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MAGAZINE[®]

THE GLASS AND GLAZING AUTHORITY • JANUARY/FEBRUARY 2022

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THE 2022 FORECAST

What stands in the way of recovery?

PLUS

FLOAT GLASS
UPDATE

DAYLIGHTING AND
VIEWS

CODES AFTER
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BY NORAH DICK

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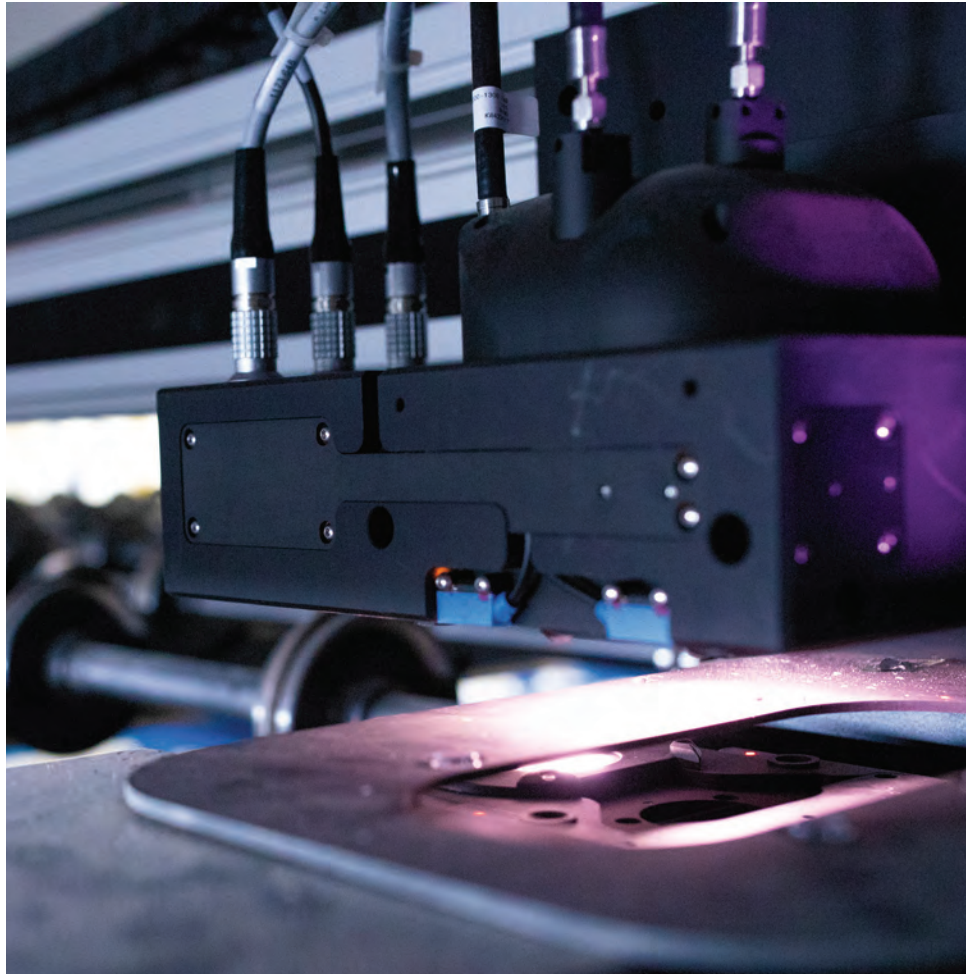
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Above: The North American float glass industry continues to push toward larger sizes and high-performance glasses. Pictured is Coater7, an MSVD coater that can process jumbo glass, at the Wichita Falls, Texas, facility of Vitro Architectural Glass. The World of Glass Special Report, beginning on page 56, offers more on investments, acquisitions and other updates from the float glass segment.



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From NGA Glass Conference: Long Beach, Jan. 24-26

GLASSBLOG



PROJECT MANAGEMENT 3 Ways to Create Project Profitability

By William Green, Technoform



ENERGY EFFICIENCY Don't Forget the Frame

By Tammy Schroeder, Linetec



FORECAST Confidence Builder into 2022

By Max Perilstein, Sole Source Consulting

PROJECT SHOWCASE



Featured in Glass Magazine Weekly and on GlassMagazine.com. To submit projects or case studies, write [Norah Dick](mailto:norah.dick@glass.org), ndick@glass.org. Pictured: The Assembly, a multifamily building in Indianapolis, Indiana, enjoying a former life as The Old Ford Building, a car manufacturing plant. The redevelopment project used 600 of Quaker Windows & Doors' historically accurate H600 fixed

and awning windows to preserve the historical design.

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Vienna, VA 22180
P: 703/442-4890

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

mgriffin@executivepublishing.com • 410/459-0158

Tim O'Connell

toconnell@executivepublishing.com • 443/717-1425

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2022 Crystal Ball

In early December, I sat down with my friend, the famous From the Fabricator blogger/podcaster and head of Sole Source Consultants, Max Perilstein. We took out the 2022 crystal ball and chatted through our projections for the industry in the new year. ►

Inflation and supply



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

MP: The biggest concern I see going into 2022 is price escalation. No one has a feel for how that's going to play out and look. Your smart businesses are going to be able to survive. But, there is going to be disruption, with some companies not able to make it through 2022. It's a combination of supply chain, price escalation and the COVID situation. That's the bad news side.

KD: It seems like many companies came into 2020 with more cash on hand. They seemed to be more resilient at the start of COVID. But it's been two years of uncertainty.

MP: That resilience was also the PPP. We saw big numbers of companies getting PPP loans. But you can only run on that for so long.

KD: You mention supply chain, which has been the big concern among everyone I've talked to for months. My forecast is that we will start to see improvement midway through the year. Ports are working at record levels. Supply will start to catch up to demand.

MP: The smaller components, hardware, spacer, that will start to loosen up. Glass will still be challenging.

Vaccination roadblocks

KD: I worry that the construction industry's low vaccination rate is going to be a problem in 2022.

MP: Even with no OSHA mandates, we're already hearing from glaziers that they are struggling to man jobs that have a vaccination requirement. If the mandates do hold up, and companies with more than 100 employees need vaccinations, that is really going to affect our fabricator base as well. Companies are trying very hard, but the messaging on this has been such a mess from the beginning. I've heard of one fabricator in Mississippi that is incentivizing workers with \$1,000 to get the vaccine.

KD: Yes, I've heard something similar from a glazier

that is doing the same. They said even such a large incentive ends up paying off, as there is less missed time due to COVID absenteeism.

Product and process improvements

MP: Glass companies are finding they have to be more sophisticated. They know that sustainability is the way to go. They know they have to sell higher-margin products—things that also do well by the environment, whether it's net zero, bird-friendly, solar.

KD: Similarly, companies are becoming more sophisticated in their processes. COVID has forced them to digitize, to introduce automation, to bite the bullet and invest in those solutions. They need to increase productivity with fewer people.

Interior boom

MP: I really thought interior explosion would happen in 2021, but it was delayed due to delta. Even now, with the new variant coming through, companies are moving ahead with their renovations. These interiors, especially in city, are being gutted and remodeled. Every design is open floor plan with glass and glazing. We'll have a good start to that in 2022, and it's going to continue.

Hot takes in sports

KD: I can't bring you in for a 2022 forecast without getting your bold predictions in the world of sports. Who do you have coming out on top next year?

MP: I think the Baltimore Ravens are going to win the Super Bowl.

KD: Wow, that is a hot take, Max. Okay. I'm going to be a homer and say, despite the antics of Aaron Rodgers, the Packers will take it.

MP: For the NBA, I do like your Milwaukee Bucks to repeat. There's nothing like Giannis.

KD: I like that prediction. Here's hoping. Bucks in Six. ■



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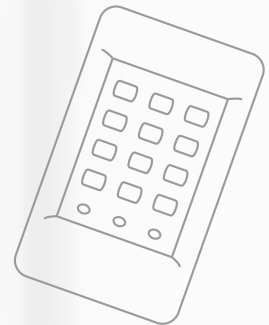
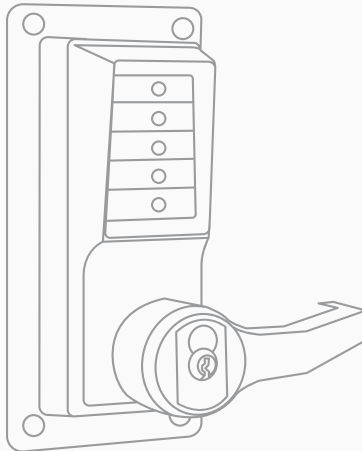
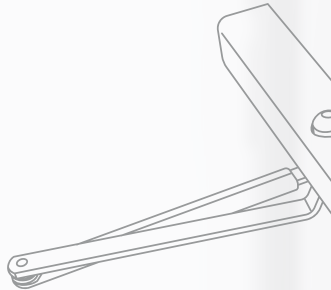
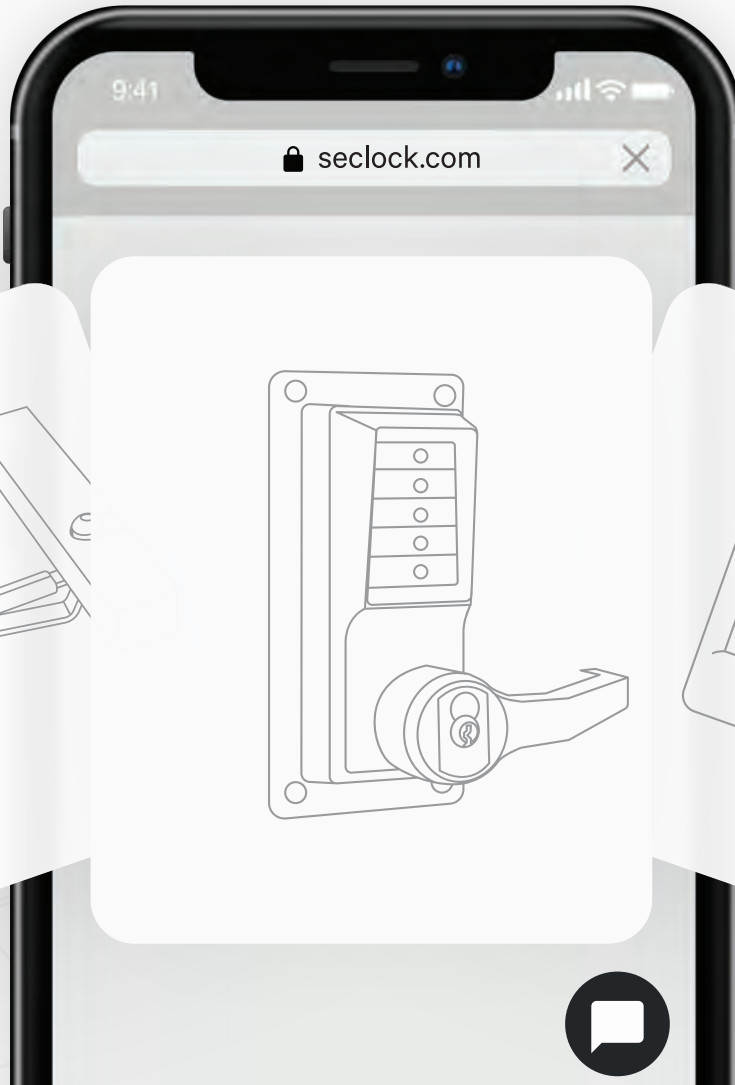
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2022 IS THE INTERNATIONAL YEAR OF GLASS

The year 2022 has been declared the International Year of Glass (IYOG 2022) by the General Assembly of the United Nations. The year will celebrate the essential role glass has in society, serving as a life-changing material in architecture, the environment, health care, science, technology and more, according to IYOG organizers from the International Commission on Glass (ICG), the Community of Glass Associations (CGA) and ICOM-Glass.

In the United States, the National Glass Association will lead efforts to promote the solutions glass provides to the built environment. Additionally, NGA will use IYOG 2022 as a platform to spotlight the glass industry as home to exciting and rewarding careers to the next generation of workers.

IYOG activities will take place throughout 2022. Learn more at glass.org. ■

BEC CONFERENCE AND GPAD HEAD TO NASHVILLE

NGA announced the co-location of two solutions-focused educational events in 2022: the Building Envelope Contractors (BEC) Conference for glazing contractors, and Glass Processing Automation Days (GPAD) for glass fabricators focused on software and machinery efficiencies. The conferences will run March 27-30 in Nashville.

The BEC Conference will take place March 27-29, and features educational presentations, marketing presentations and tabletop displays. GPAD is March 29-30 and offers presentations by technical experts from leading production and technology suppliers.

Each event will retain its traditional elements and will be enhanced with overlapping programming intended to “bridge” the supply—connecting glazing contractors, fabricators and suppliers alike—in a way that promotes greater communication and collaboration in the midst of many challenges impacting the supply chain. The “Bridge Day” presentations will take place the morning of March 29.

Visit glass.org/events/conferences for more information. ■

NGA RELEASES NEW FRAMELESS SHOWER ENCLOSURES TECHNICAL DESIGN GUIDE

NGA published the Frameless Shower Enclosures Design Guide, the second guide available in NGA’s new technical resource category. The new design guide category is intended to fill a targeted need for more in-depth guidance and recommendations related to design and installation best practices for the glazing and glass products industry.

“The Frameless Shower Enclosures Design Guide brings together information from across the industry to provide guidance on the recommended design approach to frameless shower enclosures. As the interior design trend for more glass and low profiles continues to grow, this design guide fills a long-held gap in the information available on the product,” says Urmilla Sowell, NGA advocacy & technical director.

The new design guide discusses design considerations for frameless shower enclosures including doors and fixed panels, dimensional and weight tolerances and limitations, hardware and structural support, visual quality expectations, and cleaning and maintenance guidelines. It also addresses specialty glass considerations when using patterned or coated glass.

“The frameless shower industry has been working towards issuing a safety-minded design guideline for decades,” shared task group chair Danny Donahue, FHC Inc. “With the publishing of this new resource, the NGA has succeeded in addressing the needs of a billion-dollar business that, until now, has functioned with tribal knowledge passed from one glazier to another. This design guide is the document frameless shower installers have been clamoring for to support their design methods with an emphasis on safety.”

