

GLASS

MAGAZINE®

THE GLASS AND GLAZING AUTHORITY • MAY/JUNE 2022

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TOP



GLAZIERS

30 YEARS
OF GROWTH,
EVOLUTION,
ADVANCEMENT



Protective glazing
idea book

School security
glazing

Managing supply
chain problems

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Deciphering LEED Credits

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SHOUT OUTS

The Massive BEC Recap

By Max Perilstein, Sole Source Consultants



DECORATIVE

Promoting Biophilic Design with Glass

By Spencer Raymond, GGI

PROJECT SHOWCASE



Featured in Glass Magazine Weekly and on Glass-Magazine.com. To submit projects or case studies, write Norah Dick, ndick@glass.org. Pictured: Despite COVID-19 delays, glass fabricator InKan helped complete the revitalization of Massey Hall, an original concert hall from the 1800's, located in Toronto, Canada. Designed by KPMB, and installed by InKan Contracts, the fabricator supplied confidence rail glass with platinum ceramic frit on surface No. 3 under low-iron acid etch.

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30 Years of Top 50 Glaziers



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

Glass Magazine's annual Top 50 Glaziers celebrates its 30th anniversary with this year's report, beginning on page 36 of this issue. That's three decades of tracking the impressive evolution and growth of the U.S. glazing market.

The report was first published in 1992 with the goal of highlighting leading U.S. glazing contractors, ranked by sales volume. Over the years, it has also become a market study and health check for the domestic glazing market, presenting leading trends, growth segments, industry headwinds and more. Here are a few takeaways from 30 years of Top 50 Glaziers.

A growth industry

Three decades of Top 50 Glaziers demonstrate a growth industry. Even in the face of economic setbacks—including the early 2000s recession following the dotcom bubble burst and 9/11, the Great Recession beginning in 2008, and the recent turmoil caused by COVID-19—U.S. glazing market sales continue to trend upward. Consider, in the first decade of the Top 50 report, combined non-inflation adjusted gross sales for Top 50 companies hovered around \$1 billion. In this year's report, combined sales reach \$3.8 billion, marking a return to pre-pandemic levels.

More glass, better glass

At the root of the growth in the U.S. glazing market during the past 30 years are design trends for more value-added glass, often in larger sizes, in more places on a building. Glaziers point to increasing demand for high-performance products, jumbo sizes, interior installations, specialty glasses and more. For example, in this year's survey, 63 percent of companies worked on a project with curved or bent glass, 59 percent worked on a project with jumbo glass, and 44 percent worked on a project with bird-friendly glass.

Digital boom

Back when Glass Magazine launched Top 50 Glaziers, companies were still writing estimates and take-offs by hand. Processes are now online and interconnected across project teams. Additionally, glaziers are adopting new digital tools and software for better project delivery. In this year's survey, 60 percent of companies report using 3D modeling, and 67 percent of companies report investing in new software during the previous year.

A business of legacy companies

Top 50 captures many of the same U.S. glazing leaders year after year. Two glazing firms have been Top 50 Glaziers every year since the program began: Harmon Inc., which captured this year's No. 1 spot, and Karas & Karas Glass Co., No. 10 on this year's list. Giroux Glass has appeared in 29 of the 30 Top 50 Glaziers lists. Haley Greer Inc. and TSI Corporations have made the ranking 26 times, and Ajay Glass Co., 25 times. An impressive 19 companies have made the list at least 20 times.

A note of thanks

Thank you to the glazing firms that contribute to the Top 50 Glaziers survey year after year. It is only with your participation that we're able to compile this comprehensive market report to present to the wider industry, at no cost. And thank you to Glass Magazine's Associate Editor Norah Dick, who has been at the helm of the Top 50 report since 2017. ■

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NEED-TO-KNOW INFORMATION
FROM THE NGA



Leaders from the NGA and NGA member companies on Capitol Hill for Glass & Glazing Advocacy Day.

ON GLASS & GLAZING ADVOCACY DAY, INDUSTRY LEADERS MAKE THE CASE FOR GLASS

The National Glass Association hosted glass industry leaders on Capitol Hill in April for its first-ever Glass & Glazing Advocacy Day, providing an opportunity for those versed in all corners of the industry to meet face-to-face with their legislative representatives.

During sessions with Congressional representatives, industry leaders sought clarity on critical issues, such as supply chain challenges and glass recycling, and also made a case for glass as a high-performance, sustainable building material. Other topics included

the ongoing labor shortage, plus the importance of recruitment, training and apprenticeships.

"2022 was declared the International Year of Glass by the United Nations," said Nicole Harris, president and CEO of the NGA at Advocacy Day. "With momentum building across the globe, we wanted to take this opportunity to amplify our message here at home, with leaders in Washington, D.C., to share how glass is an adaptable, sustainable, energy-efficient, strong, beautiful, safe, and essential building product." ■

BEC CONFERENCE DRAWS AT-CAPACITY CROWD TO NASHVILLE

The National Glass Association's Building Envelope Contractors Conference returned to Nashville in March with an at-capacity crowd of nearly 650. Glass industry leaders gathered for two days of glazier-focused education during the return of BEC Conference, which was cancelled last year due to the pandemic.

"We're back," said Max Perilstein, owner of Sole Source Consultants and the emcee of BEC. "It's been a long two years, but we're bringing everyone back together."

BEC programming once again targeted the most top-of-mind issues for the North American glazing contractor community. "Since March 2020, the NGA doubled down on finding solutions for the glass and glazing industry," said Nicole Harris, president and CEO of the NGA during her opening remarks. "Our supply chain is hurting. At your jobsites and operations, I hear the same things over and over again—supply shortage, skilled labor shortage and general contractors and building owners who don't listen when we tell them about longer lead times and rising costs. ... Today's BEC program is about solutions for glazing contractors." ■

GLASS FACTORY ADVANCEMENT TAKES CENTER STAGE AT GPAD

Glass Processing Automation Days, a two-day glass fabrication educational conference, drew more than 160 attendees to Nashville in March. The conference, hosted by the National Glass Association,

drew leaders in glass fabrication, technology, machinery and more for education, tabletop displays, plenty of networking, and solutions for the future.

Speakers discussed moving from islands of automation to fully integrated factory floors. They addressed the importance of using machine and production data to perform predictive and on-time

maintenance. And presenters provided insights on advancement in glass machining technologies.

GPAD was held in conjunction with the BEC Conference and included a special Bridging the Supply Chain crossover educational event that brought together attendees from the glazing, fabrication and supplier communities. ■



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GLASS ADVOCATE

NGA Resources for Glaziers & Installers

The National Glass Association Installing Committee volunteer members have developed numerous technical resources for glaziers. The following resources are available for download from glass.org/store.

The Top 10 Items Commonly Missing from Fenestration System Shop Drawings

Glass Technical Paper IN01-06. Shop drawings for glass and aluminum windows, curtain walls and skylights must document and detail all requirements of design parameters, material ordering, fabrication and erection. Failure to properly document these requirements can result in numerous errors and project delays.

Bid Considerations for Contract Glazing Proposals

Glass Technical Paper IN02-09. Today's business climate requires glazing subcontractors to take steps to reduce their agreements to writing, clarify those agreements and limit their exposure. The purpose of this document is to list optional inclusions, exclusions and qualifications for glazing subcontractors to consider adopting. This is not a comprehensive list; it is a tool to assist subcontractors in evaluating their bid proposals.

Key Elements of Fenestration System Shop Drawings

Glass Technical Paper IN03-12. Shop drawings are required by subcontractors, whether it is for glazing, metal panels, masonry, precast concrete or any substrate that makes up the exterior façade of a building. The intent

of this document is to focus on the key elements of shop drawings designed for detailing glass and metal curtain wall, window, skylight and storefront installations. This bulletin presents a general checklist of items that should be included in shop drawings for fenestration systems and is presented in an "Order of Assembly" format for the documents.

