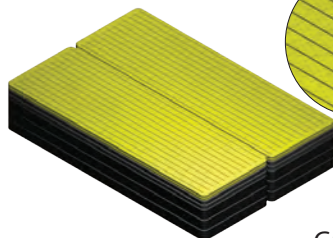
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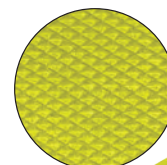
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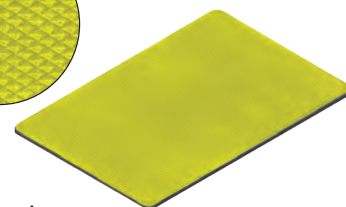
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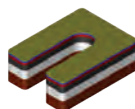
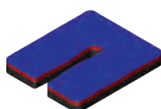
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AN ANALYTICAL ALTERNATIVE TO COMMERCIAL WINDOW TESTING

BY GLENN FERRIS



The most obvious way to verify compliance of fenestration products with code requirements for structural strength under wind pressure loading, often based on commercial-grade requirements of the North American Fenestration Standard, is laboratory testing. However, when a specific project calls for non-standard configurations such as larger or smaller sizes, variations in framing configuration or higher wind pressure levels than those of the tested baseline assembly, it can

be prohibitively expensive and time-consuming to test all such variations.

Accordingly, the Fenestration & Glazing Industry Alliance offers a standardized process for engineering evaluation of windows and doors, in the form of AAMA 2502-19, Comparative Analysis Procedure for Window and Door Products, an FGIA standard. Approved as a reference standard in the International Building Code, AAMA 2502 sets forth engineering design rules by which commercial products that differ from the test unit can be qualified for code compliance. By providing guidelines for applying loading forces based on the geometry and number of supported panes of the window and door, these rules can also assist manufacturers in the product design effort.

The engineering design rules specified in AAMA 2502 are intended for use in the structural analysis of product framing elements (single span, simply supported beams) subjected to bending under uniform loading, such as that induced by wind. Note that these rules do not apply to the design of infill materials such as glass or panels but can be related to glass loading limitations.

The rules cover five elements:

1. Load distribution and magnitude.

Uniform static loading acting normal to the plane of the window or door.

2. Section properties.

Area moment of inertia and section modulus for standard and nonstandard or asymmetrical shapes and bending moments.

3. Strength.

Stress calculations for both tension and compression; calculated stress

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THE ENGINEERING
DESIGN RULES ... ARE
INTENDED FOR USE
IN THE STRUCTURAL
ANALYSIS OF PRODUCT
FRAMING ELEMENTS
SUBJECTED TO BENDING
UNDER UNIFORM
LOADING.
”

cannot exceed guidelines in various industry standards for different framing materials. Note that for products with framing spans longer than those of the tested version, calculated deflection is subject to the limitations imposed by AAMA TIR-A11, Maximum Allowable Deflection of Framing Systems for Building Cladding Components at Design Wind Loads, or ASTM 1300/ CAN-CGSB 12.20, Standard Practice for Determining Load Resistance of Glass in Buildings. If not otherwise defined in the referenced documents, the material yield stress is subject to a safety factor of 1.5 as the basis for allowable stress design.

4. Connections.

Analyzed for tensile, shear and bearing strength. The calculation of maximum load on each fastener used to anchor the unit to the

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building is also discussed. Be aware: capacity of fasteners is calculated per AAMA 2501, Voluntary Guideline for Engineering Analysis of Anchorage Systems for Fenestration Products Included in NAFS.

5. Deflection.

Formulas are provided for figuring deflection and stress limits of simply supported beams, including the calculation of modulus of elasticity, which varies by material, for both symmetrical and unsymmetrical cases. Formulas are also given for calculating the deflection of composite framing sections such as thermally broken framing. Note that calculated frame element deflections cannot exceed those set forth in referenced performance standards (TIR-A11, Maximum Allowable Deflection of Framing Systems for Building Cladding Components at Design Wind Load, and ASTM 1300,

Standard Practice for Determining Load Resistance of Glass in Buildings/CAN-CGSB 12.20, Structural Design of Glass for Buildings).

To aid in the implementation of these design rules, AAMA 2502 includes detailed diagrams and associated formulas covering:

- Equivalent concentrated loads (equivalent loads for maximum deflection for rectangular, trapezoidal and triangular load profiles).
- Distribution of uniform loads (illustrations and calculation formulas for 15 different configurations of framing).
- Section properties (at five locations as identified within a representative framing profile cross-section diagram and associated formulas for first moment, moment of inertia and section modulus).

- Bending moment and deflection formulas for simple beams subjected to uniform (rectangular), trapezoidal and triangular load profiles.

To obtain code compliance for the aforementioned variations applicable to a given commercial project, structural analysis computations encompassing all reasonable failure modes, detailed drawings and test data for windows and doors are typically compiled in the form of an Analysis Report, signed and sealed by a registered professional engineer. AAMA 2502 provides guidance for developing such reports. Engineers and architects can obtain a copy of AAMA 2502-19 by visiting FGIAonline.org/store. ■

Glenn Ferris is fenestration standards specialist for the Fenestration & Glazing Industry Alliance.



Photo courtesy of Vision Systems

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GREAT GLAZING: THE UNIVERSITY OF CALIFORNIA MERCED

The basics: Merced 2020 is an ambitious, \$1.2 billion extensive expansion of the University of California Merced campus. According to UC Merced's website, this project is "the largest public-private partnership social infrastructure project completed in U.S. history." This includes new facilities used for academic, administration, laboratories, housing and recreation. According to architect SOM, "It is the first public research university in the U.S. to be certified carbon-neutral and the only academic campus to have every building LEED certified."

The players: SAFTI FIRST supplied the fire-rated glass and framing to eight buildings within the expansion, including three lab buildings, four residences and an administration building. The company collaborated with general contractor Webcor, architects Mahlum Architects, Page Southerland Page, SOM and WRNS Studio, and with glazing contractors Architectural Glass and Aluminum, Ranker AMG and Royal Glass.



1-hour Fire Resistive Wall with SuperLite II-XL 60 in GPX Architectural Series Framing and Full-vision 60 Minute Pair Doors with SuperLite II-XL 60 in GPX Builders Series Temperature Rise Doors. Photo by SAFTI FIRST.

The glass and systems: SAFTI FIRST supplied interior and exterior 1- and 2-hour fire-resistive, ASTM E-119 rated walls using SuperLite II-XL in GPX Architectural Series Framing, as well as 60-90 minute full vision GPX Builders Series Temperature Rise Doors. Because sustainability and LEED were important for the project, the exterior fire resistive glazing systems included high performance energy efficient glazing to bring vision, daylighting and a connection to the outdoors while maintaining occupant comfort. The transparency that the interior fire resistive glazing systems provides extends natural light into the building, promotes shared artificial lighting between spaces, and promotes wayfinding. Additionally, having all the fire rated glass and framing systems manufactured within 10 miles of the job site helped in reducing impacts from transportation emissions and fuel costs.