The Frameless Shower Enclosures Design Guide is now available for purchase among a host of additional resources in NGA’s Store at glass.org. ■

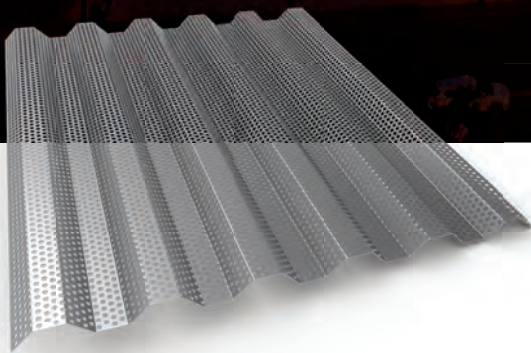
Artful Perforation



An art-inspired perforated screen with lights at abstract angles serves to mask the parking area. The transparency balance is key. "We wanted to push the perforation ratio to the minimum open area allowed by code. This made each screen read more like a skin than an opening."

-Knox Jolly, RA, Lord Aeck Sargent

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GLASS INFORMATIONAL BULLETIN

Benefits of Decorative Glass in Daylighting

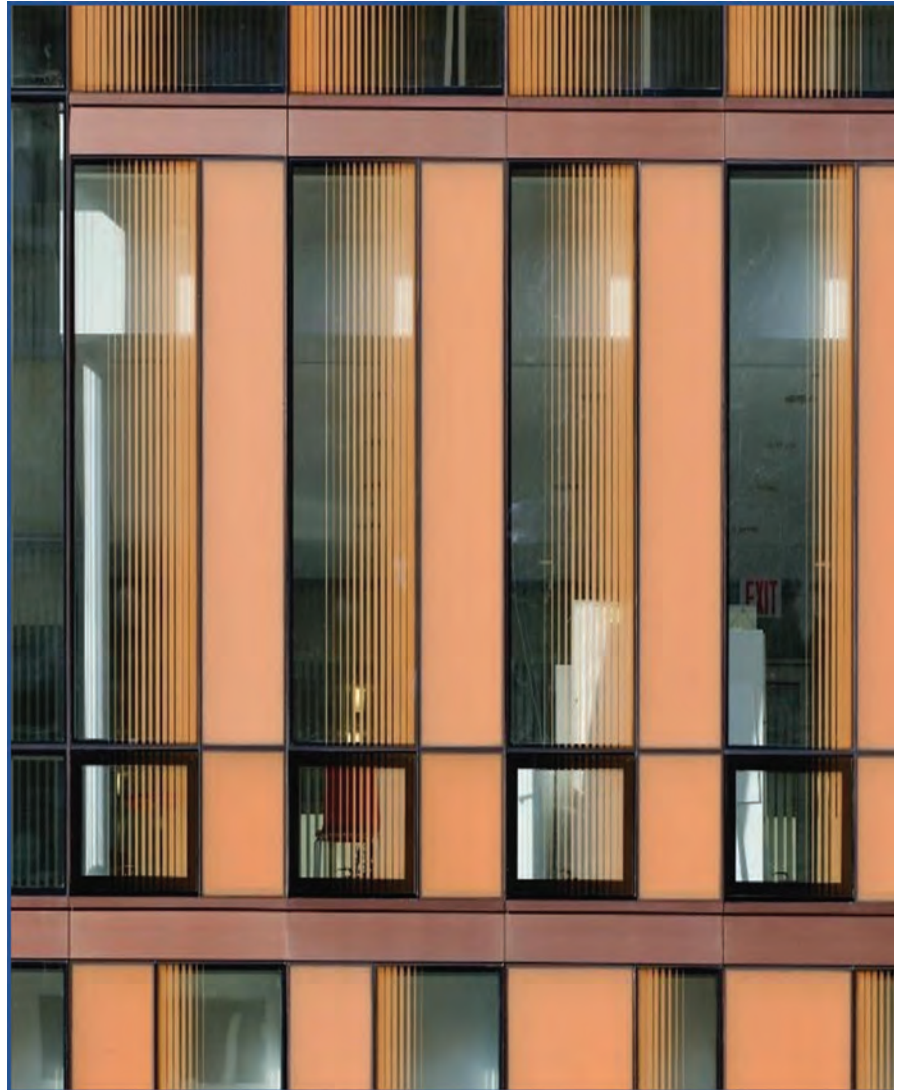
A wide variety of interior and exterior decorative glazing solutions are available to help the architectural community create building designs that provide an appropriate balance between aesthetics, solar performance and daylighting. Windows have two essential functions in daylit buildings. First, daylight delivery/admittance requiring a high visible transmittance; and second, provision of view to occupants requiring low visible transmittance to prevent glare. Decorative glass can easily accommodate these two functional components.

Reduce energy consumption

Combining decorative glass with low-emissivity coating can allow as much useful light as possible while optimizing energy consumption. Decorative glass can reduce heat gain, enabling downsizing of HVAC systems and use of electricity. In addition, decorative glass filters can decrease the harshness of direct sunlight. By controlling how and where daylight penetration exists, decorative glass can reduce the likelihood of excessive brightness in vision areas.

Improve light level control

We have all seen how intense a beam of light streaming through a simple window can be. In this case, only one small area of the room will get a concentrated amount of light, while the rest of the room only gets the redirected/reflected light and remains in the dark.





GLASS INFORMATIONAL BULLETIN—BENEFITS OF DECORATIVE GLASS IN DAYLIGHTING

This is especially true with a skylight in a high ceiling, like in a mall or museum. Ideally, this intense beam of light would be transformed into a more diffuse light source and light up the whole room or transport sunlight into areas without a direct line of sight to the exterior.

- **Light reflection or redirection**

The level of daylight can be enhanced in darker areas such as the basement or in the center of the building. Decorative glazing can be used to replace opaque walls so that light can pass through, while mirrors can be used to redirect light further into the rooms.

- **Light scattering**

Just as for glare control, some types of decorative glazing can be used to diffuse direct sunlight and spread out the beam, thereby maximizing the area lit up by a window.

Manage glare and light-induced heating

Some decorative glazing products are designed to scatter light, transforming intense sunlight into a softer array of diffuse light. Textured films, rolled-patterned glass or surface treatments, like ceramic frit or acid etching, turn ordinary float glass into a light diffuser which spreads the light out, reducing glare and localized heating.

Designed to absorb or redirect part of the sunlight, glare-control glazing products control the total amount of light entering a building. Low-E or reflective coatings, tinted glass, electrochromic glass, acid-etched glass or a decorative pattern can be used to decrease light transmission or absorb light through the glazing. Particularly in areas where

people will be stationary for significant amounts of time, for example an office, workstation or cafeteria, it is important to control daylighting levels to maintain occupant comfort.

It is usually important to maintain consistent lighting levels even when the amount of daylight available can vary, such as cloudy versus sunny days or at noon versus 6 p.m. Most decorative glazing products have a fixed effect on the amount of light they block or absorb. One exception is dynamic glass, where the light transmission can be adjusted dynamically to the light level entering the building. Designers often use static decorative glazing products in combination with complementary and variable methods to adjust area lighting levels. Such variable methods include movable blinds and light level sensors to adjust artificial lighting levels in response to the amount of daylighting available.

Greater privacy

Decorative glass is instrumental in maximizing daylight while achieving an appropriate measure of privacy in both residential and commercial applications.

Certain types of glass with a translucent surface offer excellent light transmittance with limited or no line of sight. In residential applications, they are typically found in bathrooms and kitchens, but they are also used creatively as room enclosures or dividers, creating more illuminated spaces while providing a sense of openness and grandeur.

In commercial applications, such as health care facilities, research laboratories, and corporate buildings with meeting rooms and offices, the need

for appropriate privacy is high but the desire to restrict light flow is as important. In both cases, the privacy/light flow combination can be achieved with various types of decorative glass products.

Options such as rolled patterned glass, stained glass, cast glass, acid-etched glass or thermoformed glass can provide privacy, light flow and an element of design. Somewhat dense designs on glass, through ceramic frit, acid etching or sandblast, may also meet the desired objectives.

Another option is diffusing light through glass. This can be done with a number of surface finishes such as acid etch or sandblast or through a laminate assembly with somewhat translucent interlayers. Post-installation solutions also include films and decals on glass.

The challenge is finding the right glazing where privacy is paramount, but vision is still required, and also considering factors other than glass. Daytime and nighttime outdoor conditions as well as interior lighting may have an impact on the actual level of privacy achieved. Appropriate testing of glazing solutions considered should always be performed. ■

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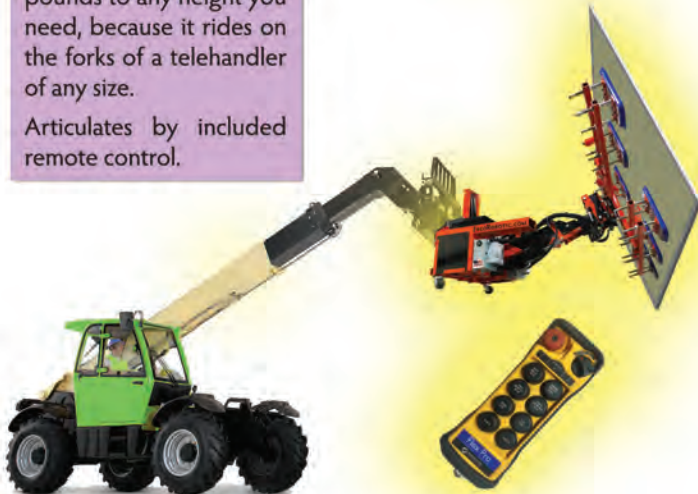


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Apogee Enterprises Reaches Agreement to Sell Facility in Statesboro, Georgia

Apogee Enterprises Inc. announced that it entered into an agreement to sell its architectural glass facility located in Statesboro, Georgia, to Cardinal Glass Industries. Apogee had previously announced its intent to close the Statesboro location as a part of a broader restructuring plan. Cardinal Glass plans to repurpose the facility to support its residential glass business. The transaction is expected to close in the fourth quarter of fiscal year 2022, subject to certain closing conditions. Apogee expects to record a pre-tax gain on the sale of between \$18 million to \$20 million.

“This sale agreement is a terrific outcome for Apogee, our employees in Statesboro, and the surrounding community,” says Ty R. Silberhorn, Apogee’s CEO. “This transaction will further improve Apogee’s already strong financial position and gives us more financial flexibility as we move forward with implementing our new enterprise strategy. I’d like to recognize the efforts of our Architectural Glass team for bringing this to a successful conclusion.”

Guardian Glass Adds Super Jumbo Coating Capability at Michigan Plant, Expands Capacity at UK Plant

Guardian Glass announced the company is now producing 130-by-240-inch, or “super jumbo,” SunGuard coatings on clear or Guardian UltraClear float glass at its Carleton, Michigan, facility.

The company also invested in its Goole, East Yorkshire, float glass



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production plant, based in the U.K. The purpose of the investment is to increase the company’s ability to supply float glass, primarily to the U.K. and Ireland, while also improving the plant’s energy efficiency.

The cold tank repair, which began in April and will be completed this month, will rebuild the furnace and expand the melting capacity by 20 percent to 909 tons per day.

2020 Acquires FeneTech

2020, a provider of applications and enterprise solutions dedicated to interior design, space planning and furniture manufacturing, acquired FeneTech Inc. The acquisition expands 2020’s end-to-end solutions into the adjacent market of fenestration and plans to offer extended solutions to new and existing customers for the design, construction and placement of windows and doors.

“We are thrilled to welcome the

FeneTech team to 2020,” says 2020 CEO Mark Stoeber. “Our vision is to provide end-to-end solutions to customers to streamline their business from inspiration to installation and FeneTech’s solutions complement our vision and existing portfolio of products perfectly. Ron Crowl, Horst Mertes and their high-performing teams both emulate the culture of technical excellence and customer satisfaction that has been key to both our companies’ success.”

Isoclima Group Acquires Global Security Glazing, Dlubak

Isoclima Group, a supplier of glass and transparent solutions, acquired Global Security Glazing and Dlubak Specialty Glass Corp. from SSI Consolidated Holdings. “We are very excited about this acquisition. This [is] a major step towards achieving our strategic plan for Isoclima by 2023. With this acquisition Isoclima will strengthen its leadership in the ballistic transparencies industry, expanding in a new market segment and establishing local production capabilities in a region which is pivotal to the achievement of its growth targets. From this strong base, Isoclima plans to become the North American leader of the armored transparencies market,” says Paolo Cavallari, CEO of the Isoclima Group.

Şişecam and Ciner Group Invest in U.S. Soda Ash Market

Şişecam and Ciner Group, Turkish-origin global companies, will co-invest \$4 billion in the U.S. soda ash industry. With the planned investment, Şişecam will become one of the world’s largest soda ash producers, say officials.

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NEWS TO KNOW

The companies, which became development JV partners in the natural soda ash project based in the U.S. two years ago, are expanding the scope of their cooperation and changing the structure of their partnership.

Şişecam and Ciner Group have been development JV partners in the Pacific natural soda ash development project since 2019. As part of the new investment plan, Şişecam will become a 60 percent shareholder by acquiring an additional share in the Pacific Project. In addition, Şişecam will also purchase a 60 percent share in the Atlantic Project and Ciner Resources, the existing natural soda ash production facility of Ciner Group in Wyoming.

Saint-Gobain Sells Two Fabrication Businesses in France, Germany

Saint-Gobain announced the sale of the French company Aurys, which

specializes in shaping and fabricating flat glass, to a former manager of Saint-Gobain. The Group also sold the German company GVG Deggendorf, which specializes in tempered glass, to the Swiss Arbonia group.

Eastman Completes Acquisition of PremiumShield

Eastman Chemical Co. completed the acquisition of the business and assets of Matrix Films and its U.K. affiliate, PremiumShield Ltd., marketer of PremiumShield performance films, including its extended line of automotive film patterns.

“The completion of this acquisition is another step in Eastman’s commitment to being a leading innovator and service partner for paint protection and window film professional installers,” says Erin Bernhardt, general manager of Eastman’s Performance Films business.