Safety Guidelines for Deglazing Structural Silicone

Glass Technical Paper IN04-14. There are various reasons for glass or infill removal from a structurally glazed window system. Reasons might include removal due to glass breakage, for quality control purposes or a desire to upgrade to more energy-efficient glass. The removal of glass from a structurally glazed window system is typically called "deglazing" by the glass and glazing industry.

Overview of Building Information Modeling (BIM) for Glass and Glazing Systems

Glass Technical Paper IN05-17. Building Information Modeling, or BIM, is an intelligent, model-based process that starts in the early stages of planning and design. It is used through construction and can also be used throughout the operational management stages. BIM projects can display the proper graphics at different scales, represent accurate geometry, and be rich with manufacturer product data.

NGA Commercial Fenestration Systems Manual

The CFMS is meant to offer those new to either the architectural, glazing or con-

struction industries an entry-level primer into what makes curtain walls functional, cost-effective and efficient in terms of their design, fabrication, installation, and long-term performance over the life of the building where they are used. This manual covers systems descriptions, design parameters, pre-construction and onsite testing (to ensure expected performance), how manufacturers use shop drawings to convey the design intent of the architect, and how systems are installed onsite. Latter sections cover applicable industry standards, the most common building codes and other glazing industry standards.

Guide to the Glass and Glazing Requirements of the Model Building Code

The purpose of this Guide is to assist glaziers/glass installers in complying with all appropriate glazing requirements. It is intended primarily for architectural glazing contractors, replacement glass installers, architects, plan reviewers, building inspectors and specification writers.

"Manage Risks with Mock-Ups"

Article in January/February 2022 Glass Magazine. Glass Magazine article on the purpose and importance of performance and visual mock-ups: "test performance, identify design concerns and align expectations before construction begins." Read this article in the January/February print edition of Glass Magazine or online at glassmagazine.com.

More than 100 technical publications are now available for download on glass.org, including 20 manuals, 88 glass technical papers and three Design Guides. To find these technical resources, visit glass.org and click on the "store" icon in the top menu. ■



GLASS INFORMATIONAL BULLETIN

School Security Glazing

The objective of this bulletin is to provide information on security glazing options for windows and doors installed in schools. It is important to determine the assets, the potential threats and hazards, and the level of vulnerability to know what level of testing or certification is required before specifying the glazing.

Specification considerations

When deciding what level of protection to specify, consider these factors:

- Direct line of sight to students
- Location and movement of students during an active shooter event
- Distance and time for first responders.

FEMA publication “Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings” includes the following considerations:

- Use extensive glazing at main entrance to enhance visual surveillance to parking lots and pedestrian routes.
- Install openings or windows in solid walls to make areas adjacent to the school without line of sight visible from the interior.
- Consider using burglary- and ballistic-resistant glazing in high-risk school areas.
- Consider using steel window frames securely fastened or cement grouted to the surrounding structure.

Security selection

The appropriate glazing penetration resistance should be determined based on the levels of resistance:

Basic safety glazing has enough strength to withstand accidental human

Security Selection Quick Reference Summary

Security selection	Security level of the selection*			
	Test standard	Low	Medium	High
Basic safety glazing	ANSI Z97.1	Class B		Class A
	CPSC	Cat I		Cat II
	CAN CGSB	Class B		Class A
	ASTM F3006/F3007	0.75 m Cat 2	3.66 m Cat 3	3.66 m Cat 2
Enhanced	UL 972	Std - 10 ft	Ind/Outdoor	High Energy (40 ft)
	ASTM E2395	L1	L3	L5
	ASTM F1233	1.0	1.1	1.2
Forced entry	ASTM F1233	1.4	2.3	5.0
	ASTM F3038 - mob with hand tools	5 min	15 min	30 min
Enhanced forced entry	ASTM F1233 Annex A2	3 shots with 9 mm handgun; Class 1.4	3 shots with .357 Magnum; Class 2.3	3 shots with .44 Magnum; Class 5.0
Ballistic protection (handguns)	UL 752	1 (9 mm handgun)	2 (.357 Magnum)	3 (.44 Magnum)
	ASTM F133	HG3 (9 mm handgun)	HG2 (.357 Magnum)	HG4 (.44 Magnum)
Multiple forced entry assault (ballistics and forced entry)	ASTM F1233	HG1/R1-1.4	HG2/R2-2.3	HG4/R3-5.0
Blast resistance	ASTM F1642/F2912	H3	H2	H1

* This is not meant to be all-inclusive; there are levels existing outside of this table.



GLASS INFORMATIONAL BULLETIN—SCHOOL SECURITY GLAZING

impact and glass fragments are contained. Products such as laminated safety glazing or surface-applied safety films could be used for situations such as slowing immediate entry through glass and reducing the ability of someone to reach through an opening to release a door handle.

Enhanced burglary-resistant glazing can be a deterrent to smash-and-grab crimes involving the use of hands, elbows, fists and general tools such as a hammer. Products in this category are intended to deter vandalism such as breaking into a display case or entering the building and fleeing.

Ballistic protection (bullet resistant) glazing is designed to resist penetration from a variety of firearm ammunitions and provides an improved safety barrier against bullets and flying glass or plastic fragments. Examples include all-glass laminates, glass clad polycarbonate laminates, etc.

Forced-entry glazing is designed to increase the amount of time required to gain entry, to allow for the enactment of lock-down protocols. These products may be used in areas with high risk of prolonged attack or in critical areas such as entry vestibules. Forced-entry-resistant glazing should resist penetration from hand-held or hand-thrown objects such as hammers, crowbars, bats, knives, bricks and rocks.

Multiple forced-entry assault (ballistics and forced entry) products are designed to combine the resistance of ballistics classified laminates with additional resistance to forced entry. Testing involves weakening the sample by ballistic assault but not allowing the bullets to penetrate. The glazing is then tested to withstand physical impact and attack

with various weapons. This glazing would carry a ballistic and forced-entry classification and would be used in very high-risk areas, where intruders may be armed with guns.

Blast-resistant glazing can reduce injury from flying glass resulting from direct blast shock waves. When properly designed, framed and anchored, blast-resistant glazing could maintain the integrity of the building envelope following an explosion and reduce interior damage. Blast-resistant glazing may offer some level of forced-entry resistance but must be tested to quantify resistance. This glazing is not typically bullet-resistant without being tested to a ballistic threat level.

Security glazing testing: glass only

- ANSI Z97.1 Safety Glazing uses a 100-pound swing bag dropped from two different heights to determine the rating.
- ASTM F3006 Ball Drop Impact Resistance uses a single impact from a 5-pound ball released from different drop heights.
- UL 972 Burglary Resisting Glazing Materials is a mechanical test in which a 5-pound steel ball is dropped from different heights to evaluate resistance to attempted burglary with multiple impacts.
- ASTM F1233 Security Glazing Materials and Systems gives a wide range of threat levels and uses various hand tools and/or ballistic attack to give a resistance rating to the glass.
- UL 752 Standard for Bullet-Resisting Equipment evaluates the ballistic resistance of glazing.

Security glazing testing: glazing system (frame and glass)

- ASTM E2395 Voluntary Security Performance of Window and Door Assemblies with Glazing Impact uses timber missiles, followed by striking the glazing with a hammer, simulating the capability of window and door assemblies to frustrate and potentially delay or deter opportunistic entry by unskilled and semi-skilled intruders.
- ASTM F3038 Timed Evaluation of Forced-Entry-Resistant Systems is a glazing impact test with timed assault sequences designed to simulate a spontaneous mob using readily available hand tools for forced entry.
- ASTM F1642 Airblast Loadings evaluates glazing in intentional or accidental explosions. The test data is used to determine the glazing or glazing system hazard rating using ASTM Specification F2912.