"This project is near and dear to SAFTI FIRST, because Merced is home to our

manufacturing facilities," says Diana San Diego, vice president of marketing for SAFTI FIRST. "When this ambitious project was first announced, Mike Augustine, our director of architectural promotion, made sure that the University and building team knew that we are here to support them in all their fire rated glass and framing needs. This included an educational presentation and plant tour of our fire rated glass, framing and door facilities for the UC Merced Fire Marshals. Our territory manager Rafael Valencia and architectural sales representative Mike Vizcarra attended job site meetings with Webcor to ensure that we address all their design, performance, schedule and budget needs."

San Diego continues, "The sheer size and scope of this project, with multiple buildings, architects and glazing contractors, meant that coordination was of utmost importance. Our project manager Paolo Mercado worked with all the players involved to ensure that our delivery is on time and within budget."

A

TRANSFO

There are glasses that achieve the thermal performance of an opaque wall. There are glasses that can hold up a roof without the need for metal supports. There are glasses that can generate electricity, stand up to hurricanes, protect against the spread of disease, prevent intruders from entering a building. In short: “there is a proper glass product to fit any and

all applications,” according to Urmilla Sowell, technical and advocacy director for the National Glass Association.

“Glass is the only building product as strong as steel, that can withstand hurricane winds and that keeps you safe and comfortable,” said Sowell, speaking during the webinar panel, “There’s a Glass for That,” organized by the NGA and Architectural Record. The panel

took place in fall 2020 and hosted Sowell and three other experts in glass and architecture, discussing the capabilities of glass and how the glass industry and design community are redefining what’s possible with the material.

“Glass doesn’t corrode, it doesn’t age, it is infinitely recyclable and incredibly strong,” said panelist Sophie Penner, associate director of Enclos.

BRIMATW

———— MATERIAL

“Why glass? It allows you to do more than just a single job,” added Kai-Uwe Bergmann, partner at BIG. “Its transparency properties let you look out. It has the potential to provide structural solutions, taking some of the weight of the building into the façade. With colored glass you can create and make moods, atmospheres.”

The following pages present “Glass

and Metals 601: All that Glass Can Do.” The guide takes a deep dive into the energy performance capabilities of glass, spotlights a range of emerging glass technologies, and outlines the scope of design capabilities available with glass. It is based on discussions from the “There’s a Glass for That” panel, and the NGA-hosted webinars “Glass Can’t Do That, Can It?” and “Glass Options for a

Healthy Environment.” The webinars are available for on-demand viewing and CEU credit through glass.org.

ONLINE—

Access the complete six-part guide, All About Glass and Metal: A Guide to Glazing for Architects and Specifiers, at glass.org/store.

01

High Performance

This guide on All That Glass Can Do begins with a closer look at thermal and energy performance. When it comes to glass, the top demand from owners and designers are systems that allow projects to feature large expanses of glass while meeting energy code requirements.

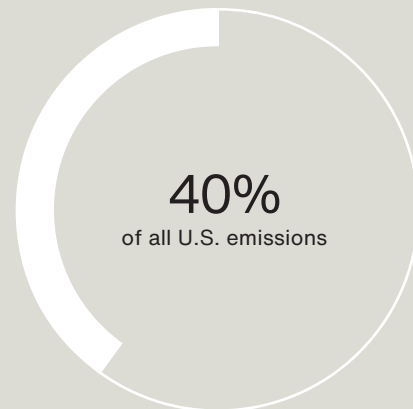
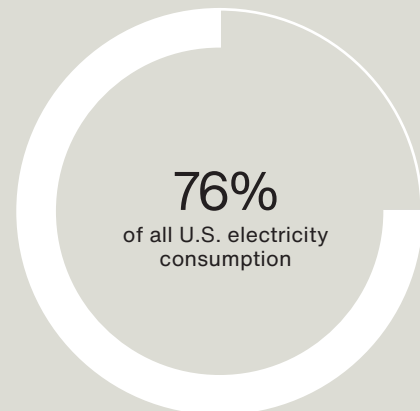
The national energy codes are becoming more stringent, cycle after cycle, according to Tom Culp, owner of Birch Point Consulting and energy code consultant for the NGA. Culp describes it as a rough “zone shift” in each updated edition. “Every three years, in our normal work at ASHRAE, IECC, California Title 24, we see steady advancement and uptake in energy-efficient technologies while also being practical and cost-effective,” he says.

In addition to the national codes, the building industry is seeing more aggressive jumps in energy requirements in local and state codes. (Read more about these requirements on page 52.) More rigorous performance targets are also being set by





The building sector accounts for:

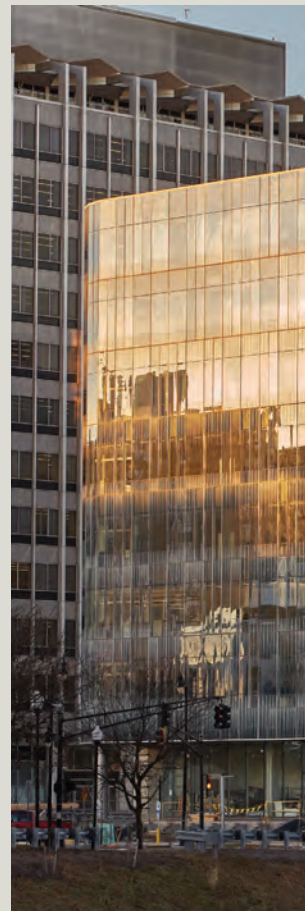
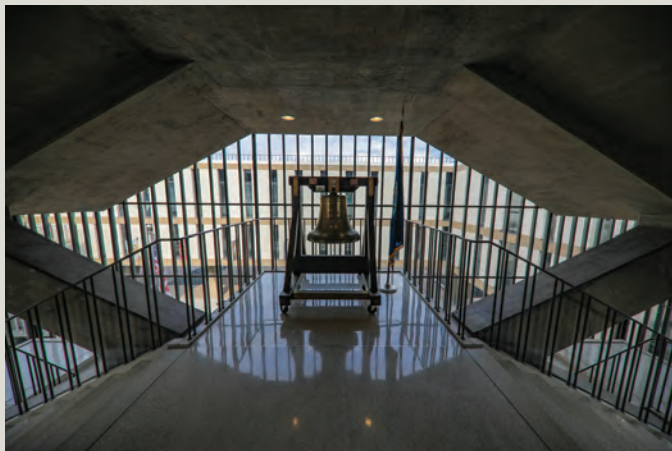


Source: U.S. Department of Energy



The new 707 Fifth “AAA” office tower in downtown Calgary, Alberta, features a distinctive, curved glass appearance with high energy efficiency and a comfortable interior. In spite of the cold climate, the 27-story, 564,000-square-foot building met its energy targets, due in part to the use of high-performance glazing systems. The project features Technoform’s bendable TGI Spacer M in a triple-glazed curtain wall system. The architect was Skidmore, Owings and Merrill. West Inc. was the contract glazier, and Tianjin North Glass supplied the bent, triple-pane IGUs with two custom low-E coatings from G-Crystal Glass Group. The thermal performance requirements of 707 Fifth included stringent whole unit U-factors of 0.91 W/m²K (0.16 hr/ft²F). Photo by Chad Koski.