“We’re extremely excited to add the PremiumShield team, assets and dealer base to our Eastman Performance Films team.”

Biesse Group Signs Agreement to Acquire Maker of Glass Machining Equipment

Biesse Group signed a contract for the acquisition of 100 percent of the quotes of Forvet Costruzione Macchine Speciali S.p.A., a manufacturer of special automated machines for glass machining.

The value of the deal is around \$47.7 million and it will be regulated by cash mainly within this year end. This operation, in line with Biesse Group’s strategic plan, will increase the product portfolio of glass machining centers, a sector in which the Group has been present since the second half of the 1980s with Intermac brand technologies.

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NEWS TO KNOW

Isra Vision AG Breaks Ground on New Headquarters

Isra Vision AG, a manufacturer of surface inspection methods for web materials, broke ground on the construction of its new headquarters building in Darmstadt, Germany.

The new headquarters is located on a property measuring around 161,458 square feet in the city's "Knell" development district with its historic water tower at Frankfurter Straße.

YKK AP America Inc. Raises Minimum Wage to \$15 an Hour

YKK AP America Inc. will raise its minimum starting wage to \$15 an hour.

YKK AP America's new minimum wage program will affect new and existing associates. While the vast majority of company employees already exceed the new minimum, this move will have a positive impact on a portion of the company's entry-level production associates at commercial and residential manufacturing centers in Middle, Georgia, where the company has its primary operations.

TOP PERSONNEL NEWS



Feles

C.R. Laurence Announces Arty Feles as President

C.R. Laurence announced Arty Feles as president of the company.

Feles is a key leader who has helped guide the company's growth for the past 12 years in roles including chief financial officer and, most recently, regional president of U.S. operations. A member of the senior leadership team, Feles continues to be integral to company leadership.

He will be supported in the role by a dedicated senior leadership team of Mazdak Vaezpour, regional president of international operations; Barbara Haaksma, senior vice president of marketing; and Shirin Khosravi, senior vice president of human resources.

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NEWS TO KNOW



Johnson

Pulp Studio Promotes Kirk Johnson to Chief Operating Officer

Pulp Studio promoted Kirk Johnson to the newly created position of chief operating officer. Johnson will have primary responsibility for day-to-day operations of Pulp Studio.

“Kirk plays a key role at Pulp Studio and in his new position as COO, he will continue to streamline operating procedures and contribute to the continued growth and expansion of the business,” says Lynda Lax, president and founder of Pulp Studio. “We are very fortunate to have such a seasoned professional on our team.”



Blair

AIG Names Clint Blair as President

Clint Blair has been named president of American Insulated Glass. Formerly, Blair served as the vice president of operations. He joined AIG in 2017 as general manager and has played a significant role in expanding the company’s geographical footprint and fabrication capabilities.

Quanex Building Products Announces Changes to the Board of Directors

Quanex Building Products Corp. announced the appointment of Jason D. Lippert to its board of directors effective immediately. The company also announced that William C. Griffiths will retire as executive chairman of the board, effective Feb. 21, 2022, but plans to continue serving as non-executive chairman of the board. In addition, Joseph D. Rupp plans to retire as a director at the end of his current term and not stand for re-election. ■

**From Aug. 17 to press time, Nov.28. Read these stories, and others, in their entirety at GlassMagazine.com.*

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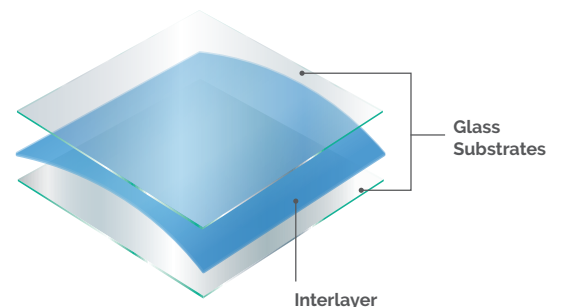
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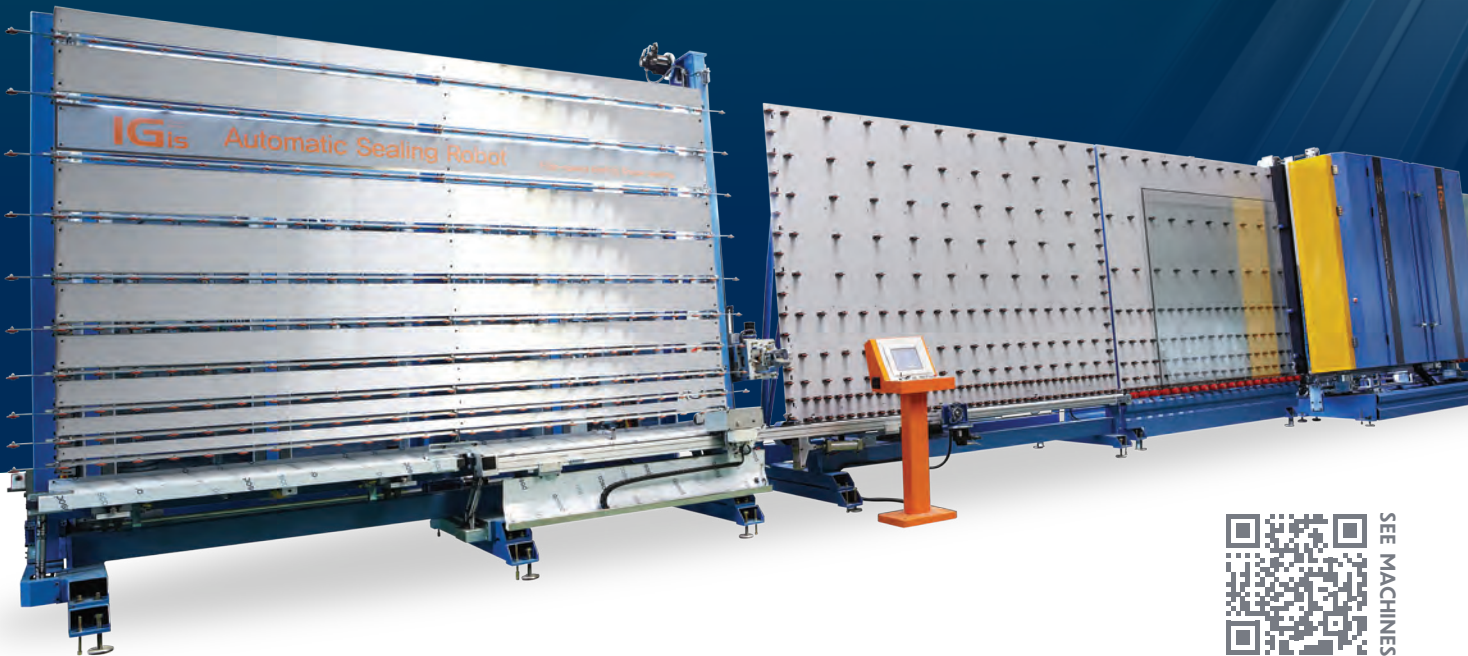


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CODE WATCH

WHAT COMES AFTER THE CHAMPLAIN TOWER COLLAPSE?

BY THOM ZAREMBA



On June 24, 2021, Champlain South Tower collapsed in Surfside, Florida, killing 98 people. The National Institute of Standards & Technology, or NIST, immediately began an investigation. Although no timetable for the identification of the causes of the collapse has been announced, the NIST investigation is expected to take two years or more. Congress has authorized \$22 million to fund that effort. So far, at least seven other buildings in South

Florida have been evacuated due to safety concerns.

How could this happen from a building code enforcement standpoint?

The current state of code enforcement

Typically, the authority of building code officials begins with the submission of construction drawings and ends when a Certificate of Occupancy is issued after inspections—intended to

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ensure compliance with all building code requirements—are complete.

The Florida building code also includes a “threshold inspection law.” Florida’s threshold inspection law requires all structural elements of large-occupancy buildings (500 or more) to be inspected by a third-party “threshold inspector” to ensure compliance with approved construction drawings and Florida’s building codes. However, Florida’s threshold inspection law does not extend the authority of building code officials to include post-occupancy inspections.

Beyond its relatively unique threshold inspection law, Florida has some of the U.S.’s most stringent storm-specific building code requirements. These came about after Hurricane Andrew destroyed more than 25,000 homes and damaged 100,000 more in 1992. Nevertheless, even the changes made to Florida’s building codes following Hurricane Andrew did not require any post-occupancy building inspections.

Only two Florida Counties, Miami-Dade and Broward, require mandatory recertification inspections and these are only required after 40 years of occupancy.

What’s next?

Recertification inspections, coupled with specific compliance periods and potential penalties for noncompliance, seem likely. Recent recommendations from the Florida Bar Association and the Architects & Engineers Task Force back up these predictions.

The Florida Bar Association created a task force to develop proposed legislation to address the Surfside collapse. Among its recommendations:

- **Regular inspections.** Florida has more than 1.5 million residential condos, and of those, nearly 600,000 are at least 40 years old, with an estimated 2 million people living in condos 30 years or older. In other words, a big universe of Floridians live in these aging buildings.

The Bar task force recommends structural inspections every five

years. That should provide timely notice of any significant deterioration and give condo associations time to budget for repairs.

- **Strengthening reserves.** Condos typically fund major repair projects by using reserves or levying special assessments on unit owners. But existing loopholes allow condo associations to waive or reduce these reserves, which may be more financially palatable to unit owners, but can also defer much-needed repairs.

The task force recommends tightening condominium laws to close loopholes that allow reserves to be waived or reduced, thus providing money for long-term maintenance and repair. Likewise, this would make it easier for condo associations to levy assessments or borrow money for major repairs, in turn, funding projects necessary to safely prolong building life.

- **Increase transparency.** The Bar task force would also increase transparency so that condo boards, unit owners and government building officials would all be more informed about the structural integrity of their buildings and plans for keeping them safe. Florida law currently has no requirement for reporting or tracking a condo’s maintenance records.

The task force recommends a standard template for inspection records and more document-sharing between local governments, condo associations and property owners and buyers. Having more eyes on the state of these buildings, and in real time, could keep more needed repairs from falling through the cracks.

A Florida Task Force of Architects and Engineers released similar recommendations. This group consists of seven of the state’s leading engineering and architecture associations, including the Florida Engineering Society, the American Council of Engineering Companies of Florida, the Florida Structural Engineers Association, the American

Society of Civil Engineers, the International Concrete Repair Institute and the Building Officials Association of Florida. Some of its recommendations:

- Florida should require that nearly all large buildings be inspected for structural problems within their first 30 years, with follow-ups every 10 years.
- For buildings within three miles of salt water, such as Champlain Towers, inspections should be done within the first 20 years of occupancy, with follow-ups every seven years.
- These inspections would apply to condominiums, office buildings and any other buildings that exceed 10 occupants, are greater than 2,000 square feet and that are covered by the state’s building code. Only one- and two-family dwellings and townhouses three stories or smaller would be exempt from this requirement.
- Inspections would be conducted in phases. Phase 1 inspections would be visual observations under the direction of a licensed professional engineer or architect. At a minimum, they would include random inspections of garages, pool decks, roof parapets, common areas and accessible exterior areas of the structure, including at least 33 percent of the balconies and handrails.
- If structural distress is found during Phase 1, a Phase 2 inspection would be done by an experienced engineer or architect. The inspection would be far more thorough and potentially include destructive testing and the use of outside specialists.

What does this mean for the glass & glazing industry?

Tragedies propel changes to our building codes. As changes following the Champlain Towers collapse are considered, other changes to our building codes should also be considered. Specifically, the

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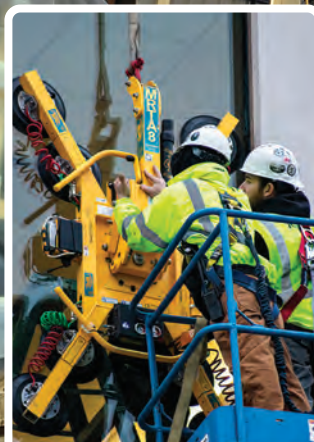
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consequences of climate change (fires, floods and drought) can be as tragic as a building collapse. According to an August 2021 article in Anthropocene Magazine: “An intensive push to improve energy efficiency in buildings throughout the United States could prevent 1,800 to 3,600 premature deaths every year, according to a new modeling study.”

The glazing industry can have a major role in ensuring the energy efficiency of our existing building stock. Consider this: Buildings account for approximately 40 percent of the energy consumed in the United States. Windows built of monolithic glass in metal frames were very common before 1960. These types of windows are horribly energy-inefficient but can last for 100 years or more. Unless these types of windows are replaced with insulating glass units, this can result in an extraordinary waste of energy, especially considering that 70 percent of all buildings in at least 30 cities throughout the United States were built before 1960. However, even if monolithic glass windows are replaced with IGUs, those IGUs will lose their argon gas fills over time, and seals will eventually fail.

This posits an important question: Should post-occupancy inspections of buildings include windows?

The tragedy of the Champlain Tower collapse demonstrates the importance of regular post-occupancy inspections. It's clear that significant energy can be saved and the pace of climate change slowed by including windows in any post-occupancy inspections or other building code changes that may result from this tragedy. ■

Thom Zaremba is a partner at Roetzel & Andress and code consultant for the National Glass Association and the Glazing Industry Code Committee.

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Performance mockup testing at an Intertek test laboratory.

MANAGE RISKS WITH MOCKUPS

TEST PERFORMANCE, IDENTIFY DESIGN CONCERNS AND ALIGN EXPECTATIONS BEFORE CONSTRUCTION BEGINS

BY KATY DEVLIN

Pre-construction mockups, whether in the field or the laboratory, provide essential information to project teams early in the process, allowing issues to be resolved without extended delays or substantial costs. Teams rely on mockups to aid in product selection. They use them to ensure systems meet performance requirements and aesthetic goals. They look to mockups to test out complex elements and guarantee designs can be actualized in the real world. Sometimes they even use the mockup stage to test out and practice installations.

“The more mockups that you do in development and design before production, the better you can refine things before you order material and before it’s too late to change the underlying structure,” says Steve Dean, senior procurement specialist for Permasteelisa North America.