Resources and References

From the Federal Emergency Management Agency, and available at dhs.gov:

- FEMA Primer to Design Safe School Projects in Case of Terrorist Attacks and School Shootings (December 2012) (see Checklist in Appendix)

From the National Glass Association, and available at glass.org/store:

- NGA Glass Technical Paper FB16-07 Bullet Resistant Glazing
- NGA Glass Technical Paper FB43-14 Security Glazing
- NGA/PGCI Protective Glazing Manual
- NGA Laminated Glazing Reference Manual
- Glass & Metals 401: Protective Glazing ■



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Bacon & Van Buskirk Announces Sale and New Owner

Aaron Hiatt, long-term employee and current company president of Bacon and Van Buskirk Glass, purchased the company from Rod Van Buskirk.

Founded as a small paint and glass store in Champaign, Illinois, during the early 1900s, BVB Glass has grown into one of the region's leading full-service glass companies, and has been recognized as one of the United States' leading contract glazing firms, say company officials.

"I am excited to build upon the legacy

that is BVB Glass for our associates and our community," says Hiatt. "I would like to thank our past and present customers for their continued support and would also like to thank Rod for his guidance over the years."

Purchasing the family business in 1997 from his father, Roy Van Buskirk, Rod guided the company through market turbulence in the 2000s and continued to grow the company. He has been a board member of the FGMA, president of Distributors Council, and chair of the National Glass Association.

New Glass Handling Company SmartGroup America Opens in Maryland

SmartGroup America is a new company incorporated in Annapolis, Maryland, offering a uniquely designed glass lifting manipulator. SGA has appointed Eric Maynard to lead its marketing efforts as the national sales director.

Maynard has a proven history in leadership and organizational development and is grateful for the opportunity to expand his love of learning and his appreciation for the glass and glazing industry. In this



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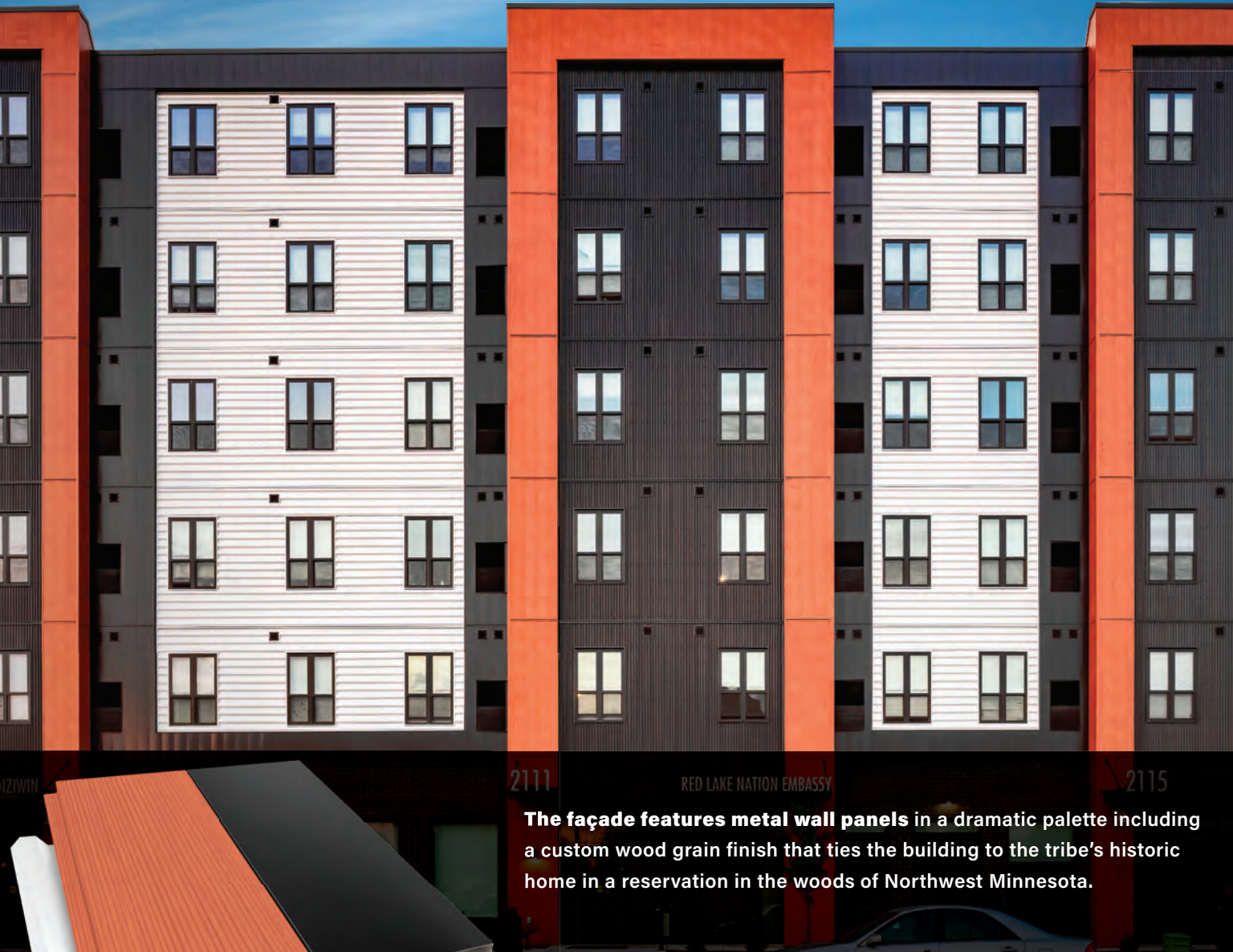
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The façade features metal wall panels in a dramatic palette including a custom wood grain finish that ties the building to the tribe's historic home in a reservation in the woods of Northwest Minnesota.

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Architect: Cuninghame Group Architecture GC: Loeffler Construction & Consulting Photo: Alan Blakely

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NEWS TO KNOW

role, he will focus on building SGA's brand awareness through marketing, sales and educational offerings while building a support and sales team to serve the glass and glazing communities across in the US.

Extech Acquires Martin Metal Designs of Las Vegas

Extech, headquartered in Pittsburgh, purchased the assets of Martin Metal Designs, located in Las Vegas.

The acquisition expands Extech's capabilities in its core business of daylighting systems and custom façades. It will also position Extech to complete architectural metal work. Matt Martin, a metals artist, will continue as part of the Extech team.

For 12 years, Martin Metal Designs has created and fabricated original architectural metal work for commercial and high-end residential building projects in Nevada and beyond.

Pilkington UK St. Helens Glass Plant Runs Furnace on Biofuel for Four Days

Pilkington United Kingdom Limited, part of the NSG Group, became the world's first flat glass manufacturer to fire its furnace on 100 percent biofuel, as part of an industry trial to find sustainable alternatives to natural gas.

A sustainable biofuel made from organic waste materials powered the St. Helens glass manufacturer's furnace entirely for four days, creating 165,000 square feet of the lowest-carbon float glass ever made. The fuel emits around 80 percent less carbon dioxide than traditional natural gas used in the sector.

The trial forms part of a \$9.5 million project led by industry research and technology organization Glass Futures, working under the Department for Business, Energy and Industrial Strategy's Energy Innovation Programme. It aims to demonstrate that the furnace could run safely at full production on the low-carbon fuel without impacting product quality.

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NEWS TO KNOW

PEOPLE NEWS

Vitro Architectural Glass announced that *Brian Pigney* has been appointed national architectural manager for the Great Lakes region.

In this role, he will focus on delivering product, technology and service solutions to architects, specification writers, glazing contractors, façade consultants and Vitro Certified Fabricators for the commercial construction market in Wisconsin, Ohio, Indiana, Michigan, Chicago and northern Illinois.

GGI announced the promotion of *Stephen Balik* to vice president. Balik joined the 122-year-old company in 2010. Balik began his career at GGI assuming ground-level roles, first in estimating. He later progressed to project management, architectural sales, business development and marketing.