A



C

programs such as Architecture 2030.

“The market is driving us to build office buildings with floor-to-ceiling glass. We want well-lit spaces,” says Robert Garlipp, technical designer and senior associate at Gensler’s Los Angeles office. To meet performance requirements in glass-clad spaces, “We have to use all the technology we have available and build really smart buildings with a really small footprint,” he says.

The glass industry offers a wide range of options to meet the toughest of requirements. Project teams can look

to improved glass units—low-emissivity insulating, with, for example, argon-fill, warm-edge spacers, fourth surface low-E and more, says Culp. Improved framing with high performance thermal breaks can be used to meet the full-window system performance targets. Multi-cavity insulating glass units or emerging products, such as vacuum insulating glass, achieve even higher thermal insulation values.

For daylighting control, the glass and glazing industry offers static solutions (for example, frits on the glass or

sunshades) and dynamic solutions (electrochromics, or automated blinds and shades). Dynamic shading devices can be automatically controlled to ensure systems perform optimally, says Stephen Selkowitz, retired senior advisor for building science and former group leader of the Windows and Envelope Materials Group in the Building Technology and Urban Systems Division at Lawrence Berkeley National Laboratory.

Energy-generating products are also possible, with building integrated photovoltaics. (Read more on page 54).



(B)

Using the right high-performance products and technologies is only half the battle, according to façade experts. “If it’s going to work, it has to work as an integrated system, based on what people need, what the building needs, what the grid needs,” says Selkowitz.

Additionally, the systems must be tuned for the building’s orientation. “One of our main concerns is always solar orientation,” says BIG’s Bergmann. “We’re looking at a building not only with four façades, but also the roof. We start by looking at the specifications of

glass, the transparencies, properties.”

Garlipp agrees. “We do a lot of variation on the façade, depending on the orientation. We use shading devices, different glass types. We work to respond to the environment and the needs for user comfort,” he says.

It is possible to design a glass/façade system that will outperform an insulated opaque wall. However, it comes with challenges, Selkowitz says. “We have to design it, build it, make it operate, and it may cost more. And we need to do it at scale, not just as a one-off,” he says.

A—Vacuum Insulating Glazing was critical to the restoration of the 1955 Eero Saarinen-designed “Bird Cage” at the Milwaukee County War Memorial. The Bird Cage is a double cantilever staircase enclosed with a glass and steel curtain wall. The glass, Pilkington Spacia VIG from NSG Group, provided two benefits to the project: thermal performance and a thin profile. The VIG has a thin profile that allowed the high thermal performance glass to be incorporated into the original, restored curtain wall system. The restoration project architect was HGA Architects and Engineers, the preservation consultants, Preserve LLC, and the glazing consultant and contractor, Restoric LLC.

B—The glass on the new Taxation Building in Trenton, New Jersey, features multiple high-performance attributes, including: double glazing with argon fill, low-emissivity coating, digitally printed frit for solar control and a warm-edge thermal spacer. The makeup is 1 1/16-inch VRE1-46 insulating glass, made up of 5/16-inch clear VRE-46 low-E coating and printed frit on the No. 2 surface, 1/2-inch argon airspace, and 1/4-inch clear lite. The center-of-glass U-value is 0.25 Btu/(hr x sqft x °F) in the winter and 0.21 Btu/(hr x sqft x °F) in the summer. Viracon was the glass fabricator and National Glass & Metal Co. was the glazing contractor. The architect was Ballinger. Photo by Greg West Photography.

C—Transforming an opaque recycling center into a daylight-filled creative office space, Gensler chose Solarban 70 glass to glaze large windows, clerestories and skylights for UPCycle in East Austin, Texas, a 2020 American Institute of Architects Committee on the Environment Top Ten Award winner. The glass systems deliver outdoor views to 91 percent of occupant workstations and predicted lighting power density is 0.27 watts per square foot. Vitro Architectural Glass was the glass manufacturer.



Upscale villas adjacent to Xi'an Tang Paradise in Shaanxi, China, feature vacuum insulating glass for the windows and skylights in the units' sunrooms. The glass is laminated LandVac VIG in maximum sizes of 69 inches by 73 inches. The units achieve a U-value of $0.4\text{W}/(\text{m}^2\cdot\text{K})$. LandGlass was the VIG supplier. Photos courtesy of VIG Glass Technologies.



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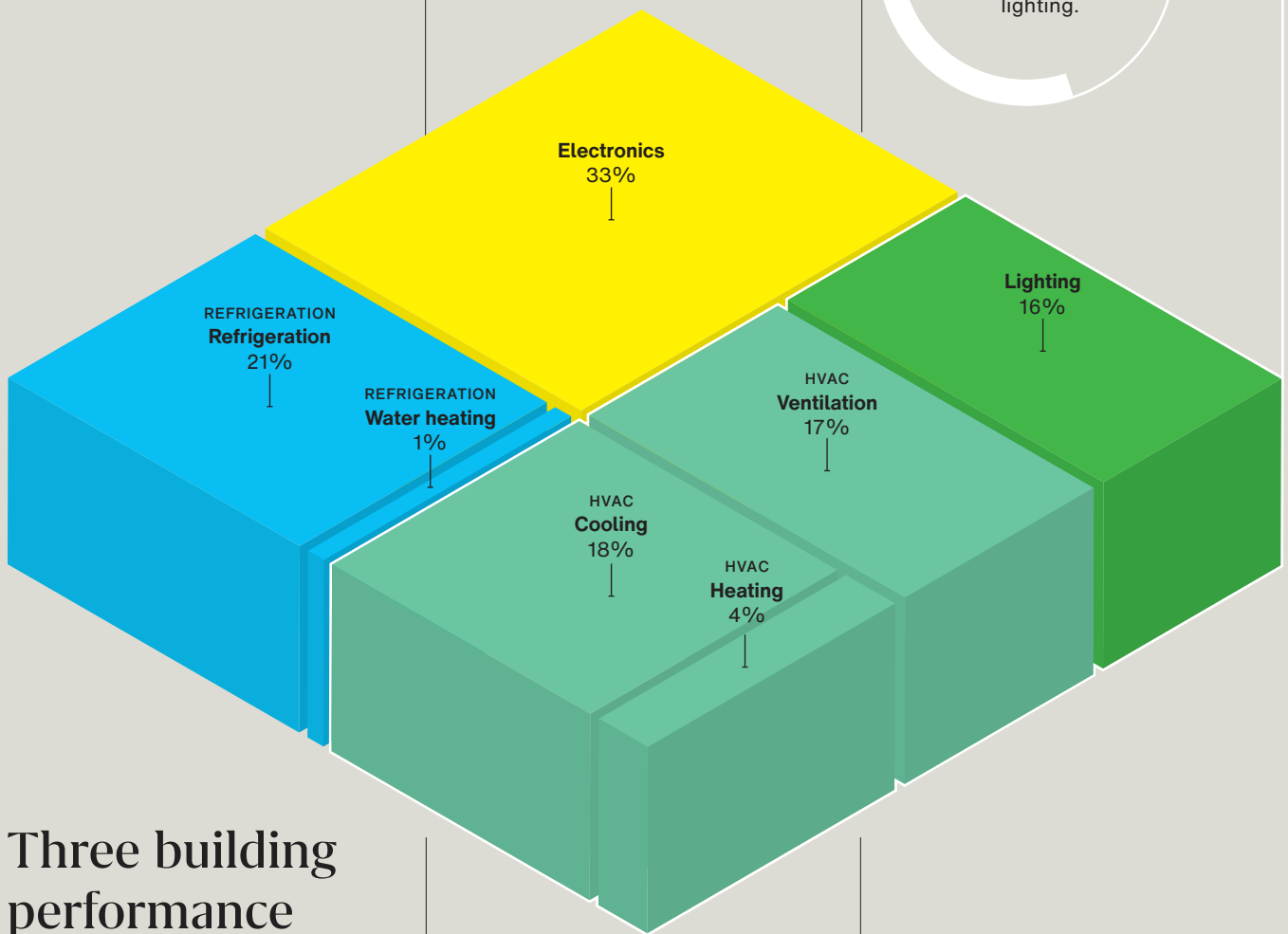
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How can glass and glazing cut down HVAC and lighting costs?