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Why mockup?

The primary reason projects require mockups is to reduce risk. “You can show your client what they can expect and get their approval. It puts [the client] right there next to you, so you are getting incremental approvals throughout the project and not sticking your neck out so far,” says Dean.

Additionally, mockups allow teams to verify system engineering and test performance.

Mockups can also provide glazing firms with a competitive advantage. Glaziers need to be able to manage mockup logistics, connect with test labs, interface with manufacturers, execute construction and more. “The ability to handle and perform mockups is an advantage,” says Dean.

What is a mockup?

Glazing mockups can range from scaled tabletop displays to full-size installations of large sections of a façade that will undergo months of labor field testing. Each provides important information to the project team early in the process. This article focuses on laboratory performance mockups, which are the most comprehensive pre-construction mockups.

Intertek, a global product testing laboratory, describes performance mockups as “full-size representations of the proposed exterior wall system built before the exterior wall design is completed in order to study proposed construction details, test for performance and possibly judge appearance of the exterior wall system.” Mockup testing is performed in a laboratory environment where the mockups undergo a range of performance tests.

According to Intertek, the performance mockup allows teams to: validate structural integrity; measure airtightness; verify water drainage; observe condensation behavior; identify critical construction details; review sequencing/logistics; establish the standard of care for a system; verify code compliance; and confirm

“
MOCKUPS CAN ALSO PROVIDE
GLAZING FIRMS WITH A
COMPETITIVE ADVANTAGE.
GLAZIERS NEED TO BE
ABLE TO MANAGE MOCKUP
LOGISTICS, CONNECT WITH
TEST LABS, INTERFACE WITH
MANUFACTURERS, EXECUTE
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”

compliance with contract requirements and program specifications.

Requirements for performance mockups are found in design specifications. Glaziers see them referenced most frequently in larger projects, such as “high rises, airport terminals, convention centers, arenas and universities. Big buildings with beautiful façades,” says Intertek’s Jose Colon, regional sales director. Mockups can be required for jobs of any size that feature non-standard glazing systems that have not already been tested by the manufacturer. “For example, you might see a performance mockup requirement on a smaller project that includes a large glass entrance,” Colon says.

While some companies perform mockups and testing on every project, others are just beginning to bid projects with mockup requirements. “We’re seeing a lot of smaller players out there. Glazing contractors are bidding jobs that are requiring small mockups,” says Colon.

Another type of pre-construction mockup is a visual mockup, which can help a project team to determine the final glass types, final colors and other specific details, such as a trim piece, says Dean. Because they aren’t being used for performance testing, visual mockups don’t need to be built to size, nor do they require a laboratory environment. “We have the ability to do visual mockups in our facilities. But a lot of times, we’ll do them right onsite—right in a corner of the

site. They can stay there for a while and be referred to throughout the project,” Dean says. “I’ve seen visual mockups that are relatively simple, built into the side of a container. And I’ve seen \$1 million full-size three-story mockups that are turned into interior fit outs.”

Teams may also use even smaller tabletop mockups or hand samples to help visualize final systems. “These are relatively small and not very costly, but they can give a sense of a certain product type or design details,” says Dean.

What to include in a laboratory performance mockup?

The project team decides what to include in the mockup. Sometimes the architect or the developer makes the decision, and other times it’s up to the façade consultant, Colon says.

Intertek offers some best practice general suggestions on what to include in the mockup: accurate representation of the wall design inclusive of typical details; “specialty” details and transitions; anchorage conditions; support conditions; longest spans; corner conditions; system transitions.

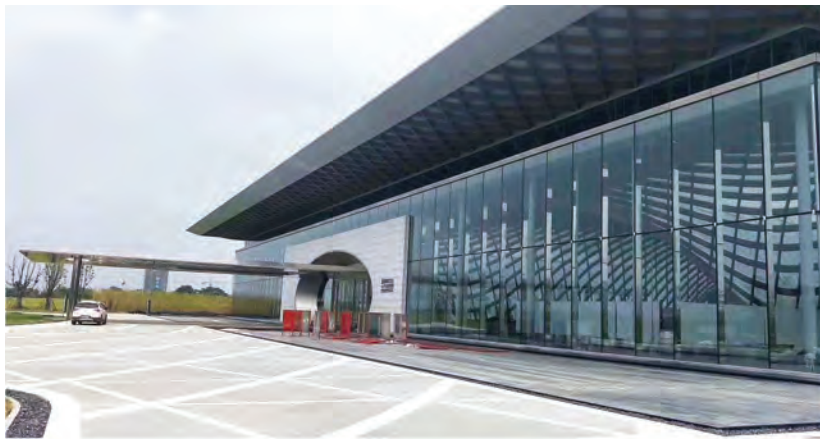
What is the timeline?

A laboratory performance mockup is a several-months-long process that begins once a project is awarded. The basic stages include design, construction, installation and testing.

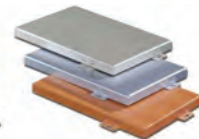
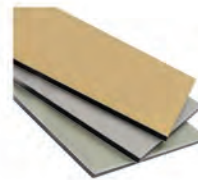
Along with the construction and mockup design drawings, the glazing team should also provide information on how the system will be installed in the field.

At the installation stage, glazing firms often bring in the team that will handle the installation onsite. “This is practice for installing in the field. You can make sure it’s going to work as you intended,” Colon says.

Once the system is fully installed, testing can begin. Testing can take anywhere from a week to several months, depending on what is being tested. Most performance tests, however, can be completed within a week or two. ■



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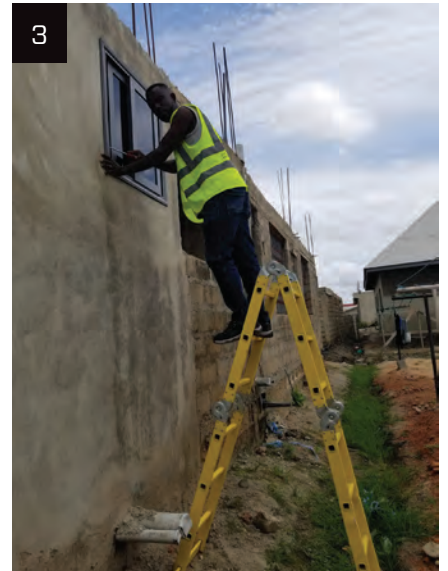
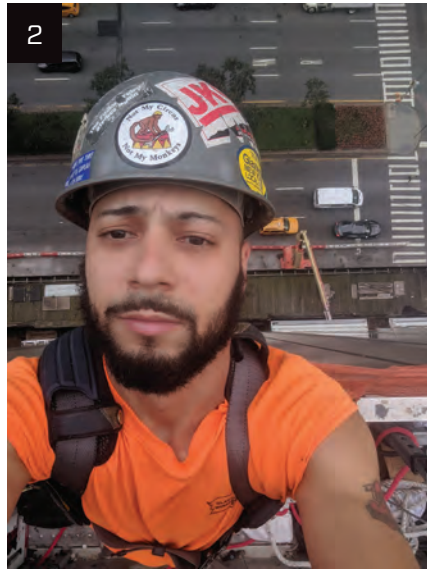


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VIEWS FROM THE TOP

Glaziers see the most amazing things on the jobsite. They tackle incredible challenges with a remarkable building material, sometimes at extraordinary heights. During October's Careers in Construction Month, Glass Magazine and its publisher, the National Glass Association, invited glaziers to submit their jobsite selfies and photos to show off what those in the glazing trade accomplish on a daily basis. Take a look at select submissions from men and women in glazing across the United States and abroad. For even more, visit GlassMagazine.com.





7



8

1. Lane Raposo of Custom Metal Contracting, looking out at the start of construction of a new tower.

2. Charlie Castillo of Glaziers Local Union 1281 New York.

3. Frank Kofy Baidoo, a glazier based in Ghana.

4. Glazier Julia Dietel, with a view of the city.

5. Photo submitted by glazier Loren Esparza.

6. Photo submitted by Ramon Bones of Glaziers Local Union 1087 New York City.

7. Joey Kinard of Glazier Local 740 Portland Oregon.

8. Jasper Fitzpatrick of Glaziers Local 1087 New York City.

9. Glazier Tim Powers.



9



10

10. Glazier "Danny G" installing curtain wall on the 53rd floor of Resorts World Las Vegas for Enclos Corp.

11. Glass installation on the D.C. Metro Purple Line. Submitted by Ruhay Asfaw of United General Contractors Inc.

12. Nick Jaramillo of New York City Glaziers Local 1087.

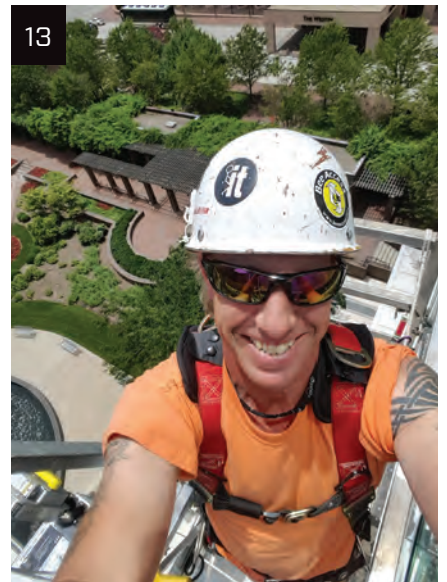
13. David Walp of Tom Smith Glass on a swing stage at the Simon Building in Indianapolis.



11



12



13



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THE



FORECAST



TOP 10 TAKEAWAYS

U.S. economic recovery continues, clouded by labor, supply and inflation challenges. Highlights from the latest construction forecasts

BY LAURIE COWIN AND
KATY DEVLIN

01

A STRONG U.S. ECONOMIC RECOVERY IS IN THE WORKS

Robust consumer spending and low interest rates will contribute to continued economic growth in 2022, according to Richard Branch, chief economist, Dodge Data & Analytics, and Cris deRitis, deputy chief economist at Moody's Analytics, speaking during the Dodge Construction Network Construction Industry Outlook 2022, held in November. "The economy is on a much better footing than it was a few weeks ago, or even a few months ago," says deRitis.

The economists project that U.S. GDP will close out 2021 at just under 6 percent year-over-year growth. In 2022, they forecast GDP growth topping 4 percent. "This is very strong on a historical basis," says deRitis. "2022 should be a very positive year for GDP, for consumers, and we should see very good job growth."

02

THE CONSTRUCTION SEGMENT IS RESILIENT AND GROWING.

The Dodge Momentum Index, which serves as a leading indicator of future construction spending, ticked up “significantly” since the beginning of 2021, says Branch. Perhaps even more importantly, the index has become more well-balanced toward most types of public and private building projects, he says. The number of projects in bidding also suggests market resilience. The count of general projects is ahead of this time in 2020 and a little bit behind 2019 levels. “We feel pretty positive about construction starts next year, but cognizant of the many challenges that face the sector,” Branch says.

Total construction starts will rise 6 percent in 2022, which is higher than 2019 levels. Much of that growth, however, is skewed toward the residential sector. Taking residential out of consideration, 2022 would be three to four percent shy of 2019 on a nominal dollar basis, says Branch. “It’s a long road back to full recovery for the construction space,” he says.

6%

PROJECTED
INCREASE
IN TOTAL
CONSTRUCTION
STARTS FOR
2022

03

INSTITUTIONAL, RETAIL AND WAREHOUSE LEAD THE WAY FOR NONRESIDENTIAL SPENDING.

The recovery of commercial starts will even out in 2022 after staging a strong 2021, regaining about half of what was lost in 2020, says Branch. Much growth until now has been based on warehouse construction, but commercial construction will have a broader base moving forward, with renovation being a key source of growth.

Warehouse starts “continue to stagger the imagination,” says Branch. The sector will amount to \$46.7 billion in 2021 and an expected \$52.8 billion in 2022. In fact, the first three quarters of 2021 were the best three quarters in the history of tracking warehouse starts. The lack of short- and long-haul truck drivers may incentivize warehouse developers to keep building larger distribution centers closer to each other instead of one larger one feeding smaller warehouses.

Institutional building starts will recover “solidly” in 2022, with education accounting for about half of all activity. K-12, college and university construction is down. Lab space leads the education sector. Meanwhile, health care shows the most strength outside of warehouses. Hospitals continue to outperform clinics and nursing homes.

Expect continued growth in retail. Branch projects the sector to amount to \$13.6 billion in 2021, which is comparable to 2009-10, and \$15.5 billion in 2022.

Other sectors that will see growth in 2022 include transportation and data centers.

04

RECOVERY LAGS FOR OFFICE AND HOTEL SECTORS.

Office starts “continue to underwhelm” as demand for the space remains uncertain. Occupancies may start to improve in the second half of 2022, assuming no COVID variations enter the equation, says Branch. Renovations account for about 40 percent of all office activity, about 10 percent higher than historical numbers.

Hotels have what Branch describes as a “limited path to full recovery.” Although tourism is increasing, business travel still lags, and that’s where hotels make the majority of their money. “Hotels will not return to 2018 levels within a five-year space,” he predicts.

Finally, manufacturing centers have been “a real pleasant surprise” with construction starts in 2021, but Branch expects the number to be flat in 2022 as challenges in the manufacturing labor market restrain activity. Automation in plants will be key to future growth in the sector, says Branch.

05

THE RESIDENTIAL MARKET WILL EASE BACK BUT STAY STRONG.

The residential sector has been on “absolute fire,” Branch says, and will likely ease back next year. The sector grew 14 percent in 2020, with much of that growth backloaded in the second half of the year. Branch expects a comparable growth rate in 2021. “Growth in the first half of 2021 was strong, but as we got toward the third quarter, single-family eroded pretty quickly,” he says. “We’re about 10 to 11 percent below where we were at the end of 2020.” Even so, this is the first time since 2006 that the single-family market will exceed 1 million units.

For single family, Branch expects 2022 to bring about a more tepid and sustainable pace. Home sales may have slowed from the “torrid” pace earlier this year as affordability has weakened, “but we’re not seeing a cataclysmic erosion.” In fact, every state is positive on single-family construction; none are underwater.