Balik has been part of the senior leadership team since 2014. In recent years, he joined GGI President David Balik and Executive Vice President Richard Balik on the executive management board, and has expanded his focus across the company's divisional and departmental activities.

Halio, a smart windows manufacturer, welcomed *Lou Podbelski* to its leadership team as senior vice president, business development. Podbelski is responsible for Halio's sales and marketing, bringing his years of experience and relationships in dynamic glass, commercial glazing and curtain wall, architecture, and building and products services industries to Halio. ■

**From March 3 to press time March 30. Read these stories, and others, in their entirety at GlassMagazine.com.*

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LEGAL

RISKS OF EXAGGERATING PRODUCT PERFORMANCE

BY MATT JOHNSON



Statements about product capabilities and capacities have the potential to form legally binding contracts and warranties. Where those statements are untrue, or made indiscriminately, the legal and financial penalties can be significant when it is discovered that a product can't meet the required or represented performance. The legal risk is not necessarily in the act of making a representation about performance, but rather, what it represents.

Consider the category of protective glazing, a focus of this edition of Glass Magazine. The features and capabilities that fall into the general description of protective glazing show the amazing capacity of glass and glazing systems. And while marketers love terms like protective glazing, risk managers and

lawyers find them more troublesome because of the liability that can follow marketing representations.

Fraud versus misrepresentation

The worst examples, but fortunately most infrequent, are found in downright fraud—lies to get a sale. In these situations, intentional decisions are made to misrepresent a product's performance or installations. Similarly deceptive are installations that intentionally substitute a knowingly less-effective product—the proverbial bait-and-switch. These rather obvious situations create liability that is not only expansive but cannot be insured against.

More regularly encountered are situations where representations about a product's characteristics are made without adequate information or with simple inattention. Without reasonable and appropriate due diligence, suggestions of product capacity that cannot be met are often found to be negligent misrepresentations that can result in damages to not only replace with compliant systems, but also broad consequential damages that are necessary to prove the noncompliance in the first place.

Financial and compliance risks

Separate from these legal risks, financial risks multiply where there is a cavalier approach to market representations. Warranties of performance are not limited to paper copies with pretty edges. Any express representation of capabilities, capacities, or functionality of a product has the potential to become an affirmative warranty that will bind the seller. And where those representations are not met or performance proves less than full, sellers can bear the financial burden of bringing systems into compliance or sourcing alternatives.

Regulatory compliance is also a considerable risk point. The Federal



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Trade Commission has express oversight over how certain materials can be marketed. These requirements are broad and far-reaching. Defending against a claimed violation is often difficult and the penalties for violating these standards can prove severe.

Of course, knowing about a risk does not need to inhibit marketing or sales. The key point is managing risk.

Standards and expertise

Industry consensus standards that define and provide for how to measure performance, are perhaps the most valuable sales tools around. A working understanding of the applicable standards and their proper use allows discussions with project designers and engineers to occur from a shared basis of understanding. This maximizes the opportunities to ensure needed performance requirements are met, without overselling or unknowingly delivering underperforming products.

It also provides the opportunity to validate product performance from common frameworks, not individual whims.

Industry expertise also provides opportunities to rely on supplier experts to ensure product performance is not misrepresented. Manufacturers spend thousands of hours in research and development so that the design and testing of products can conform to industry standards. Independent validation of compliance to these standards helps support represented performance. The key is to manage relationships with these manufacturers and suppliers. Lean into their expertise on the specifics of their system. Moreover, keep current with their offerings and representations of performance because they can—and often do—change over time. Fostering these relationships helps limit situations where assumptions based on historical performance lead to misapplication on current projects.

Importance of limitations

It is also important to remember that no one is an expert on everything. Disclosure of appropriately tailored limitations that identify the representations of others can provide a key shield to later claims of poor or misrepresented performance. This step does not require lawyerly fine print, but rather a direct identification of the products being provided, their represented performance characteristics and specification of the standards by which that performance is measured. This helps establish performance expectations and operative assumptions about represented performance, and allows all parties to assess any potential substitutions. ■

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

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MANAGEMENT

MANAGING SUPPLY CHAIN PROBLEMS

BY MARCO TERRY



The past couple of years have been marked by severe supply chain problems. Small businesses have collectively waited for these problems to end. However, these problems persist and will likely remain for a few years.

Supply chains are complex, interconnected systems. A disruption in a link of the chain can create a cascade of downstream and upstream problems. There is no simple or fast way to fix this, especially during a pandemic.

As business owners, we have to adapt to this situation. We must find ways to operate in this environment, overcome

its challenges and grow our companies. Here are six tactics to help you deal with the current situation.

01— FORECAST POSSIBLE SUPPLY SHORTAGES

Companies in the construction industry usually forecast their sales using a simple but effective method. Review past sales volumes and current market conditions to come up with an estimate. In the past, business owners never spent a lot of time planning for potential supply issues. After all, suppliers always had products

when you needed them. Unfortunately, this is not always the case anymore.

A more effective forecasting approach accounts for possible supply chain issues. This task is difficult for small businesses with limited resources. However, a simple method can provide a reasonable estimate. Talk to your suppliers to understand their perspectives on the market. Get their opinions of the near-term supply situation based on their order flow. See if they are willing to discuss their expected sales to other companies in your industry. This conversation provides valuable insight about the anticipated direction of the market. Incorporating supplier information into your business forecasts enables you to make better inventory, sales and personnel decisions.

02— DIVERSIFY SUPPLIERS

Most small-business owners prefer to work with as few suppliers as possible. This strategy has advantages. It allows you to build a track record and get volume discounts and good payment terms. This approach works very well during normal times. Additionally, you also develop a good relationship with the supplier, which can be helpful during challenging times.

However, this strategy has a significant limitation. It leaves you exposed if a critical supplier runs into supply chain problems. This situation can lead to delayed projects, dissatisfied clients and lost revenues.

Consider working with multiple suppliers for each essential product that your company uses. Spread your purchases around, so you build a track record with each supplier. Evaluate prospective suppliers carefully and work only with well-established companies. Consider buying a commercial credit report on them to determine the health of your suppliers' businesses. These reports are inexpensive and are available from Dun & Bradstreet, Cortera and Ansonia.



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03— CONSIDER HOLDING MORE INVENTORY

Inventory is a double-edged sword. It takes money, time and space to purchase inventory. Inventory is an expense until you sell it, at which point it becomes revenue. For this reason, companies try to minimize the inventory they keep on hand. The problem with this strategy is that it has no safety margin. It leaves you exposed to inventory problems during supply crunches.

Any increase in your inventory should be done gradually to minimize sudden expenses. The obvious benefit of this strategy is that you are better prepared to meet customer demand. Unfortunately, the downside is the increase in cost. Businesses need to carefully weigh the cost of holding more inventory against the cost of upsetting prospective clients.

Monitor expenses carefully if you decide to increase inventory. This

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AND SPACE TO
PURCHASE
INVENTORY.
INVENTORY IS AN
EXPENSE UNTIL
YOU SELL IT, AT
WHICH POINT IT
BECOMES
REVENUE.
”

scrutiny helps you avoid buying more inventory than you can afford. Otherwise, you might end up with excess inventory but no cash.

04— MANAGE LABOR SHORTAGES

Some of the problems in the supply chain system have been caused by labor shortages. Every company has been affected by this development. The best ways to handle this challenge:

- Cross-train employees. Cross-train employees so they know how to do someone else's job. This flexibility allows you to reassign employees if key team members need to miss work. Ideally, every employee who is key to the business should have a backup employee who can do their tasks.

- Use a staffing agency. Develop a relationship with a temporary staffing agency that focuses on the construction industry. An agency can help you if

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you are short-staffed. Keep in mind that staffing agencies have become very popular for this very reason. Consequently, finding a temporary employee may be difficult.