Three building performance cost-benefit questions to ask

The primary roadblock in adopting a high-performing glass product is cost. “Most of the time, [the products] are value-engineered out of a project,” says Sowell. However, the price tag for high-performance systems should be considered alongside the holistic costs of building construction and operations. Sources point to three primary areas to consider when weighing costs.

HVAC systems account for about 40 percent of total energy use in commercial buildings, according to the Department of Energy. Meanwhile, lighting systems capture about 16 percent of electricity costs. Building owners can offset costs in both areas through the use of high-performance glass and glazing products, and by maximizing natural daylighting.

“If we’re smart and do it right, we can

2018 total electricity use in commercial buildings. Source: Office of Energy Efficiency & Renewable Energy, DOE

reduce the size of HVAC. This is one of the most expensive parts of building. Reduce the size of the heating and cooling systems and take money saved and put it back into the façade,” says Selkowitz.

Performance at the highest level.

Technoform contributes to Space Needle glazing performance.

When it came time to renovate Seattle's beloved Space Needle, improving the thermal performance of the structure's visually-dominant glazing systems was a high priority. Glazing consultant Richard Green insisted on Technoform's warm-edge spacer for its leading thermal performance, while delivering the highest levels of durability and structural integrity. **Get the full story at Technoform.com/SpaceNeedle**

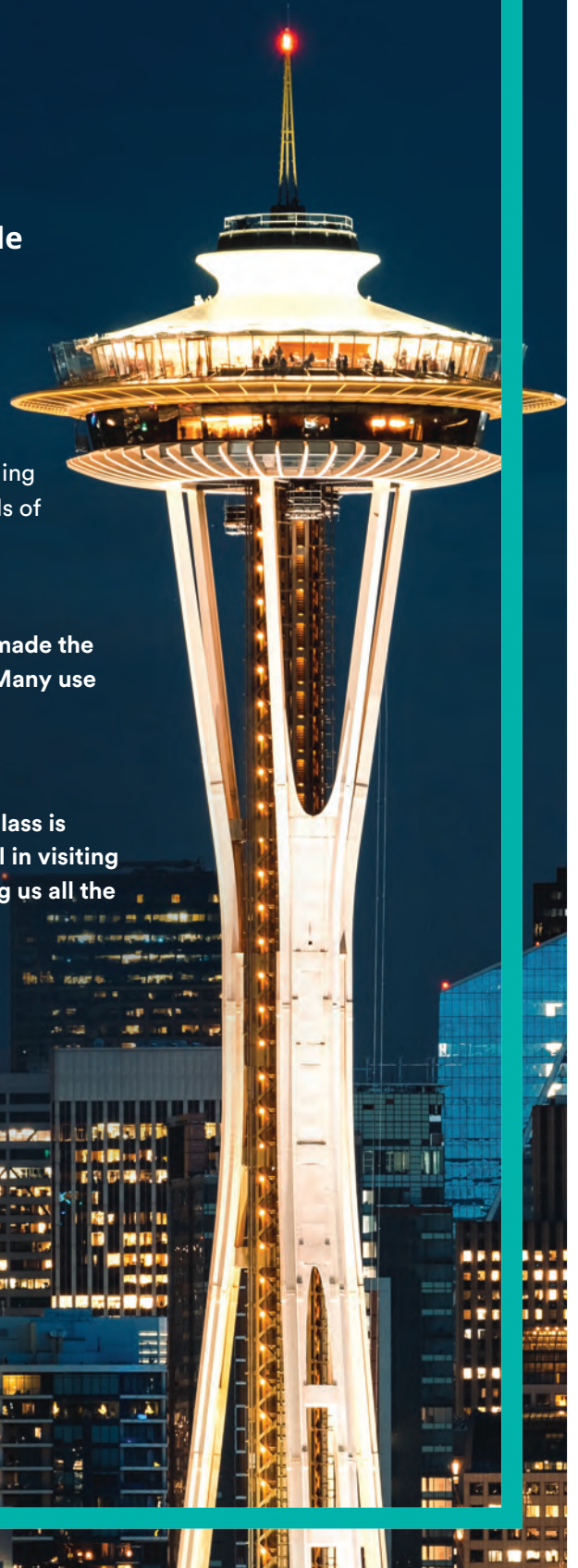
“Getting the right insulating glass spacers in there made the difference. Spacers tend to be a fabricator's choice. Many use stainless steel as standard; we needed better.”

— Glazing Consultant, Richard Green, P.E.

“Quality counts, and on this iconic project, where glass is everything, Technoform's team was extremely helpful in visiting our location, representing the product and supporting us all the way through the process.”

— Bernard Lax, CEO Pulp Studio

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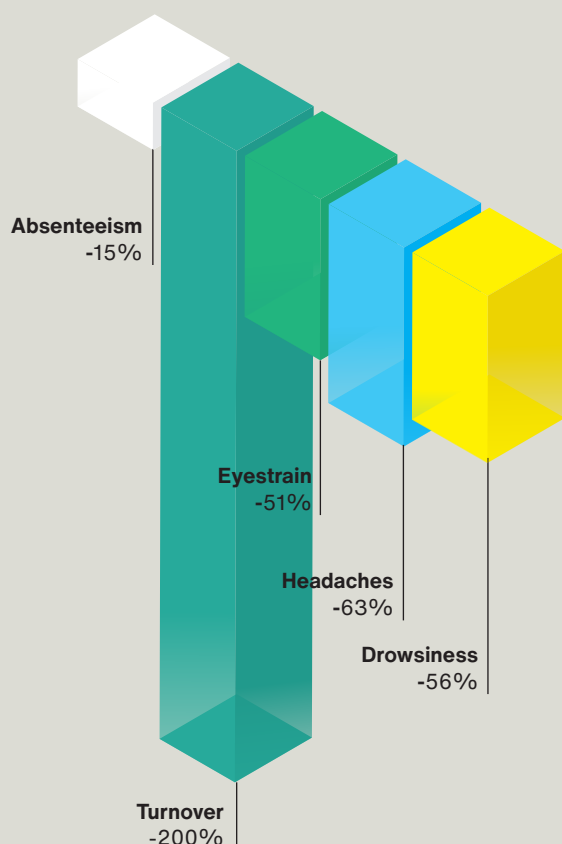


What is the payback of occupant comfort?