A strong multifamily recovery is also on tap with strength not seen since the mid-1980s. Whereas dense, high-rise multifamily buildings ruled the sector in 2018-19, most multifamily buildings today are four to six stories. The number of units per project has also decreased, with buildings with four to ten units seeing the greatest strength.



THE LABOR SHORTAGE IS “NOT TEMPORARY. IT’S SYSTEMIC AND COULD CERTAINLY MUTE CONSTRUCTION STARTS AND ACTIVITY IN 2022.”

06

LABOR SHORTAGE PERSISTS

One of the biggest headwinds facing companies headed into 2022 is difficulty finding workers. As of November, there were 10.4 million job openings but only 7.7 million people unemployed, according to deRitis. “We’re in this strange time period where we have more job openings than people unemployed, which suggests the labor market has more opportunity today for folks looking for work.”

DeRitis cites three reasons for this. One, there’s an ongoing pandemic and people are still getting sick. Two, parents are struggling with childcare, and women aren’t returning to the workforce as quickly as men are. And three, baby boomers retired early, which he says is a structural change, whereas the first two reasons are cyclical.

The situation is perhaps more dire for construction companies. The segment lost 1.1 million jobs in the first two months of the pandemic, adding to an already difficult labor situation for construction firms. While the sector has rebounded, many of those workers have not returned. As of October 2021, construction employment was 150,000 (-2.6 percent) below the pre-pandemic peak in February 2020, according to the Bureau of Labor Statistics. Branch notes that labor shortages aren’t a new phenomenon for the industry. “It’s not temporary,” he cautions. “It’s systemic and could certainly mute construction starts and activity in 2022.”

Employment in manufacturing has also lagged. Employment in the sector is down by 270,000 since February 2020, according to BLS.

07

VACCINATION REQUIREMENTS FURTHER COMPLICATE LABOR CONCERNS.

Many employers are beginning to face COVID-19 vaccination mandates. A new Occupational Safety and Health Administration emergency rule, set to go into effect Jan. 4, would require vaccinations at all employers over 100 people. At press time, challenges to the rule will go before a federal appeals court and potentially the Supreme Court. But no matter the ruling, many industry companies are already facing mandates on certain construction sites, such as medical facilities.

The mandates pose challenges to industry companies, as vaccinations lag among construction and manufacturing workers. Ken Simonson, chief economist for the Associated General Contractors of America, reported in his Nov. 11 Data Digest: “The vaccination rate among construction workers in the four weeks through October 24-30 was 52.5 percent, compared to 80.7 percent for other occupations. ... Conversely, construction workers have a far higher ‘vaccine hesitancy’ rate, 43.9 percent versus 17.3 percent for other occupations.”

The vaccination rates from the manufacturing sector are slightly higher, though still lower than the nationwide average. A November Sikich Industry Pulse survey of manufacturers and distributors found that most respondents (28 percent) reported vaccination rates between 41 percent and 60 percent. According to a November Morning Consult poll, 21 percent of manufacturing workers said they were opposed to the vaccine.

08

PRICE INFLATION (AND SUPPLY DISRUPTIONS) SHOULD EASE IN 2022.

Material and consumer prices are up significantly in 2021, says deRitis. The drivers behind inflation: continued supply chain delays and disruptions resulting from the initial COVID shutdown and ongoing recovery. “This is really due to the supply chain [issues] as we are reopening the economy. Everyone is trying to go through the door at the same time. There is limited supply and lots of demand,” says deRitis.

In 2022, production and transportation should begin to return to normalcy, which should ease inflation. “Inflation as it relates to materials will probably last into mid-next year before we start to see prices pull back. But even as they pull back in the back half of 2022, prices should remain fairly high at least through the end of next year,” Branch says.

“Historically, the cure for high prices has been high prices,” deRitis adds. “We’ll see more business expanding and adding more supply to alleviate supply chain effects, and that should lead to more goods being available. We’ll also see more people entering the market. So, some of the wage inflation should subside as well.”

DeRitis expects hotter inflation to continue for one or two quarters before moderating to a 2.25 percent rate.

“

THE DRIVERS BEHIND INFLATION: CONTINUED SUPPLY CHAIN DELAYS AND DISRUPTIONS RESULTING FROM THE INITIAL COVID SHUTDOWN AND ONGOING RECOVERY. “EVERYONE IS TRYING TO GO THROUGH THE DOOR AT THE SAME TIME. THERE IS LIMITED SUPPLY AND LOTS OF DEMAND.”

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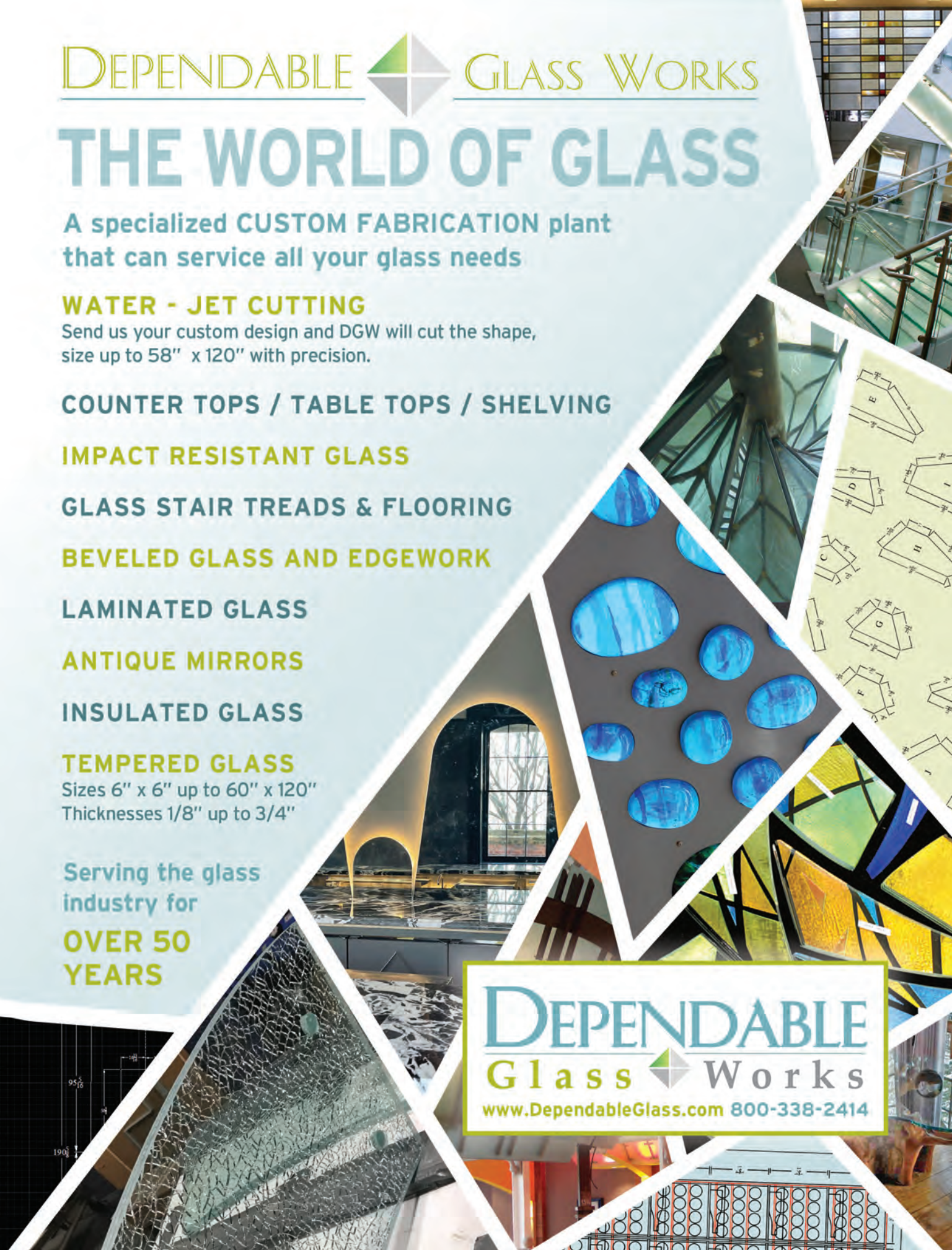
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09

PRODUCTIVITY INCREASED DURING COVID.

A silver lining to the pandemic has been productivity growth, says deRitis. “Businesses invested more in IT, machine learning, AI and remote work,” he says. “Those are now bearing the fruit in terms of enhanced productivity. Right now, it’s about a 2 percent year-over-year growth rate, compared to a 1 percent growth rate before the pandemic.”

“The ability to do more with less is what will be a critical path forward in terms of increasing your profit margins,” adds Branch. Productivity growth in construction, however, is difficult to come by, he says, with the multifamily space being the one exception. Branch also urges companies to consider productivity growth beyond just on the jobsite.

2%

PRODUCTIVITY GROWTH RATE, MID-PANDEMIC

“

ANOTHER WAVE OF THE PANDEMIC “WOULD CERTAINLY CAUSE THE ECONOMY TO STALL. OR, IF IT WAS REALLY BAD, YOU COULD SEE A RECESSION AS CONSUMERS PULL BACK ON SPENDING.”

10

KEY RISK FACTORS COULD CHANGE THE FORECAST.

Economists at Moody’s Analytics put together a list of key risk factors that could change the trajectory of the economy in the next few years, says deRitis. Among the risks included are international concerns (for example, an escalation in U.S.-China tensions) and domestic concerns (such as a government shutdown).

One more likely event that could trigger a more severe economic shock is another wave of the pandemic. “This would certainly cause the economy to stall. Or, if it was really bad, you could see a recession as consumers pull back on spending,” deRitis says.

Branch also identified several risks that could severely impact projected growth for the overall economy and for construction. “We can’t underscore the potential for a man-made disruption from the expected paths of growth; in particular, should there be a government shutdown, should the debt ceiling should not be raised, should the \$550 billion in new infrastructure spending not be approved. Any one of those changing could certainly alter the landscape of our construction starts forecast,” he says.

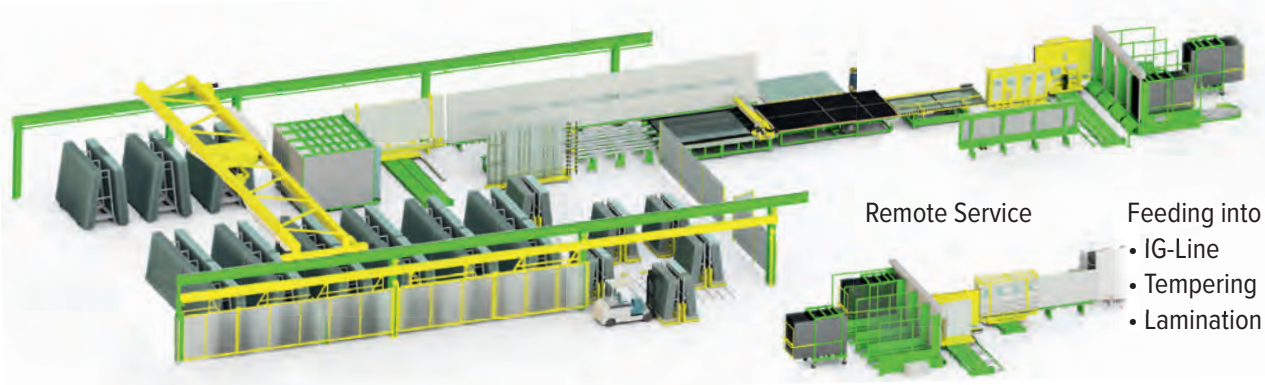
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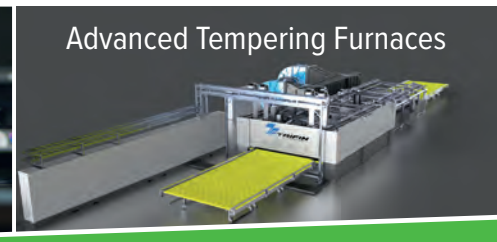
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PRIMARY GLASS MARKET FACES CONTINUED
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BY NORAH DICK

WORLD OF GLASSES

As with all other glass industry sectors, primary manufacturing faced significant supply chain issues in 2021. Supply chain hurdles spurred major acquisition decisions and reinvestments that reshaped the North American market. These challenges and changes take place in an already complex landscape, which is seeing not just a new trend, but a new chapter in the glass industry as companies focus increasingly on creating materials for greener and greener building. While this year's report will focus in on the North American market, worldwide trends mirror the region's challenges of tight glass supply and expanding innovation. For more detail on glassmakers abroad, see news stories on [GlassMagazine.com](https://www.glassmagazine.com).



2020-2021 Expansions in North America

1. Saint-Gobain: Saltillo, Mexico [new float line]
2. NSG/Pilkington: Luckey, Ohio [new float plant]
3. Vitro Architectural Glass: Garcia, Mexico [new float line]
4. NSG/Pilkington: Laurinburg, NC [furnace rebuild]
5. Spring Hill, KS [float glass]
6. Greenland/Church Hill, TN [float glass]
7. Abingdon, VA [coated glass]

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Visit worldofglassmap.com for the updated searchable and downloadable map database of global float glass locations. The World of Glass Map is sponsored by Diamon-Fusion International and SAFTI First.

Strong demand tightens strained glass supply

While it's unclear exactly how the fallout of COVID-19 and its related challenges of supply chain snarls and labor supply will resolve in the next few

years, it is likely that demand for glass will remain high in 2022, and supply will remain tight, in North America and abroad. "If you look at the market, we're growing at 3 percent per year," says Stephen Weidner, head of architectural glass, North America, and solar products, NSG/Pilkington. "Three percent growth per year means [we would need] one new float per year just to absorb organic growth. We're not seeing that

number of new floats being built commensurate with market growth, not in any part of the world."

Canadian Premium Sand, which announced intentions to enter the float glass market in March 2021, also pointed to the high demand for glass as a major reason behind the decision. "Today there is not a single float glass manufacturing facility in Canada," said Glenn Leroux, president and CEO of Canadian



Premium Sand. “Current dynamics in North America show a manufacturing supply deficit demonstrating the requirement for up to four additional float glass facilities by 2025 for North America to be self-sufficient.”