05— CONSERVE CASH

It appears that the economic uncertainty that we have faced for the past two years will remain for the foreseeable future. I would not be surprised if financing costs increase and lending standards tighten.

Monitor your cash flow carefully. Keep your accounts receivable up to date and ensure clients pay on time. Scrutinize expenses to avoid unnecessary purchases. Lastly, work on building a cash reserve for the company. A cash reserve is essential for every company. Having enough funds to cover operations for a couple of months gives you time and space to maneuver through major problems.

06— KEEP AN EYE ON INFLATION

The combination of a pandemic, supply chain issues, and monetary policy has led to high inflation. The last time businesses had to deal with significant inflation was in the late 1970s through the early 1980s. Most small-business owners have never dealt with this degree of inflation and are unprepared for it. Here are three strategies to help with this challenge.

- Update your accounting system. Business owners must keep accurate and up-to-date accounting. Data must be entered regularly. At a minimum, update the information every week. Keeping an accounting system is tedious but necessary. An up-to-date accounting system's information allows you to implement the following two strategies.

- Check profit margins regularly. Supplier and labor costs change frequently. These cost changes affect the

profitability of your business. Check your profit margins at least once per month to ensure that your business meets your profit expectations. Take corrective action if the profit margins do not meet your expectations.

- Ensure your pricing retains profit margins. Update your pricing list regularly to keep pace with rising inflation. Ensure the sales team is up to date with new pricing, and review all proposals against expected profit margins. ■

Marco Terry is managing director of Commercial Capital LLC, a factoring company and provider of invoice financing to companies in the glass industry.

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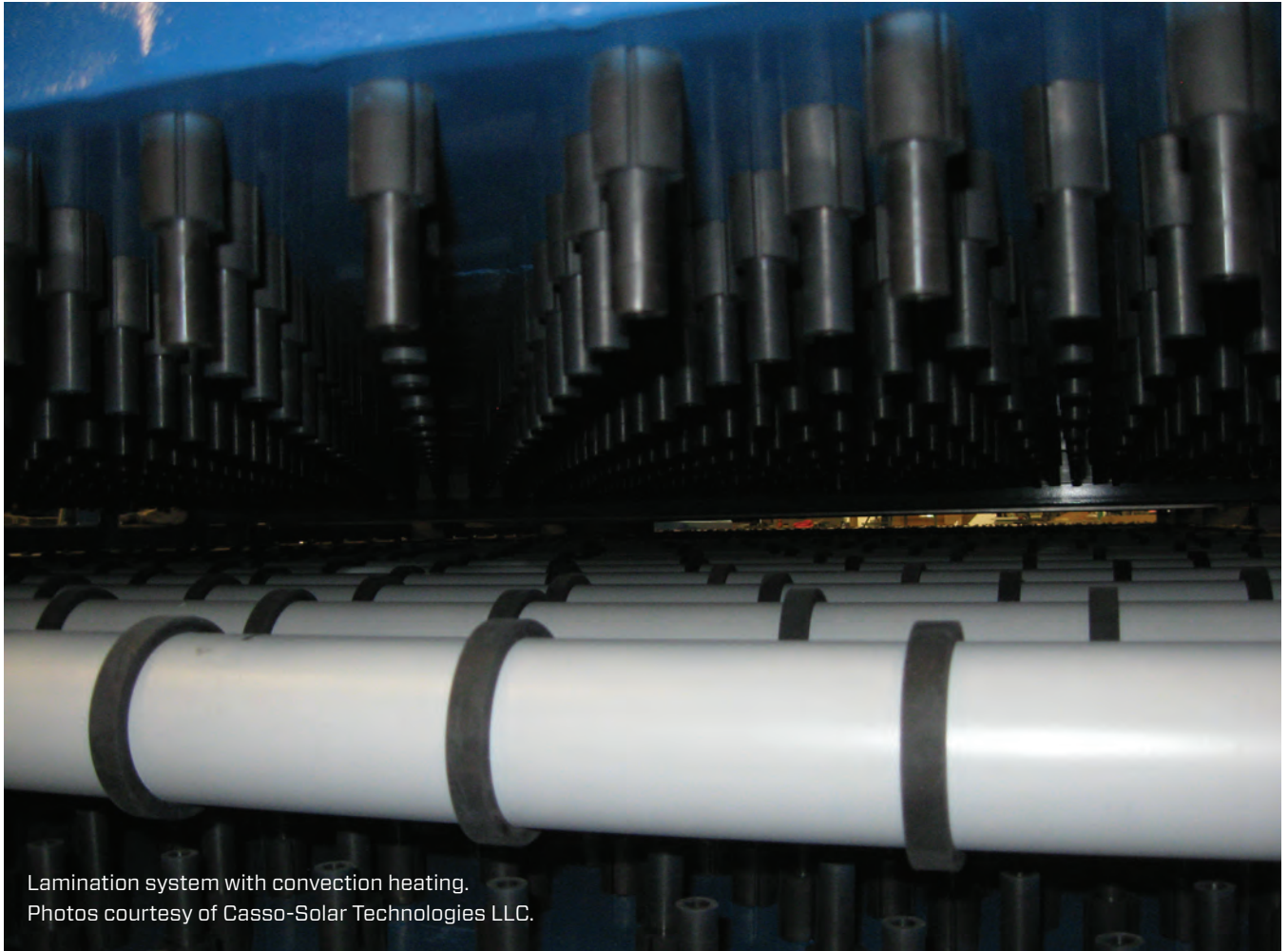
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Lamination system with convection heating.
Photos courtesy of Casso-Solar Technologies LLC.

GLASS LAMINATION SYSTEMS

WHAT TO KNOW BEFORE YOU BUY
BY DEREK BURKHOLDER



Laminated glass is a high value-added product that more and more companies are moving to producing in-house rather than relying on outsourcing. The addition of laminated glass production for any company is a major investment, so it is critical to ensure when purchasing equipment that it is designed to produce the products a company wishes to sell, while also being cost-effective to operate.

There are many components to a laminated glass production line, such as the washer, cleanroom and autoclave. Where there is the most variety in equipment are the oven and press designs. Every equipment manufacturer has a different approach to the design of their ovens, but all tend to use one of three methods of heating: convection, infrared (radiant), or a combination of the two. This

article seeks to explain the differences between the three oven designs and examine the benefits of each.

Convection

Convection heating is the most familiar method, as it is the way that most home ovens operate. Sometimes called “hot air heating,” in this type of oven air is heated up to the desired temperature and then distributed throughout an insulated chamber. To maximize efficiency the air is typically recirculated through the system to minimize losses and operating costs. Once the oven reaches the desired operating temperature and power level to raise the temperature of the laminate, it requires a reasonably low amount of energy to remain at the desired temperature.

As parts pass through the insulated chamber, a heater (either gas or electric)



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”

will heat the air. The hot air heats the surface of the glass, and the heat then conducts through to the center of the laminated assembly to the interlayer. Thus, the primary factor affecting production rate is the thickness of the assembly. The thicker the assembly, the longer the heat will take to reach the interlayer at the center.

Heating efficiency is also impacted by the design of the air delivery system (nozzles, air knives, slots, etc.), as faster delivery of larger volumes of air leads to more efficient heat transfer.

Infrared

Infrared heating utilizes radiant energy to transfer heat to the product. Radiant heat transfer relies on the principle that all hot objects radiate heat to their surroundings in the form of electromagnetic waves. Colder objects then absorb this infrared

energy to varying degrees based on their particular absorption spectrum curve. Air, for example, does not absorb most wavelengths of infrared energy and instead allows the energy to pass through it, while glass and interlayer materials such as PVB absorb the majority of infrared energy. This means that energy produced in an infrared lamination oven is primarily absorbed by the laminated assemblies and is not lost to the air, allowing the product to be targeted efficiently.