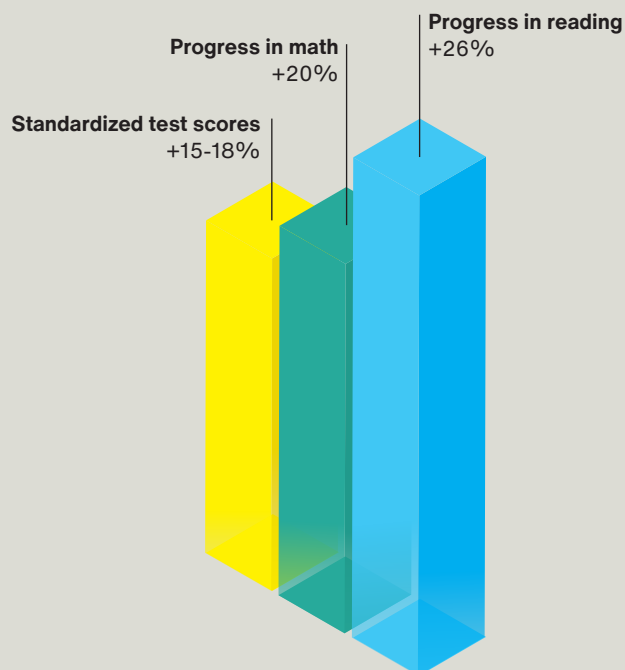
Sources: (absenteeism) independent studies from Lockheed Martin in California and ING Bank in the Netherlands; (turnover) study from Story County (Iowa) Human Services; (eyestrain, headaches and drowsiness) Department of Design and Environmental

Analysis, Cornell University, “Worker Reactions to Electrochromic and Low-E Glass Office Windows,” (in schools) Heschong Mahone Group, “Daylighting in Schools: An Investigation into the Relationship Between Daylighting and Human Performance.”

Benefits of daylighting among **office workers**:



Benefits of daylighting among **students**:



Glass and glazing—with benefits of daylighting, views, access to nature and more—are essential to occupant wellness. Numerous studies have demonstrated a relationship between glass and improved test scores among students, accelerated healing among hospital patients, and increased productivity and fewer absences among workers.

“An estimated 85 to 90 percent of our time is spent indoors. But we know our bodies need to be outside—we need to have that type of environmental connection to be happy,” says Sowell.

“There is a renewed appreciation of glass and glazing in terms of people and how they work and live,” adds Selkowitz. When the human costs of a building

are factored into building design and operations, the value of glass and glazing products greatly increases. “The most costly pieces [of building operations] are people,” says Selkowitz. “The cost of people is 10 times construction costs and 100 times operating costs.”

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How will performance disclosures and penalties affect owners?

A growing number of cities and states are adopting energy performance requirements beyond those in the national codes. “There is a new urgency in the codes—strong, quick action in response to climate change,” says Culp.

Legislation, such as Local Law 97 in New York City and Washington State HB 1257, are beginning to require post-occupancy building commissioning—performance measurements—with penalties for buildings that don’t meet requirements. “It’s essentially a carbon tax if you’re not building up to minimum levels,” Culp says. “This changes the economics.”

“The codes with proposed penalties [coming] down the road should encourage building owners to say, ‘hey, this really is a more economical approach in the long run.’ Otherwise, it’s a pay me now or pay me later situation,” says Charlie Boyer, principal, Boyer

& Associates, and consultant, VIG Technologies. “You might be installing something now, but five to 10 years later you’ll have to pay for new installations or upgrades. The time is coming to advance these technologies.”

Numerous other jurisdictions are moving toward performance benchmarking/disclosures for buildings. Culp points to legislation in dozens of cities in all parts of the country, from Seattle, to Boston, to Austin, Texas, to St. Louis, Missouri. Such disclosure requirements could affect real estate prices, incentivizing owners to prioritize performance, even without associated penalties.

By the Numbers

Sources: Urban Green Council and The Cooperator New York

Spotlight on Local Law 97

Square footage of applicable buildings

25,000

Requires owners to provide an emissions report beginning

May 1, 2025

Number of affected buildings

50,000

Fines owners 50 cents/sq. ft. for failure to report

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Next-gen performance technologies



(A)

In addition to incremental improvements, the industry is also seeing the introduction of technologies that mark a larger step forward in performance. “It’s an exciting time for glass,” says Miles Barr, cofounder of Ubiquitous Energy, producer of transparent solar. “The level [of] our imagination is the only limitation. I’m excited to see what we come up with.”

Industry officials point to several performance products with a growing footprint in

the market, in addition to the wide range of existing technologies in the industry.

VIG

Vacuum insulating glass offers thermal performance values that surpass those of traditional insulating glass units and, in some cases, begin to rival solid walls. “You have the same [visible light transmission] of a typical IGU, the same solar heat gain coefficient, but you take

with it an R-value of anywhere from 5 to 15 depending on the technology,” says Boyer. In hybrid combinations, with the VIG unit used in addition to a traditional IGU, the window achieves even higher R-values, he says.

VIG units feature two pieces of glass surrounding a hermetically sealed space separated with small pillars. The air is extracted to create a vacuum, Boyer says. The overall width of a VIG unit



Ⓑ

A—SageGlass Harmony from SageGlass, Saint-Gobain, which provides glare and daylight control and a seamless in-pane tint transition.

B—LandVac tempered VIG. Photo courtesy of VIG Technologies, IGE Solutions.

ranges from less than 7 millimeters to just over 12 millimeters—about $\frac{1}{3}$ the width of a traditional double-glazed IGU. The narrow profile makes it a promising option for retrofit and restoration, as the units can fit into existing profiles for single-glazed units, or they can be used in conjunction with existing glass to create hybrid solutions.

VIG also offers acoustic performance benefits and condensation resistance. It

is a popular option for refrigeration—for example, freezer and refrigerator doors at grocery stores.

BIPV

New code requirements for onsite renewable energy generation could drive use of building integrated photovoltaics. “In one big piece of news pushed through ASHRAE 90.1, there will be a new requirement—a prescriptive

requirement—for onsite renewables,” says Culp. “The push for renewables is coming not just in LEED buildings or green buildings, but all buildings.”

Photovoltaics are an option for owners pursuing energy generation not just through rooftop solar arrays, but through the building façade. “All buildings have lots of glass surface. We see that as potential to generate electricity,” says Barr.



Blue colored
Amorphous Silicon
BIPV from Onyx
Solar



Early building integrated photovoltaic technologies included visible solar cells on the glass and provided limited energy generation. In recent years, companies in and out of the industry have made moves to address aesthetic and performance concerns. Ubiquitous Energy, for example, developed a transparent PV window. “We want to do that while maintaining look and feel and aesthetic of standard glass,” says Barr. The technology offers transparencies between 40 and 80 percent and power conversion

of 1 to 10 percent. It is applied to the glass on a coating line, Barr says.