Such forecasts also prompted Cardinal Glass Industries’ 2021 acquisition of the AGC Glass North American float business. In the official acquisition announcement, Cardinal officials cited tight glass supply as a need for expansion. “Our capital investment plan for these operations will allow us to sustain even higher volumes in a very tight North American glass market,” said Roger O’Shaughnessy, CEO of Cardinal Glass Industries, in the official release.

Weidner also cautions that float glass supply will likely remain tight due to the pent-up demand from the automotive sector, which has faced its own production delays. “[The automotive sector] consumes 25-30 percent of float demand—that demand will remain strong for the next couple of years,” he says.

Some production expansion is happening in North America, though it’s unclear if it will allow the region to keep up with architectural glass demand, as much of the investment targets the solar and automotive sectors. Notable expansions:

- In 2020, NSG/Pilkington completed its first float line in nearly 40 years in Luckey, Ohio, which will produce float

glass for the solar market.

- Saint-Gobain added a float production line in Saltillo, Mexico, in 2020 to supply windshields and laminated roofs for electric vehicles.
- In 2021, Vitro also announced that a new float line will be added to its facility in Garcia, Mexico, located near Monterrey.
- And Canadian Premium Sand’s new Manitoba plant is in planning phases, but after a recent decision, the company will focus on solar patterned glass instead of traditional float glass for architectural applications.



Left: 3rd and Lenora, located in Seattle, uses almost 140,000 square feet of Guardian SunGuard SuperNeutral 68 coating on clear glass. Photo credit: Clarity Northwest Photography. **Right:** Coater7, an MSVD coater that can process jumbo glass, at the Wichita Falls, Texas, facility of Vitro Architectural Glass.

Solar products lead green innovations

Whether or not glass supply changes, the trend toward “green” glass continues to ramp up.

“We expect to see CO₂-free initiatives, building codes, alternative energy requirements, and other incentives to continue to drive adoption of these new [green] products,” says Martin Bracamonte, vice president of marketing and innovation at Vitro. “I think we’ve reached a tipping point and expect to see building owners demand more per-

formance from their buildings and less environmental impact.”

One major green innovation is glass for solar applications, which several North American companies are investing in heavily. Canadian Premium Sand announced that its planned facility will pivot from architectural glass to focus on solar patterned glass. The main reason is the attractiveness of the market to a North American company. “The really big reason [for the shift] was the size of the solar panel market,” says CPS’s Leroux. “There isn’t a single manufacturer in North America, including Mexico, that makes rolled patterned glass. And every bit of [the current supply] is coming from China or another Pacific Rim

country.”

NSG Group is also investing heavily in the solar market. Its Luckey, Ohio, plant officially went online in 2020, and is producing flat glass for its partner, First Solar, located in nearby Lake Township, Ohio.

In addition to producing the raw glass for the solar market, leading companies are also investing in end-use solar products.

Vitro introduced Solarvolt in 2021, a type of building integrated photovoltaic that allows the building itself to generate CO₂-free power. The product is a customized glass-glass solar lite, or a solar panel with solar cells arranged between two glass lites.

NSG Group announced a partnership



Vitro Architectural Glass's VacuMax, its vacuum insulating glass.

with Ubiquitous Energy, a manufacturer of transparent solar energy products. The company installed its own BIPV window at its Northwood, Ohio, facility at the beginning of 2021. In addition to generating power, the installation also collects technical data to analyze how best to distribute that power in the facility.

Manufacturers continue to develop their energy-efficiency and solar control glass products. For example, last year saw Guardian Glass release SunGuard Amber control glass. The amber/bronze tint of the product follows aesthetic trends, say officials, while also blocking 54 percent of heat and allowing 44 percent of sunlight to enter.

Additionally, Vitro Architectural Glass announced it would be partnering with LandVac to supply the North American market with vacuum insulating glass, which Bracamonte sees as having two major applications: “First, to replace existing 6-millimeter monolithic glazing in older, existing buildings—producing a

vast energy-saving benefit—and second, using a VIG unit as the interior lite in a conventional insulating glass unit,” says Bracamonte. “The latter, what we call a ‘hybrid’ unit, combines two low-emissivity coatings and can produce excellent SHGC as well as R-values in excess of R-16.”

Manufacturing employs green methods

Green and sustainable manufacturing methods are also becoming the norm, according to manufacturers.

Canadian Premium Sands emphasized sustainable manufacturing processes for its new plant, from its very first announcement. This will partly be possible due to the energy environment of the plant’s location, as

Manitoba’s electrical grid is 97 percent renewable energy, says Leroux. He says the proposed plant’s embodied carbon footprint will likely be 30 percent lower than that of Chinese manufacturers in the same market segment.

NSG/Pilkington has also invested heavily in green manufacturing, including adding a number of solar arrays on its North American plants. Most recently, it was in the process of completing an array on its Rossford, Ohio, facility. NSG Group also partnered with Convergent Energy + Power to implement a battery storage solution at its laminating facility in Collingwood, Ontario, Canada. The system’s software allows the plant to reduce electricity usage during the most carbon-intensive grid peaks.

Across the Atlantic, NSG/Pilkington officials announced the company had successfully manufactured float glass using hydrogen power. The world-first trial took place at the company’s facility in St Helens, in the U.K. A

second trial, using a blend of hydrogen power and natural gas, was held at the same facility, and involved running the furnace for five days.

Additionally, Guardian's Dewitt, Iowa, plant earned the U.S. Environmental Protection Agency's Energy Star certification in spring 2021. The certification is awarded based on the plant's ability to perform in the top 25 percent of similar facilities in the U.S. for the energy-efficiency performance levels set by the EPA. Leadership said that the plant improved performance by managing energy strategically and making cost-effective improvements to the facility.

Large glass trend continues

In addition to the demands for more efficient and sustainable glass products are continued calls for larger and larger sizes. Manufacturers are meeting demand by offering jumbo coating capabilities.

Guardian Glass added super jumbo coating capability at its Carleton, Michigan, plant last year, meaning it can process 130-by-240-inch sizes. "Guardian sees the need for high performance, low-[emissivity] jumbo and super jumbo glass continuing to grow," says Chris Dolan, commercial segment and technical services director, Guardian Glass North America.

Vitro Architectural Glass also released Titan glass this past year, a jumbo-size flat glass, a step which Bracamonte says was driven by customer demand. "It all starts with architects, who want larger glass openings unobstructed with mullions," says Bracamonte. "When we introduced [the MSVD coater at our Wichita, Falls, Texas, plant], we thought that was large enough. However, in the time since then, demands for even larger coated glass continued to grow, so we did too." ■



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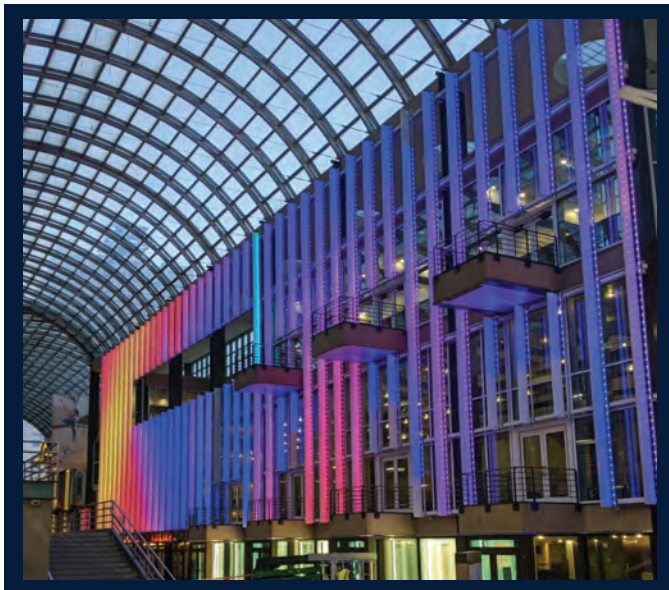
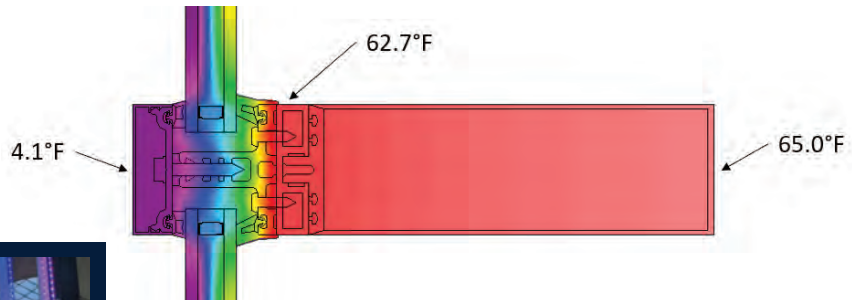
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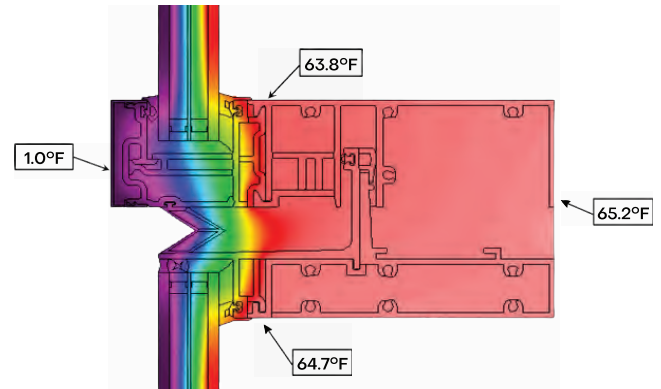
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Technical Information (Per NFRC 100)

COG U-Value = 0.102 BTU/(hr•ft²•°F)
System U-Value = 0.142 BTU/(hr•ft²•°F)
Condensation Resistance (CR) = 79

All reported U-Values calculated per NFRC 100

THE END OF COMPROMISE™

FreMarq Zero•Net™ Systems

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- comparable in cost
- no restrictions on design
- installation is same as standard systems
- same aesthetic as standard systems

R7 Systems Available Today

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- ▶ **Pressure Curtain Wall**
- ▶ **Fixed Windows**

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Daylighting design was a top priority for the net zero-designed Bullitt Center in Seattle. The design team relied on a daylighting simulation tool to help determine everything from window configurations to ceiling heights, according to Bullitt Center officials. The project features Technoform's TGI-Spacer for Schüco curtain wall and operable window systems with Solarban 60 glass. Photo © Benjamin Benschneider, courtesy of Technoform.

V I E W

D A Y L I





HEAR FROM THE EXPERTS ABOUT TWO MUST-HAVE ELEMENTS OF HEALTHY, HIGH-PERFORMANCE BUILDINGS

BY KATY DEVLIN

In November 2021, plans for an 11-story, 1.68 million-square-foot dormitory building at the University of California Santa Barbara were revealed and quickly drew backlash from numerous leaders in the design community. The project, Munger Hall, designed by billionaire investor Charlie Munger, has been called “dangerous,” “a monstrosity,” “a social and psychological experiment with an unknown impact.”

The primary target of criticism is the designer’s bold choice to greatly limit access to natural daylighting and views for the building’s occupants. While the dorm is intended to house 4,500 students, 94 percent of them would not have access to windows in their compact single-occupancy bedrooms.

How could such a proposal find traction when study after study shows that humans require access to both natural daylighting and views to thrive? To ensure that people can live, work, learn and play in healthy, high-performing environments, all spaces they inhabit—from homes to schools, and offices to shopping malls—must provide ample access to natural daylight and views.

This article features leading voices in the industry, educating about the role of natural light and views on human health and performance, and discussing the essential role of glass in daylighting design. In the following pages, read insights from Lisa Heschong, a leading daylighting researcher, and from the glass industry’s Adam Mitchell of AGNORA and Helen Sanders of Technoform.

1



A wall of glass allows natural daylight to penetrate deep into the Kitchener Public Library in Kitchener, Ontario, Canada. The project features NSG Group's Pilkington OptiView anti-reflective coating on Pilkington Optiwhite low-iron glass. Photo courtesy of NSG Group.



The Importance of Designing for Our (Un)natural Habitat

BY LISA HESCHONG

Editor's Note: The following is an excerpt from Heschong's book, "Visual Delight in Architecture," available through Routledge, routledge.pub/Heschong_VisualDelight. The publisher is offering a 20 percent discount to Glass Magazine readers. Use code GLA21 by Feb. 28.

We modern humans spend over 90 percent of our lives inside of buildings. [...] Since we now spend most of our lives inside of buildings, it matters a great deal how those buildings are designed. The indoor environment is now our (un)natural habitat! The forms, details, and functions of buildings profoundly impact our physical health and mental well-being, they set the stage for how we perceive the environment

around us, they influence our social relationships, and they both form and inform our culture.

Humans are highly visual creatures. Whereas dogs understand their world largely through their sense of smell, and creatures with exceptionally large ears or long whiskers may rely more on sound or touch, we humans use our sense of sight as our primary mode for understanding the world. In many ways, due to the very evolutionary perfection of our eyes, our interaction with the visual environment is often so seamless, so very easy, that it does not demand much thought or reflection. But the design of our buildings importantly determines the visual environment in which we spend our lives [...]

I first realized that I needed to write this book when I was working with a

team of colleagues on a proposal that one of our national 'green' building codes should require at least 50 percent of all workspaces to have access to a view of the outdoors. We called it our 'view proposal.'

My team had already succeeded in persuading this same code group to adopt minimum requirements for daylight illumination, which they considered to be a reasonable expression of best practices. I knew from my experience that, a decade or two earlier, general building industry attitudes had been strongly arrayed against daylight illumination. As a design architect, I had struggled to get daylighting design included in the schools and office buildings I was working on. However, in 1999, I completed a major research



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The Marotta Family Innovation Complex at Niagara College Canada in Niagara-on-the-Lake, Ontario, features oversized insulating glass units in the main office. The glass makeup properly controls heat gain and visible transmission values to create a comfortable working environment, while maximizing daylighting and views. The IGUs feature Pilkington OptiWhite on the inboard lite, a low iron option to improve light transmission. Photo courtesy of AGNORA.

study which showed that elementary school children in classrooms with more daylight progressed faster on their math and reading curriculum. The study's findings quickly made national and international headlines, and soon 'natural daylight' became a preferred feature for high-performance school design. In the years since, many other researchers' findings have supported the positive effects of daylight, and other codes and standards groups had already moved to adopt minimum daylighting requirements. Thus, after decades of effort by many people to persuade the building industry to embrace daylight illumination, a sea-change in attitudes had indeed happened.