Another benefit of infrared energy is that unlike convection heat it is capable of penetrating into objects to heat them from within, rather than just from the surface. For glass, infrared energy penetrates approximately ¼ inch into the material before being fully absorbed. This allows for thicker parts to be heated more quickly as the energy does

not have to conduct as far to reach the center of the assembly.

The increasing prevalence of low-e and infrared reflective coatings has had an impact on the use of infrared heating in glass lamination. Because these coatings are designed to reflect infrared energy, it necessitates the use of a different heating technology to compensate. This leads us to hybrid convection/infrared ovens. Convection or convection/infrared is a must for the coated or top side of the product. Infrared only is most efficient on the bottom or uncoated side.

Hybrid convection/infrared

As the name implies, hybrid convection/infrared ovens utilize both convection and infrared technology to provide the benefits of both heating methods. These ovens can often be run using infrared only when producing uncoated glass and then can have the convection heating technology activated when infrared-reflective coated glass is being produced. This allows a manufacturer to maximize production efficiency by using the heating technology that is best suited to the type of product being manufactured at a given time. Systems can be programmed through the PLC, programmable logic control, system to provide the correct setup for each product run.

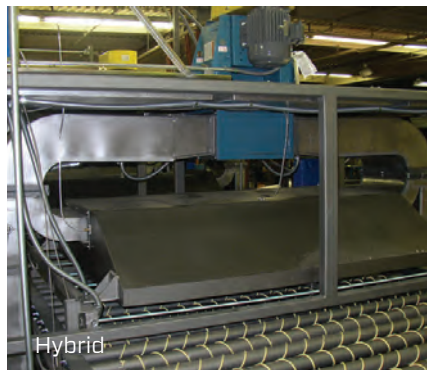
Comparison

Each type of equipment comes with benefits which are outlined in the table below.

A convection system is well-suited for companies that are constantly producing a variety of coated and uncoated products simultaneously or for companies that wish to keep operating costs down. The trade-off is the production rate. For the same size equipment, a convection system will run slower than a system equipped with infrared heating as it will require the laminates to stay in the oven for a longer period of time to reach the required temperature due to the slower rate of heat transfer. In order for a convection-only system to achieve a



Infrared



Hybrid



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Thanks to the option of equipping the machines with two additional tools besides the cutting tool, the **EVO** systems can be equipped, in addition to the low-e glass

grinding, for example, for laser cutting or labelling of the processed piece.

List of installable tools:

- Low-E removal system
- Low-E and TPF removal system
- Automatic labelling system
- Permanent marking system with CO2 laser

The **EVO** range machines are an actual automatic system to cut and “trace” the glass for subsequent factory machining. The identification of the glass from the first job (the cut) until delivery to the customer is an important challenge for the glassworking industry, in order to considerably reduce costs and to increase productivity.



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Warm-up time	Average	Best	Above average
Ease of use	Best	Above average	Average
Production rate	Average	Best	Best
Operating cost	Best	Average	Average
Produces all products	Yes	Not low-e	Yes
Setpoint change speed	Average	Best	Above average



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similar production rate, floor space would need to be sacrificed to allow the line to be longer.

Infrared-only systems are best used when 80 to 100 percent of a company's planned production is uncoated glass in large quantities. This type of system offers the fastest production rates while being relatively easy to operate. It also is the fastest at warming up and changing settings.

For a company that wishes to produce all types of products while also maintaining the highest level of production possible and minimizing floor space, a hybrid convection/infrared system is the ideal solution. A hybrid system offers the best of both technologies since it combines high rates of production with the flexibility to produce both coated and uncoated products.

Future requirements

When making any significant equipment investment, it is of course important to consider both a company's current and future needs. An infrared-only system might be the perfect fit for current production requirements of strictly uncoated glass, but it will need to be modified if future plans call for significant coated glass production. Similarly, a convection-only system might accommodate current sales volume, but if sales increase, a longer oven will be needed to allow the line speed to increase accordingly.

A hybrid system provides both high production rates and flexibility in the types of products that can be produced, which could protect from the need to upgrade the equipment as time passes. ■

Derek Burkholder is the vice president of sales and engineering with Casso-Solar Technologies LLC, a manufacturer of convection, infrared and hybrid heating systems for the glass industry. For more information, call 845/354-2010 or visit cassosolartechnologies.com.

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By
Norah Dick

● Glazing contractors are seeing work return. Glass Magazine's 2022 Top 50 Glaziers posted gross sales of an estimated \$3.8 billion last year, up from \$3.1 billion in 2020, and marking a return to pre-pandemic gross sales.

But while work may have returned, stability has not. Glazing contractors are facing market and project conditions that are better than at the start of the pandemic, but still very difficult. "We have a better than ever backlog, but our struggle is the surprise increases in costs of materials and lead-times," says John J. Cashel, owner of Above All Storefronts.

Supply chain, lead times and material costs and shortages have plagued glaziers this year, as they have for companies globally, requiring contractors to change how they do business. "Preplanning is a must, as we encounter supply chain delays," says Cassie Harker, president, Pacific Glazing. "Shortages are being seen in raw material supply, due to workers out due to COVID, and not having enough workers."

Glaziers of course also face potentially unique challenges in project delivery, being one of the final trades onsite. "As a glazing sub we can order in advance but the general contractors, and other trade partners, might not be on top of the supply chain issues, and their work must start before our work, so the project can still be delayed. That makes scheduling a challenge, and makes it difficult to retain our field and shop workforce," says Harker.

The 2022 edition of Top 50 Glaziers marks the 30th anniversary of Glass Magazine's annual standout industry report and ranking. Top 50 Glaziers offers data and analysis regarding the growth and obstacles facing glazing contractors working in the North American market.

The following pages offer a historical look at glazing contractor sales, as well as a breakdown of market opportunities, product and equipment investment, and challenges on the horizon. And of course, the report includes the annual Top 50 Glazier list, featuring leading U.S. glazing firms ranked by annual sales volume.

Visit glassmagazine.com to see additional standout projects from Top 50 Glaziers and to download the in-depth Top 50 Market Report.

THE LIST +

● Glass Magazine’s Top 50 Glaziers celebrates 30 years this year and remains the longest-running glass industry ranking. Companies are included in this list based on company and financial data that are self-reported by survey. Glazing companies on this list are ranked by gross sales. Some companies chose not to disclose financial and company information, and their listing reflects previous year submissions or research. It is only with industry cooperation that Glass Magazine can continue to compile the most accurate list of leading industry glaziers. If your company belongs on this list, or you want to update its information, contact Norah Dick, associate editor, at ndick@glass.org.

Sales Category	Ranking	Company Information	Additional Locations	Full-time Employees	Total Employees
\$200 million+	1	Harmon Inc. harmoninc.com Bloomington, MN	17	650	750
	2	Yuanda USA Corp. yuandacn.com Chicago, IL	1	20	20
	3	Elicc Americas Corp. eliccgroup.com Poway, CA	1	132	132
	4	MiTek/Benson Curtain Wall and Glass Divisions bensonglobal.com Portland, OR	7	500	500
	5	Enclos* enclos.com Eagan, MN	15	-	-
	6	W&W Glass wwglass.com Nanuet, NY	1	200	200

* Sales and company information are not confirmed by the company, but are based on data from previous years.

PARTNERS

● In an effort to recognize stand-out glazing partners, no matter their annual sales volume, Glass Magazine looked to industry suppliers for recommendations. As part of the 2022 Top Glass Fabricators annual survey, Glass Magazine asked leading fabricators to nominate the exceptional glazing partners they worked with during the previous year.