In another example, Onyx Solar has developed transparent solar product in addition to an amorphous silicon PV product that provides additional aesthetic options for designers. Onyx has also worked to increase the size of its solar products, to meet industry demands for large-format glasses.

Dynamic glass

Dynamic glass products—glasses that

shift from a clear to tinted state—have been around for decades, though the products have increased in use in recent years. The product technologies, primarily electrochromics and thermochromics, shift from a clear to tinted state, optimizing solar heat gain and visible light transmittance through a building’s façade throughout the day.

Recent evolutions in dynamic glass have included larger-sized units and units that can transition with a smooth gradation of tint.

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A high-end custom home in Newport Beach, California, features large rooftop skylights in addition to a “walkable glass skylight” that bring natural light deep into the residence. The walkable glass is the Crystal Clear Glass Flooring with GlassGrit surface from Jockimo Inc. SC Homes Inc. was the designer and Industrial Skylights the installer.



Part Two of All That Glass Can Do looks beyond energy and thermal performance to the other wide-ranging capabilities of glass, such as security glass, large sizes, curved assemblies or decorative glasses and more.

Glass’ strength, durability, flexibility and transparency allow it to tackle a seemingly endless list of building applications. “Glass is used for hundreds of applications,” says NGA’s Sowell. “It’s used in museums, zoo enclosures, glass igloos, swimming pools in high-rises, for stained glass and more.”

Note that the wide-ranging glass applications discussed in this section often serve multiple functions and incorporate the high-performance attributes discussed in Part One of the guide.

Strength and flexibility

“Glass is extremely strong,” says Enclos’ Pennetier. “In compression, the strength of glass is of the same order of magnitude [as] that of steel,” she says.

The material’s inherent strength allows designers to incorporate glass into increasingly ambitious structural applications. Consider glass floors and stairs, or floor-to-ceiling walls that don’t require additional structural supports. These design elements, made popular in Apple stores around the world, are finding their way into more and more projects, according to the façade experts.

Some specific glass types and applications that are made possible due to glass’ strength and flexibility:

LARGE SIZES—

“The glass panels fabricated now are up to 3.6 meters in width and 20 meters in length. That’s 11 ½ feet by 65 feet. And it can be laminated, hot bent, cold bent and more,” says Pennetier. While glass companies are able to manufacture and fabricate larger and larger sizes, project teams must also consider logistics. “You have to be able to lift it and ship it to the site. Our typical containers used here go



up to 40 meters. It can be done, but you have to find ways to divide these costs,” she says.

CURVED—

Curved units can be insulated, laminated, low-E-coated, in large-size format and more. In its curved shape, glass becomes even stronger, describes BIG’s Bergmann. “We think about things in tension and compression. ... Flat panels work wonderfully in compression, but don’t do well in tension. By curving the glass, we make it more resilient in tension,” he says.

ULTRA-THIN—

Researchers are seeking ways of leveraging ultra-thin glass in architectural applications, which could present exciting opportunities for structure and performance in the future, describes Pennetier. The glass, commonly used in electronics and semi-conductors, brings a strong and extremely lightweight material option to the building industry. “Overall, you’re looking at the lower use of materials and less weight. You could curve with less energy. You could consider applications such as double skins. That’s where I see potential for ultra-thin glass materials,” she says.

Safety and security

Glass and glazing protects building occupants from everything from weather threats to fires. Attention in recent years has been directed at the industry’s solutions for school security, for example, intruder-resistant entrances and systems.

SECURITY—

The industry can produce security glass for various levels of glazing penetration resistance. The levels, in ascending order: basic, enhanced, ballistic protection, forced entry, enhanced forced entry,

Oversized, curved lites of glass from Saint-Gobain, on display at glasstec 2018. Photo: Messe Düsseldorf, Constanze Tillmann.



multiple forced entry assault and blast mitigation. In terms of product makeup, security glass is often laminated, sometimes with multiple layers of glass or polycarbonate. Films can also be applied to strengthen glass.

IMPACT-RATED—

For decades, the glass industry has produced systems to meet even the most stringent wind-load and impact codes, such as those in the high-velocity hurricane zone regions. Glass companies are pushing the envelope to develop hurricane-rated systems that meet architect and owner demands for larger sizes and more minimal framing.

FIRE-RATED—

Today’s fire-rated glass and glazing systems are rated for 20-minute to 2-hour protection in walls, doors, windows and even butt-glazed assemblies. Leading suppliers are developing solutions for interior and exterior applications that match non-fire-rated systems, while protecting against the spread of fire and providing ways for occupants to exit safely in event of a fire. A popular application driving innovation in the sector: fire-rated glass floors, according to suppliers. The systems allow daylighting to pass through while protecting against spread of fire between floors.

Occupant health

Part One of this guide discussed the impact of daylighting on occupant comfort, health and performance. However, buildings must provide more than access to daylighting to ensure a healthy indoor environment. Building design also addresses potential toxins or pollutants in the air, acoustical concerns and, of great importance now in the time of COVID-19, potential pathogens.



“The built environment significantly affects human health,” says Kayla Natividad, architectural technical services engineer, NSG Pilkington. “The exposure to toxins and pollutants, the air quality, water quality, noise pollution, all have significant effects on chronic health. Now we also have introductions of pathogens.”

Some product and design considerations to foster healthy built environments:



VENTILATION—

Commercial building designs have focused on airtightness. However, “This could have adverse effects on indoor air quality,” says Natividad. “If you have ever been in a building and your sinuses start to act up, you have itchiness in your eyes ... this may have been related to indoor air quality.”

Health Product Declarations require that building material suppliers disclose

the potentially harmful contents of their products. Natividad notes that the U.S. Green Building Council “recognizes glass as an inherently non-emitting product. Coated glass products can have a net positive impact on indoor air quality,” she says.

The pandemic has accelerated calls for better building ventilation. “We want more fresh air, we want more air circulation, we want more daylighting and UV

rays to help in this pandemic moment,” says BIG’s Bergmann.

PROTECTIVE COATINGS—

Glassmakers have developed a range of sophisticated glass coating solutions for healthier environments. These include hydrophobic and oleophobic—repelling water and oil, respectively—solutions, and anti-viral and anti-bacterial coatings. “We have options available that help with



↑ The new Moynihan Train Hall, located in New York City's Penn Station, features a series of photographs from Stan Douglas, digitally printed on glass, depicting moments in history from Penn Station. The images were recreated on glass using ceramic frit paint, digitally jetted onto the surface of OptiWhite, extra-clear, low-iron float glass. The artwork is spread across nine oversized glass panels, installed in four niches: each niche measures 6 feet 1 $\frac{5}{8}$ inches high by 22 feet 2 $\frac{1}{2}$ inches wide, and $\frac{1}{2}$ -inch deep. GGI fabricated the glass using its Alice direct-to-glass printing. Photo courtesy of Public Art Fund.

cleaning and disinfecting, and manufacturers have responded by developing products that reduce surface transmission of bacteria and viruses," Natividad describes.

Decor and technology

"Glass is able to create more than just a view out," says Bergmann. "You can use it to create moods, atmospheres. Glass affects a space in a phenomenological sort of way—think about how it makes you feel."