However, the national code committee's reaction to our view proposal was very different. After many long discussions, it was soundly voted down by over 70 percent of the committee! The most succinct statement of the opposition that I received was that "a

view requirement is not appropriate for a green building code because it has no health or environmental impacts: views are an amenity." An amenity is a real estate term for something for which you must pay extra. Fresh air used to be considered an amenity, back in the days when industrial air pollution was pervasive in our cities. Now it is recognized as fundamental to human health. I realized we had a long way to go to persuade these code officials, the building industry, and the public at large, that access to views mattered, at least as much as daylight illumination and maybe more so. It can take a long time to change widespread attitudes and assumptions.

Lisa Heschong is an energy consultant and prominent researcher into daylighting, building energy and human performance.



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Photo courtesy of AGNORA.



Communicate the Benefits of Daylighting

BY ADAM MITCHELL

Daylighting is an important, well-studied and well-documented subject, but this widely accepted term is still nuanced for most. Daylighting is a term used to describe glazed areas, building orientation, light reflection/transmission values, and reflective surfaces designed to distribute light in buildings' interior.

Architectural glass, and its relation to daylighting, faces communication challenges across stakeholder groups within the building industry. To address these challenges, we as the glass industry can use the enormous body of knowledge regarding daylighting to model common benefits to building designers and owners. We can demonstrate how modern architectural glass

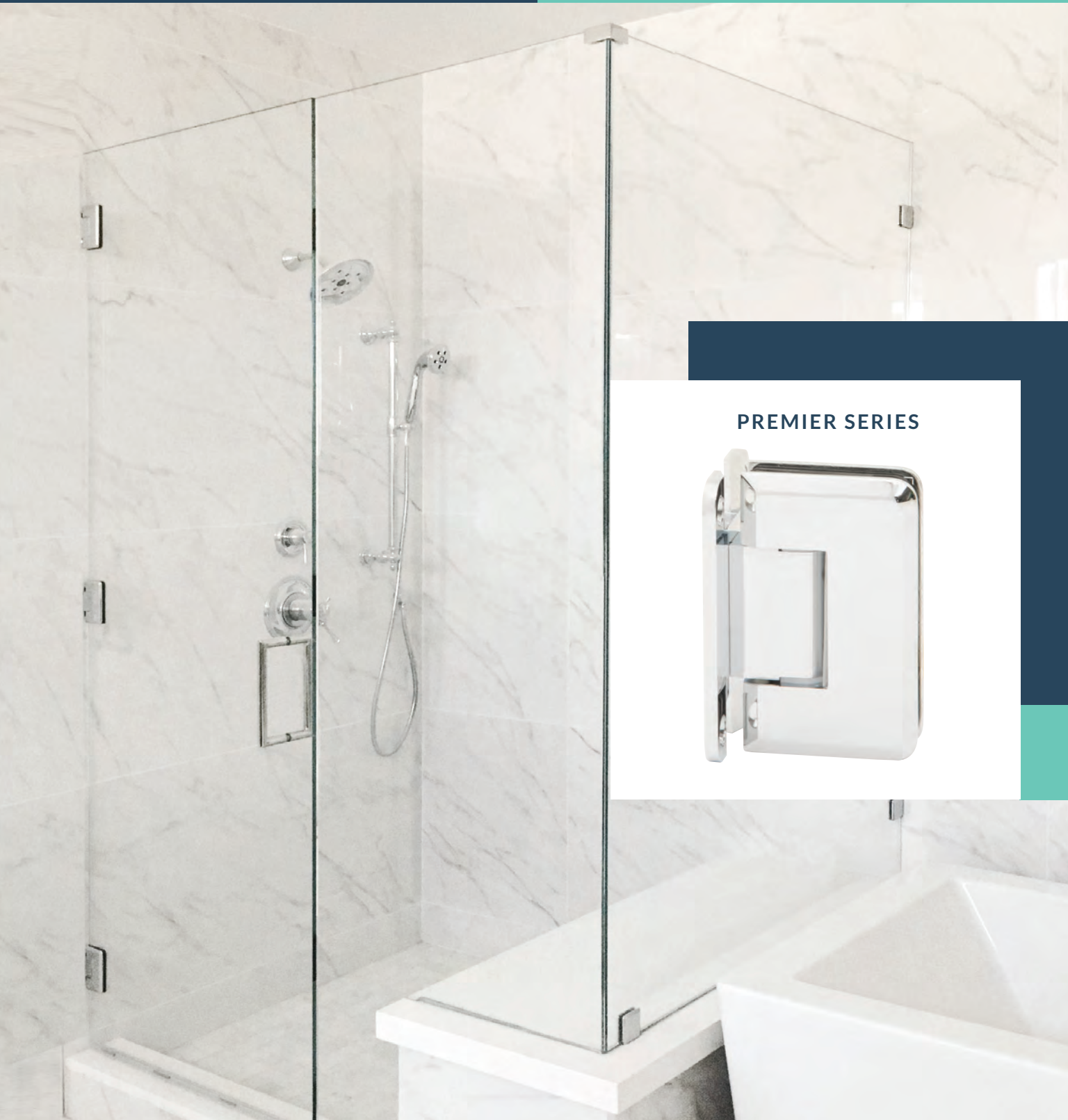
products can be used to incorporate these benefits.

1. Health

There have been several studies outlining the improvement of health from increased daylight. A key finding is increasing daylight in a built environment is known to increase an individual's amount of sleep. Getting proper amounts of sleep decreases cortisol (the stress hormone), increases glucose metabolism and decreases appetite. This leads to less stress, lower blood pressure and controlled weight. The merits of natural light are also attributed to a reduced length of stay in health care environments, indicating the body's reliance on

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light's healing properties, according to the 2018 study, "The Effects of Natural Daylight on Length of Hospital Stay."

2. Productivity

It is well-accepted that daylighting improves productivity, and often studies draw similar conclusions: productivity goes up when occupants have access to natural daylighting. The 2002 study, "Effects of Natural Light on Building Occupants," found that professionals (engineers) working in a predominantly daylit space increased output by 13 percent and decreased absenteeism by 15 percent. Light is the primary mode for humans to ingest information; consequently it's no wonder natural light improves these outcomes.

3. Cost improvements

These increased output and absenteeism rates are eye-opening and impact organizations more the larger they are.

According to Small Business Trends, the average U.S. business employs 10 people. Assume the business sees an increased output of a conservative 10 percent (versus 13 percent). This is equivalent to an hourly surplus of 2,940 working hours per year.

Further, daylighting greatly reduces reliance on artificial lights. As there are many factors it is difficult to quantify a savings value, but one such study, "Daylighting: An alternative approach to lighting buildings," assumed a saving of 20 Watt/m² for the particular environment, saving an average of 2160 MWh per year based on a specific 430,000-square-foot (40,000 m²) building.

Glass is the only façade material that allows for daylighting; thus, it is vitally important to connect the technical attributes with the benefits in a clear and concise message to partners responsible for contemporary building design and construction. As an industry, we

should not only address the incredible performance characteristics of today's glass, but also attach it to the value it provides.

Factoring windows into the design of a new building does not add much in terms of the design budget, but the long-term productivity and energy reduction benefits far exceed incremental design costs. Windows are the gateway to better environments and innovations in anti-reflective technology combined with high-performance coatings can provide improved daylighting to a space.

Adam Mitchell is marketing manager at AGNORA.

3



What's Standing in the Way of Daylighting and Views

BY HELEN SANDERS

1. Education gaps.

Changing business-as-usual practices is a challenge. In the design industry, it requires educating the full project team. However, there are over 100,000 architects and additionally, owners, who need to be educated on the impacts of daylight and views. Have we reached all of them with the depth and breadth of the information, or are we "preaching to a smaller choir" and not reaching the majority of architects who need to understand the negative consequences of not designing for occupant health?

2. Good design is neither cheap nor easy.

We run into the issues of designing good daylit spaces. The tools to assess daylight availability and glare using metrics such as spatial daylight autonomy, daylight glare potential, useful daylight illuminance, etc. are available, but they are complex to use, and the solutions to creating good daylit spaces may be difficult or costly to achieve, especially if not considered at the very outset of the design process, and in the context of meeting other design goals. Getting a daylighting profession-

Performance at the highest level.

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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**

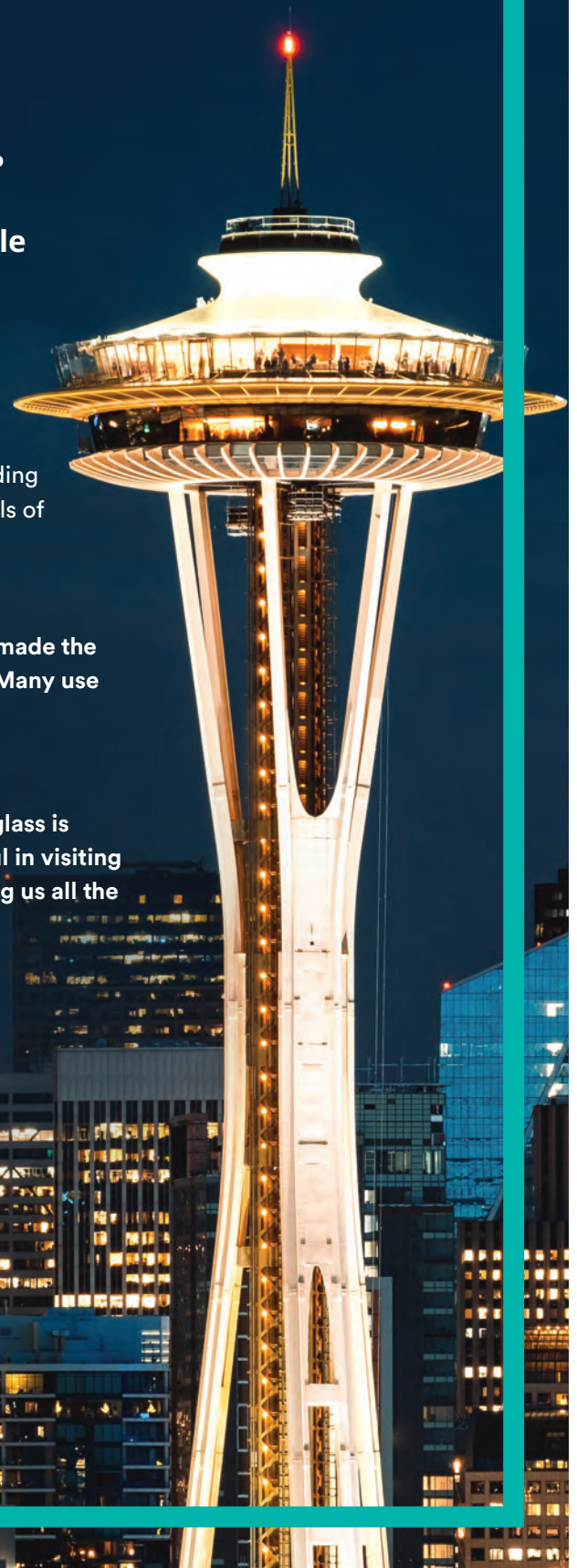
“ Getting the right insulating glass spacers in there made the difference. Spacers tend to be a fabricator's choice. Many use stainless steel as standard; we needed better.”

— 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.”

— the late Bernard Lax, CEO Pulp Studio

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al in early in the design process has historically been a challenge. It is too late to make much of an impact when designers are brought in late into the process.

Consider as an example the uptake in the daylight and views credit in the LEED certification program. Only 31 percent of LEED certified projects achieved a daylight credit in LEEDv4, so the criteria have been changed in version 4.1 to try to make it more attractive for projects to focus on. This all leads us to the fact that it costs more to hire a daylighting designer and do the appropriate analysis than to continue with the status quo. Having a daylighting designer at the table (along with other key competencies for considering thermal comfort and air quality) at the design phase is not yet business-as-usual, but needs to become that if we are to create human-centered, sustainable buildings.

I think we also have a lot of uncomfortable, over-daylit spaces that have plenty of view fenestration and daylight, but where large expanses of curtain wall are used, and thermal

comfort and glare control are not adequately considered. This gives glass curtain wall a bad reputation and leads to conversations about limiting glass areas.

3. Financial payback.

We need to do a better job of communicating the payback in hard dollars and cents to building owners. The payback on these design strategies is not immediately accessible, unlike for energy, and can require owners to take a leap of faith.

Getting the results of the research (real applied research in real buildings on real people) and impact on the bottom line to building owners (and their business tenants) seems key since they are going to be making the decisions on design and budget and setting the design intent. If all building owners came to architects and said, "I want a thermally comfortable, well-daylit building with views to nature through windows, and good ventilation to provide appropriate air quality for 100 percent of the occupants of my building" as a starting point for the de-

sign requirement, then we would have different outcomes. (We also have the split incentive in speculative real estate where the owner doesn't accrue the "health and productivity" benefits of a good/more expensive design.)

4. The real versus simulated debate.

We need to be clear about the differences between real and artificial daylight and views. The lighting industry has done a great job of selling its circadian lighting and likely gives the impression that it can replace actual daylight for the entrainment of human circadian rhythms. Data needs to be brought to the fore to demonstrate real is best, and that circadian lighting may be better than nothing, but not sufficient to replace the benefit of exposure to the much higher intensity of real daylight. Additionally, what if the power goes out? What about all the other safety issues?

Helen Sanders is a leader in strategic business development for Technoform.



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4

What the Daylighting Studies Show

SOURCE: THE NATIONAL GLASS ASSOCIATION'S BENEFITS OF DAYLIGHTING AND VIEWS FACT SHEET.