Border Glass & Aluminum

Winnipeg, Canada

“[The project we worked on together] is the tallest tower in the Central Prairies of Canada up to Toronto. Border is an excellent partner, bringing all teams/partners of the project together to create a plan and work together to ensure everyone is successful and works together to overcome any challenges that arise.” — Vitrum Glass Group

AMG Contracting Services

Lindenhurst, NY

“Tempco and AMG worked together to match and produce a high-quality product at a much more cost-effective point.” — Tempco Glass

Honorable mentions

Old Town Glass

Navato, CA
Nominated by Garibaldi Glass

Advanced Glazing Contractors

Blanchester, OH
Nominated by Glenn Glass

Cahaba Glass

Pelham, AL
Nominated by Southern Wholesale Glass



300 Main Winnipeg, new luxury apartments located in Winnipeg, Manitoba, Canada. Top Glass Fabricator Vitrum Glass Group worked with Glazier Partner Border Glass & Aluminum to complete the project.

Sales Category	Ranking	Company Information	Additional Locations	Full-time Employees	Total Employees
\$100-200 million	7	Crown Corr Inc. crowncorr.com Gary, IN	6	595	595
	8	Binswanger Glass binswangerglass.com Memphis, TN	56	800	800
	9	Flynn Group of Companies flynncompanies.com Toronto, Ontario, Canada	35	6,000	6,000
	10	Karas & Karas Glass Co. karasglass.com Boston, MA	1	80	120
	11	Massey's Plate Glass & Aluminum Inc. masseysglass.com Branford, CT	3	200	230
	12	Permasteelisa North America* permasteelisagroup.com/america Bloomfield, CT	5	-	-
\$50-100 million	13	NR Group nrwindows.com West Palm Beach, FL	2	200	220
	14	Dynamic Glass dynamicglass.com Houston	4	375	375
	15	Pioneer Cladding and Glazing Systems Inc. pioneerglazing.com Mason, OH	5	262	291
	16	TSI Corp. tsicorporations.com Upper Marlboro, MD	-	150	150
	17	Giroux Glass girouxglass.com Los Angeles	5	219	224
	18	Egan Company/InterClad eganco.com Champlin, MN	2	75	75
	19	Momentum Glass momentum-glass.com Spring, TX	4	178	178

* Sales and company information are not confirmed by the company, but are based on data from previous years.

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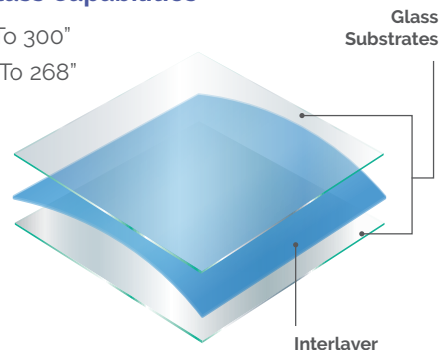
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Sales Category	Ranking	Company Information	Additional Locations	Full-time Employees	Total Employees
\$30-50 million	20	Eastern Glass and Aluminum bildega.com Norcross, GA	2	135	135
	21	Above All Store Fronts Inc. aboveallstorefronts.com Hauppauge, NY	2	190	190
	22	Cherry Hill Glass Co. cherryhillglass.com Branford, CT	-	160	180
	23	SPS Corp. spscorporation.com Apex, NC	2	85	85
	24	Lafayette Metal & Glass Co. lmgny.com Hauppauge, NY	1	98	148
	25	Architectural Wall Systems archwall.com Des Moines, IA	1	90	90
	26/27/28	Countryside Glass and Mirror countrysideglassandmirror.com St. Petersburg, FL	1	120	130
	26/27/28	Haley Greer Inc. haleygreer.com Dallas	1	100	100
	26/27/28	Ranger Specialized Glass Inc. rangerglass.com Houston	2	150	150
	29	Glass Solutions Inc. gsichicago.com Itasca, IL	1	100	100
	30	Ajay Glass Co. ajayglass.net Canandaigua, NY	2	140	140
	31	Kensington Glass Arts kensingtonglass.com Ijamsville, MD	4	225	225
	32	Alphacladding alphacladding.com Doral, FL	-	30	30

Sales Category	Ranking	Company Information	Additional Locations	Full-time Employees	Total Employees
\$15-30 million	33	Lindner Facades Inc. lindner-group.com Colmar, PA	5	730	730
	34	R & R Window Contractors Inc. rrwindow.com Easthampton, MA	-	80	80
	35	RynoClad Technologies Inc. rynoclad.com Ontario, CA	1	70	70
	36	Anderson Aluminum Corp. andersoncompanies.com Columbus, OH	1	91	138
	37	Aragon Construction Inc. aragonconstruction.com Montclair, CA	1	80	120
	38	MY Shower Door myshowerdoor.com Ft. Myers, FL	10	155	155
	39	Progress Glass Co. progressglass.com San Francisco	1	90	90
	40	Alexander Metals Inc. alexandermetalsinc.com Nashville	-	60	60
	41	seele Inc. seele.com Long Island City, NY	-	20	50
	42	National Enclosure Co. nationalenclosure.com Ypsilanti, MI	3	35	80
	43	Metropolitan Glass Inc. metroglass.com Denver	1	75	75
	44	Dallas Glass dallasglass.net Salem, OR	1	84	84
	45	Denison Glass & Mirror denisonglass.com Denison, TX	1	121	121

Sales Category	Ranking	Company Information	Additional Locations	Full-time Employees	Total Employees
	46	Pacific Glazing pacificglazing.com Hollister, CA	2	62	64
	47	H.J. Martin and Son hjmartin.com Green Bay, WI	2	863	863
	48/49	Key Glass Inc. keyglass.com Bradenton, FL	-	51	52
	48/49	TepcoGlass LLC tepcoglass.com Dallas	3	95	150
	50	Crawford-Tracey Corp. crawfordtracey.com Deerfield Beach, FL	1	93	93

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**MRT4 MANUAL
ROTATOR/ TILTER**
CAPACITY: 700 LBS

**MRT8 MANUAL
ROTATOR/ ASSISTED TILT**
CAPACITY: 1,400 LBS

**MRPT16 MANUAL
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CAPACITY: 2,800 LBS

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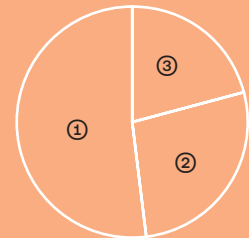
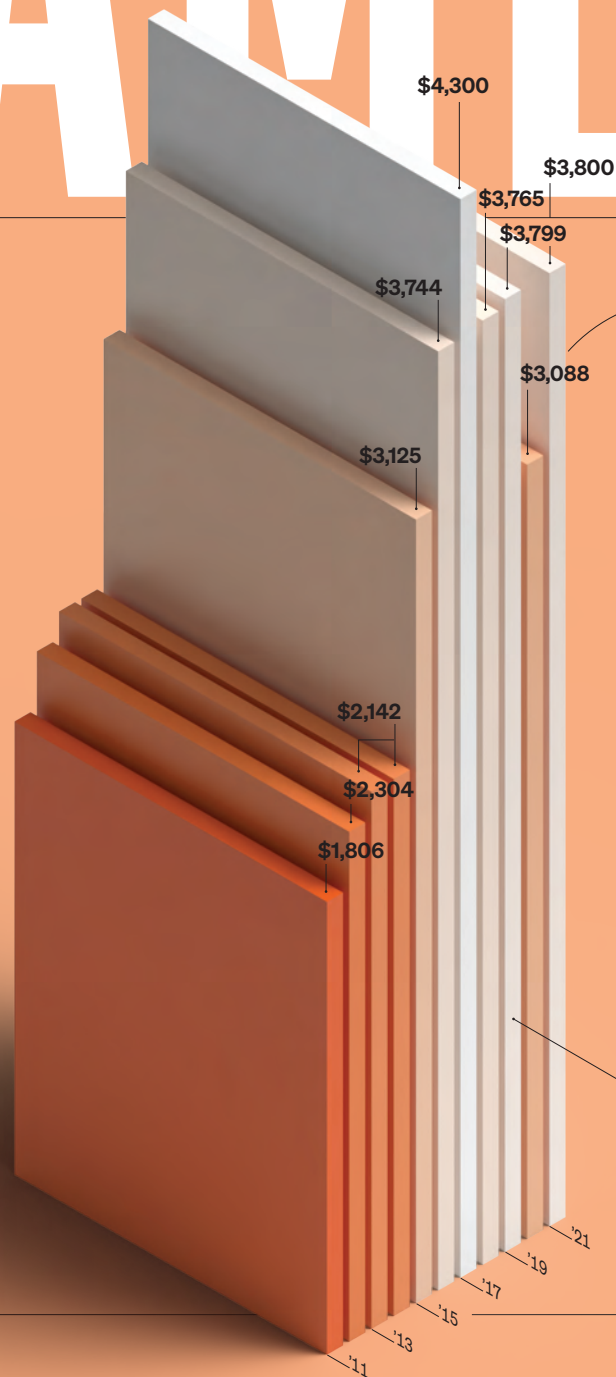
AIGlass.com