Architects and artists look to glass to create beautiful, durable spaces in and out of buildings, and glass fabricators provide near endless options for them to do so. Glass can be digitally printed, etched,

silk screened, laminated with decorative interlayers and more.

Additionally, the industry is beginning to incorporate new technologies into glass and windows. Some emerging technologies:

PHOTO-REALISTIC DESIGNS—

Glass fabricators can achieve resolution quality upwards of 2880 DPI thanks to advancements in printer technology. Designers can print nearly any design in photo-realistic quality on glass with the promise of durability and longevity.

MAGNETIC MARKER BOARDS—

Glass marker boards are a niche, but

increasingly popular, application. The laminated, safety glass boards serve as a writable wall cladding. Many glass suppliers offer magnetic marker boards, which are available in custom colors.

SWITCHABLE, INTERACTIVE GLASS—

Architectural glass companies are also developing switchable and even interactive smart glass products. Switchable products can provide privacy, turning from clear to opaque at the flip of a switch. The application is becoming more common in changing rooms and restrooms. Companies are also pushing to add interactivity to their switchable products for applications such as multimedia walls.

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Resources

The National Glass Association offers 90 in-depth glass technical papers and Glass Informational Bulletins, written and developed by industry experts for architects and specifiers, fabricators, glaziers, suppliers and manufacturers, and others involved in glazing and glass building products.

Several glass technical papers that address topics included in this guide:

Products for Energy Performance

NGA Task Group Member companies:

- 3M
- Fenzi North America
- Helima Helvetion International
- Technoform
- Viracon
- Vitro Architectural Glass

Vacuum Insulating Glazing, an Introduction

NGA Task Group Member companies:

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- NSG Pilkington
- VIG Technologies LLC
- Viracon
- Vitro Architectural Glass

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- Manko Windows
- McGrory Glass
- Midwest Glass Fabricators
- Oldcastle BuildingEnvelope
- SWM International
- Technical Glass Products
- Tristar Glass
- Trulite Glass and Aluminum Solutions
- Viracon

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Find these and more NGA Glass Technical Papers at glass.org/store. Click Browse, then search keywords or sort by type. Additionally, access AIA continuing education resources at glass.org. Click “Resources” and find “AIA Continuing Education” in the Education and Training section.

Glass and Metals 601 is the final installment of Glass Magazine’s six-part series “All About Glass and Metal: A Guide to Glazing for Architects and Specifiers.” The complete series provides an in-depth look at specification and design for glass and glazing. It begins with “Glass and Metals 101: An Introductory Guide to Glazing for Architects and Specifiers” and in subsequent sections covers topics ranging from specifications to interior glass, protective glazing, glass and the energy codes and more. To access the complete series, visit glass.org/store.

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PRODUCTS

01



01. Solar control glass

Vitro Architectural Glass launched Solarban R77 solar control, low-emissivity glass. The building-code-friendly glass features a magnetron sputtered vacuum deposition coating, and delivers a solar heat gain coefficient of 0.25 in a clear 1-inch insulating glass unit. It also offers visible light transmittance of 47 percent in the same configuration, providing clear exterior views and illuminating interiors with soft, natural, neutral daylighting. Exterior reflectance is 25 percent.

412/820-8500 | VITROGLAZINGS.COM

02



02. Pattern collection

Tecglass launched the Transparent Collection, a range of special graphic pattern options for interior glass decoration. The patterns open up a new range of possibilities with digital printing applications, according to officials. The transparent textures, developed by Tecglass graphic designers, allow maximum transparency while achieving a comfortable privacy level. The patterns are available at the Tecglass online Vitro Design Catalog, where the selected pattern can be previsualized in different interior settings.

+{34} 986-787-627 | TECGLASSDIGITAL.COM



04

03

03. Impact system

Oldcastle BuildingEnvelope released an enhanced version of its StormMax storefront system. This hurricane-resistant system was updated to make installation easier, say officials. The StormMax FG-5700, FG-5750 and FG-5750T storefront systems also feature additional infill options, 12-foot frame heights and simplified anchoring. Combined with both inside and outside glazing options as well as pre-glazing, the systems offer maximum flexibility to provide customers exactly what they need for every job, per OBE officials.

866/653-2278 | OBE.COM



04. Aluminum railing

The Trex Signature railing collection is an ideal choice for any commercial setting, according to Trex Commercial Products. With its straightforward, classic design Trex Signature spans long lengths for panoramic sightlines from balconies, patios, decks and public walkways. Additionally, it can be installed with continuously graspable rail options for added safety, comfort and functionality. It's available in Charcoal Black and Classic White, and modifiable to accommodate many commercial project needs.

877/215-7245 | TREXCOMMERCIAL.COM

05. Steel window

EFCO Corp. introduced its new 590X Steel Replica Window, which replicates the look of a classic, industrial steel window in a choice of three standard profiles—bevel, cove and t-grid—or in made-to-order options. Finishes also can be specified with different colors on the exterior and interior to complete the desired architectural aesthetic. Applications include new construction or renovation of mid-rise buildings such as schools, universities, student residences, courthouses, hospitals, offices, retailers and properties on the National Register of Historic Places.

800/221-4169 | EFCOCORP.COM

Training course *(not pictured)*

Ametek Surface Vision now offers remote training courses to provide safe, convenient instructions on how to get the best performance from its online surface inspection solutions. The online training sessions allow customers to discover all the features and benefits of the SmartView defect detection and identification system, building technical proficiency, increasing operational productivity and maximizing system uptime. It uses a “live” training system to reinforce the material and focus on particular customer tasks.

610/647-2121 | AMETEKSURFACEVISION.COM

Software interface *(not pictured)*

A+W developed a new interface, the A+W Gantry Interface. The new software interface allows users to synchronize glass inventories in glass storage systems from Hegla, Bytronic, and Lisee by utilizing the A+W ERP systems, such as A+W Business Pro and A+W Business. The new interface also allows users to automate stock by allowing employees to keep and avoid deviating inventories in storage and the A+W ERP system. This enables employees to generate orders based on actual inventories.

847/471-4387 | A-W.COM

06. Frameless impact railing

Faour Glass Technologies announced that the Slimpact Railing was issued its product control notice of acceptance, or NOA, for large missile impact in Miami-Dade County and its municipalities. The glass railing is part of the family of Slimpact frameless impact glazing solutions that includes window walls, pivot and automated entry doors, skylights, and now railings. According to company officials, the railings complement the company's line of frameless impact glazing solutions for the high-end commercial market.