School

- 21 percent increase in student test scores
- Improved student behavior
- Increased teacher retention

Workplaces

- 20 percent increase in employee performance
- 39 additional work hours per year in employee productivity
- Reduced absenteeism and turnover
- Decreased employee sick days

Healthcare

- Reduced post-op recovery time
- Reduced length of mental health hospital stays by 2.6 days
- 22 percent less pain medication in post-spinal surgery patients
- Reduced depression, improved sleep
- Improved hospital staff performance
- Reduced medical errors

Economic Impact

- Reduced HVAC costs with high-performance glass
- Increased real estate values and rent

For additional daylighting resources from the National Glass Association, visit glass.org/resources/market-intelligence/daylighting.

Daylighting Task Group

NGA's daylighting resources have been developed with the support of the Daylighting Task Group.

- Technoform (chair)
- NSG Group
- SageGlass
- Trulite



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PRODUCTS



01



02

Guardian SunGuard SNE 50 25 HT coated glass.



03



04

01. Jumbo glass

Vitro Architectural Glass launched Titan glass, a new oversized glass product for large-scale exterior insulating glass units. Titan glass products are 130 by 240 inches, an increase from the maximum size of 130 by 204 inches previously available. The glass is available initially in heavy thicknesses of 8 and 10 millimeters.

855/887-6457 | VITROGLAZINGS.COM

02. Float glass

Guardian Glass achieved UL Product Lens Certification, covering three global product categories: uncoated float glass; sputter, or vacuum coated float glass, including commercial SunGuard and residential ClimaGuard products; and UltraMirror products. Through the certification, Guardian offers customers third-party certified data for its glass products.

855/584-5277 | GUARDIANGLASS.COM

03. Decorative glass

Sevasa launched the Lineas Collection, its new etched/engraved glass collection. The new line combines the geometry of linearity with an organic inspiration. The glasses feature Sevasa's SatenDecor satin and its diffusion of light, with the unique effects and brilliance of CriSamar engraving.

+{34} 9382-8033-3 | SEVASA.COM

04. Vision panel

Privacy Glass Solutions released Vista-Vision. This vision panel is based on the standard Vistamatic Vision Panels, known for their simplicity, durability and refined aesthetics. Vista-Vision is made in the U.S., can be used as an exterior panel and can fit openings up to 70 by 55 inches. The product comes standard with ½-inch vertical banded lines.

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PRODUCTS



01



02



03



04

01. Impact windows

Faour Glass Technologies's Slimpact Jumbo received its Florida Product Approval for HVHZ large-missile with design pressures of +/-65 pounds per square foot. The product is a 10-by-20-foot oversized, frameless impact window system. Slimpact was introduced in 2015 and featured a frameless structural glazing technique designed for the luxury residential and commercial markets in hurricane-prone regions.

813/884-3297 | SLIMPACT.COM

02. Fire-rated system

Technical Glass Products introduced the Fireframes Designer Guard System. The system is the first fire-rated full-lite glass door system in North America certified to forced entry standards. All components have been system tested together to ASTM E2395 and Intertek certified to verify all components perform as intended. To meet the dual need for life safety, the system is available with fire ratings up to 60 minutes.

800/426-0279 | FIREGLASS.COM

03. Railing system

The Frameless Hardware Co. announced that the International Code Council Evaluation Service granted approval for compliance for the company's entire line of Achieve frameless glass railing systems. The ICC-ES serves to assist code officials and regulatory bodies in reviewing and approving products for installation. The new report covers the entirety of the system, from substrate attachment to the top rail.

323/994-2168 | FHC-USA.COM

04. Protective clothing

Magid unveiled a new line of Personal Protective Equipment specially engineered to serve the unique needs of the glass industry. Products include ANSI Cut A9 garments that are up to 30 percent lighter than comparable products, say officials, for the highest levels of cut protection. New products also include PPG and Neat certified gloves; some with HB Fuller approval for butyl adhesion resistance.

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PRODUCTS



01



02



03

01. Edging machines

HHH Equipment Resources, a division of Salem Fabrication Technologies Group Inc., launched a new line of glass edging equipment, Kodiak. The Kodiak machines feature heavy-duty spindles and frame construction designed for continuous use and ideal for oversized glass. The Kodiak line launches with the Kodiak 10 Flat Polishing Machine and the Kodiak 10-45 Glass Polishing and Mitering Machine.

336/201-5396 | HHHGLASSEQUIPMENT.COM

02. Groover machine

Global Brands Group Inc. announced that its Hydrapower Product Line is now being made in Bath, Pennsylvania. The company's V Groover machines are made in the U.S. The Hydrapower Press Brake and Shear range continues to be made under license in the U.S., Canada, Mexico and Australia. Hydrapower International Inc. will continue providing service and parts in North America and will handle sales and service worldwide.

239/642-5379 | HYDRAPOWER-INTL.COM

03. Spacer system

GED introduced the latest in its Intercept warm-edge spacer systems, the Intercept SureLock. The system offers three key benefits for manufacturers; a positive, secure lock when folding spacers, making handling easier and quicker; extreme rigidity for manufacturing large spacers, allowing for better placement; and automation-ready capabilities, for future spacer system options.

330/963-5401 | GEDUSA.COM

BIM software (not pictured)

Graphisoft released Archicad 25, the latest version of its BIM software. New and improved features include faster modeling workflows and greater consistency thanks to unified navigation commands between 2D and 3D views. Users can also generate precise quantity estimates due to custom-shaped openings using plain polygons in a familiar 2D or 3D environment, as well as create custom stairs.

617/485-4200 | GRAPHISOFT.COM

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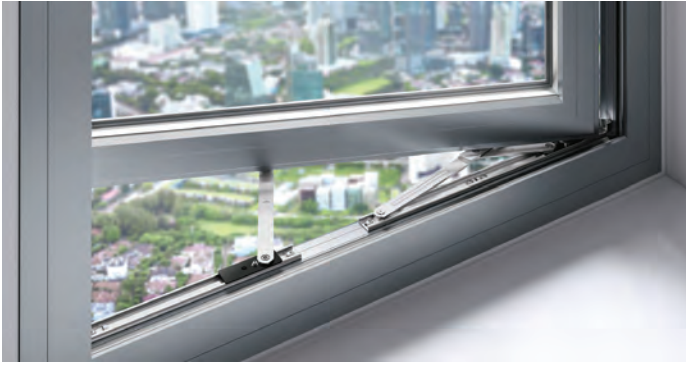
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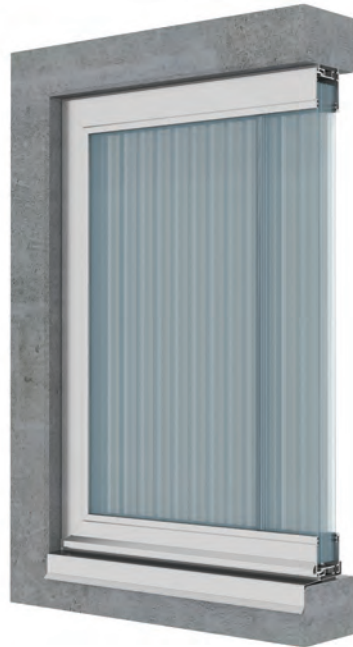
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PRODUCTS



01



02



03

01. Hinges

Roto introduced the new Roto FS Kempton range. The stainless steel 4-bar hinges are used for top-hung and side-hung applications, are suitable for all frame materials, and can be used up to a 396-pound sash weight. Outward opening windows with integrated friction hinges both limit the possible opening angle of the window and ensure that the sash is held open in any opening angle.

860/526-4996 | ROTONORTHAMERICA.COM

02. Wall system

Extech/Exterior Technologies Inc. introduced its new Lightwall 3450 Series, an interlocking polycarbonate translucent wall system. Accommodating 50-millimeter glazing panels, the new 3450 Series expands the Lightwall offering to four standard products plus customizable options. The system is lightweight, easy to install and backed with a 10-year warranty.

412/781-0991 | EXTECHINC.COM

03. Exit device

Inox debuted its new XSF Series Exit Device Designer. The XSF Series Trim delivers a consistent, matching lever design across openings of an entire facility for aesthetic uniformity while still maintaining the proper ratings and codes. The XSF features a solid stainless-steel escutcheon and lever with a heavy-duty internal mechanism while maintaining a designer exterior aesthetic.

916/388-1888 | INOXPRODUCTS.COM

Payment service (not pictured)

Paradigm introduced Paradigm Payments, a payment processing service. Paradigm Payments allows contractors, distributors, dealers and manufacturers to securely accept credit or debit cards and process checks in the field or in-store. The service integrates with existing accounting systems and applications and works seamlessly with leading third-party terminals.

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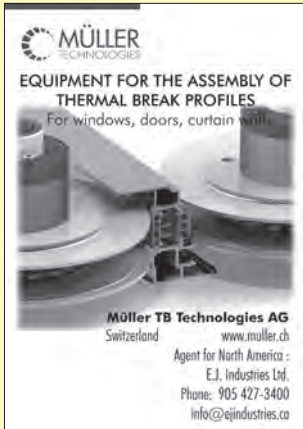
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WHY GLAZING? TWO GLAZIERS GIVE THEIR REASONS

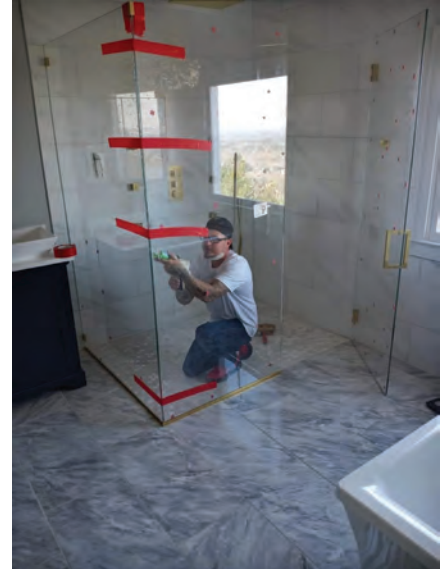
Labor is a perennial issue in the glass industry, made worse by recent supply chain shortages. As part of an initiative for Careers in Construction Month, recognized in October of each year, National Glass Association staff reached out to two glaziers about their life and work. Paul Miller works at Vienna Aluminum, a glass shop in Northern Virginia. Andrew Leopard is an Atlanta-area glazier working at A Modern Glass and Mirror Co.

Answers have been edited for length and clarity.

Q How did you get started in the industry?

Miller: When I first graduated from high school, I wasn't sure what to do. Luckily, I knew my Dad, Jerry Hamilton, and my uncle, Jeff Hamilton, owned their own glass business in Northern Virginia. So, I reached out to my dad, and he said I could help them out part time.

Leopard: I've been in the business for seven years, and come from a family of glaziers. My grandpa was a glazier for 30 years.



Left: Paul Miller is a glazier for Vienna Aluminum Inc., based in Northern Virginia. Right: Andrew Leopard is an Atlanta-area glazier and employee of A Modern Glass & Mirror Co.

Q What do you like about being a glazier?

Miller: I like that I get to be creative. There are so many different types of decorative glass that we've installed over the years, especially in churches. We also get to go to these huge houses and install skylight glass or bay windows.

I also enjoy the process of installing glass. When you get to the house sometimes the cracked window glass or cracked storefront door can be an eyesore. Once I'm done, I can step back and see the finished product; it feels good to know I did that. ... I love my job. I love what I do, and my focus now is just perfecting my craft.

Leopard: There's something for anything you want to do ... If you're fast paced, there's a spot for you. If you want to be slamming frames in the field, you can do that. If you want to stay in the shop and

be shop foreman, there's a place for you. If production is your thing, you can be in the [fabrication] shop.

Q What kinds of opportunities or benefits does glazing offer as a career?

Miller: [I've stayed in the industry because I know] that I can take it a step further and become a project manager. The end goal is for me to either take over my uncle's shop one day or start my own business.

Leopard: The big thing right now is teaching the younger generation that you don't have to go to college all the time to make six figures. You can start in the field—if you're a union glazier, you could make \$20 an hour, which is good money for an apprentice. In some areas, people can make up to \$60 an hour, with benefits. ■

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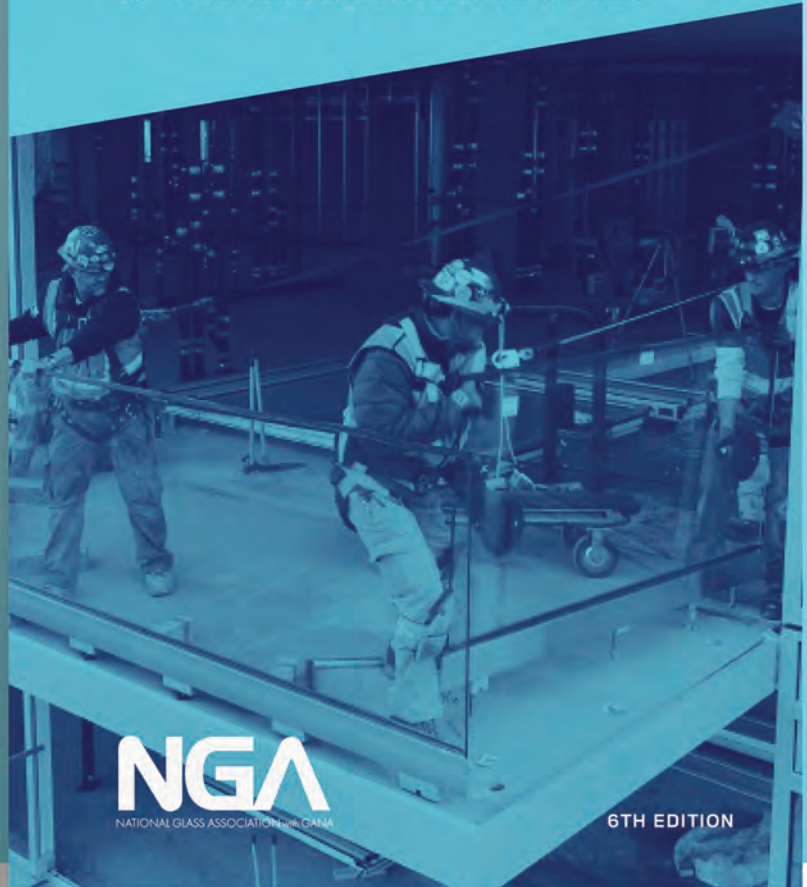
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