813/884-3297 | SLIMPACTVIEW.COM

01



03

02



01. Fabrication machinery

GED Integrated Solutions introduced the new generation of its Colonial Muntin Machine, CMM 2.0. The new controls permit onsite and offsite machine diagnostics by taking advantage of the modern Ethernet I/O, as well as providing a long machine service life. CMM 2.0 can make five notches simultaneously with the ability to quickly interchange tooling for optimal production flexibility. Safety features include presence sensing technology that integrates a light curtain into the normal production sequence while at the same time preventing unwanted operator-machine interaction. 330/963-5401 | GEDUSA.COM

02. Grinding wheel

The need to regularly stop grinding machines to remove built-up plastic waste during the processing of laminated glass can present a problem for fabricators. To solve this issue, Tyrolit product specialists developed a wheel, Reverse. The wheel features different slots angled in opposite directions—hence the name Reverse—which are designed to break plastic waste into small fragments that can be easily drained away from the grinding area. 800/239-2902 | TYROLIT.GROUP

03. U-clamp

C.R. Laurence Co.'s new Adjustable U-Clamps are designed for use with CRL Z-Clamps to create a versatile barrier system. Users can easily attach them to existing vertical surfaces by sliding the clamping mechanism to the desired location and tightening screws. No drilling or permanent installation is required. Adjustable U-Clamps are compatible with Z-Clamps that accommodate ¼-inch, ⅝-inch, or ¾-inch thick extension panels, and are offered in round and square profiles. 800/421-6144 | CRLAURENCE.COM



Silberhorn

Apogee Enterprises

Apogee Enterprises Inc.'s board of directors named *Ty R. Silberhorn* as the company's new CEO and a member of the board of directors. Silberhorn will join Apogee from 3M, where he was senior vice president of transformation, technologies and services. This appointment follows the company's previous announcement of Joseph F. Puishys' planned retirement. With Silberhorn's appointment, Puishys is stepping down from his position as chief executive officer and board member.

Silberhorn will become the fifth CEO in Apogee's 71-year history. He joins Apogee following over 20 years at 3M, where he worked to reshape 3M's efforts in business process and digital transformation to further enable growth and productivity. Prior to this position, he held several global business unit leadership roles, serving as vice president and general manager for divisions within three of 3M's business groups, including Safety & Industrial, Transportation & Electronics, and Consumer.



Dwyer

Syracuse Glass

Syracuse Glass Co. will transition leadership from President *John Dwyer* to newly hired CEO *Joe Gudenburr* as part of a designed succession plan. Dwyer will continue to act as SGC's chairman of the board and provide ongoing support to the business.



Gudenburr

Dwyer joined SGC in 1984 and has served as president since 2005, overseeing a period of transformative growth through an unwavering commitment to product line extensions, product quality and customer service.

Gudenburr is a highly accomplished business executive with more than 30

years' experience leading and growing businesses in the sales and marketing, manufacturing, supply chain, service, logistics and distribution arenas. Gudenburr joins Syracuse Glass Co. from Sprague Energy, where he was the division general manager for a \$150 million delivered fuel business.

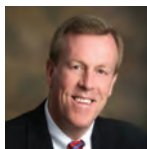


Mahedy

Hartung Glass

Hartung Glass Industries hired *Paul Mahedy* as chief operating officer.

A 35-year veteran of the glass industry, Mahedy's commitment and contributions to glass fabrication are well-known; he has held several high-level roles, including industrial engineer, general manager and COO with some of the largest fabricators in North America.



Altman

NSG Group

The head of NSG Group's architectural business, *Richard "Dick" Altman*, retired on March 31 after 41 years of service.



Weidner

Altman joined Libbey-Owens-Ford in 1979 and has seen the company transition from LOF to Pilkington to the NSG Group. He was named

regional director of architectural glass and solar in 2006, and in this role has been responsible for the company's architectural business as well as the growing solar business. Most recently he led the successful commissioning of the new Luckey, Ohio, float glass operation.

Stephen Weidner has been named head of Architectural North America, replacing Altman. Weidner has been with the company for 33 years and in the flat glass industry for more than 40 years. Most recently he held a dual role leading the commercial side of the architectural business in North America and a global role driving the value-added strategy for the company. ■

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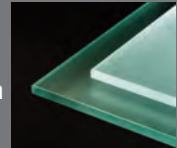
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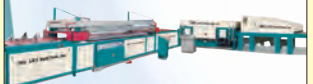
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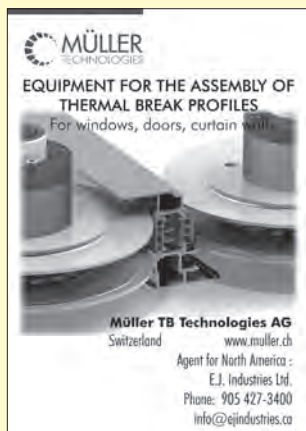


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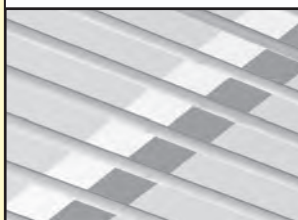
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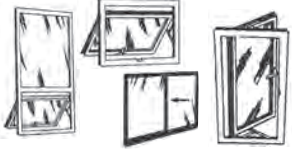
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Companies from all parts of the glass and glazing industry have implemented innovative, out-of-the-box ideas to improve business from the ground up. Here's an Idea showcases these sometimes small behind-the-scenes ideas that can make a big impact on a company's bottom line. If you have an idea that you would like to share, contact Norah Dick, ndick@glass.org.

REDUCING CYBER SECURITY RISK FOR A REMOTE WORKFORCE

There's no question that the pandemic has made remote work more of a necessity than ever before, a situation that has led to a rise in cyber security risks. According to "Cyber Security: Protocols for Manufacturers during COVID-19," produced by the National Association of Manufacturers, the COVID-19 work experience can create unique vulnerabilities for companies, as employees' home networks may not be as secure as traditional business networks.

What kinds of cyber risk are there?

There are many kinds of cyber security risks. According to NAM's report, some of the most common cyber threats include ransom or ransomware, an attack during which a third party infiltrates a company's network, and remotely holds a company's files or systems hostage, restricting access until the person's money demands are met. Additionally, a phishing scam can arrive in the form of an email, or attached document, that seems to be from a trusted source but is designed to allow a third party to steal the email recipient's, or the company's, information.

What can an employer do?

Update all systems. eSentire, a cyber security firm, recommends that companies ensure that all computer systems are up to date, including

workstations and servers. The firm also recommends restricting the downloading of applications.

Create a closed or segmented network. NAM's guidelines also recommend implementing a virtual private network, or VPN, for home network users. This kind of network is closed, securing it from outside users, and offers a secure and encrypted connection between devices and the company server. A company can also divide its network into several segments that are not connected, which limits the impact of a data breach in any one segment.

Train employees. Both NAM and eSentire emphasize the importance of employee training. This includes making staff aware of the ways to securely access the company's systems, and what current cyber threats look like. Sending employees "tests," such as practice phishing emails, is one tool to gauge employees' understanding.



What can employees do?

Follow email best practices. As stated, phishing scams are a common type of cyber-attack that employees should be aware of. The IT solution firm designData recommends that users always hover over links in emails to make sure they're legitimate, and to never click on an attachment until the reader determines that the email is legitimate. Users should also distrust emails that have threatening language or ask for personal information, they say.

Change passwords. According to a 2019 Verizon data breach report, 81 percent of data breaches resulted from stolen or weak passwords. DesignData recommends that users ensure that all accounts have different passwords, with a length of 15 characters or more. The firm also recommends password managers, such as LastPass, that generate unique passwords for all accounts, as well as two-factor authentication applications that require users to provide two pieces of information in order to access an account. ■

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