BACK IN THE GAME



TOTAL GROSS SALES REACH PRE-PANDEMIC LEVELS

Total Gross Sales, 2011-2021
(in millions, USD)



2021 GROSS SALES

- 1. Higher sales year-over-year **54%**
- 2. Lower sales **26%**
- 3. About the same **20%**

Top 50 respondents post increased sales as stalled projects rebound

● Individual Top 50 respondents reported higher gross sales in this year's survey; 54 percent said gross sales in 2021 were higher than the previous year. Only 44 percent of respondents in the 2021 survey reported higher sales.

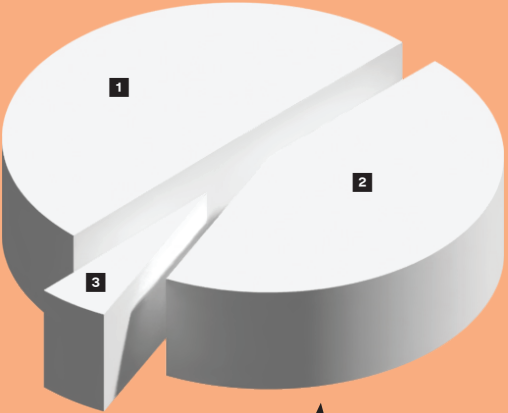
Market indicators including profit margin and competition for projects appear to have remained flat across 2020 and 2021, but bid levels have increased, according to respondents; 45 percent said bid levels had increased in 2021, compared to only 28 percent in last year's report.

Companies are also reporting slightly larger backlogs. Only 19 percent of 2021 respondents said they had a backlog of 18 months to 2 years, but 27 percent of 2022 respondents said their backlog was now at this level.

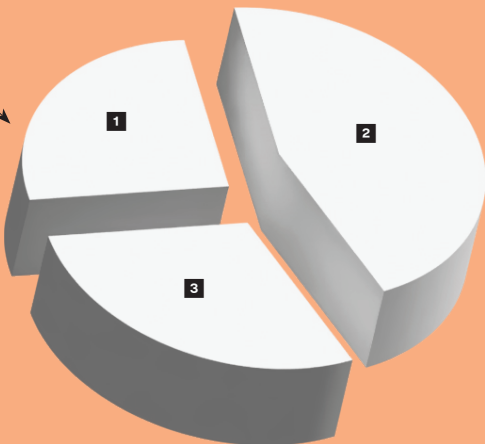
By geographic region, the Southwest and West did not become growth regions, as predicted by last year's respondents. Instead, East Coast projects appeared to dominate, as Northeast and Southeast regions were reported to show the most growth. Several survey respondents attributed the growth to projects restarting after pandemic delays.

The Southeast may also be seeing a general population increase; one survey respondent explained the region's building growth as due to, "The increase in new capital/wealth, tech companies, the cost of living, the building of multi-family high-rise buildings and communities, and a high quality of life."


COMPETITION FOR PROJECTS

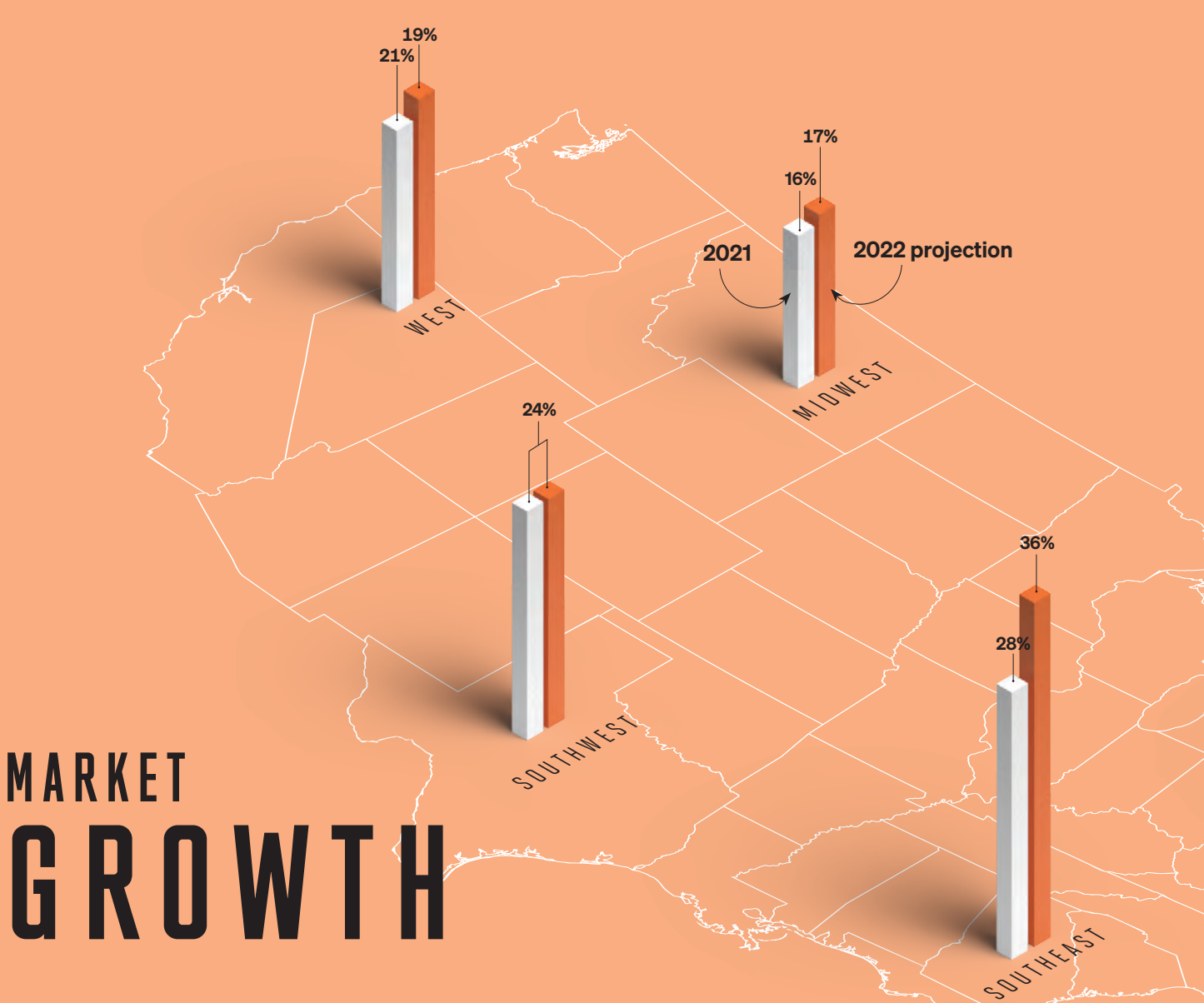
- 
1. Higher competition **50.8%**
 2. About the same **44.6%**
 3. Lower competition **4.6%**

PROFIT MARGINS

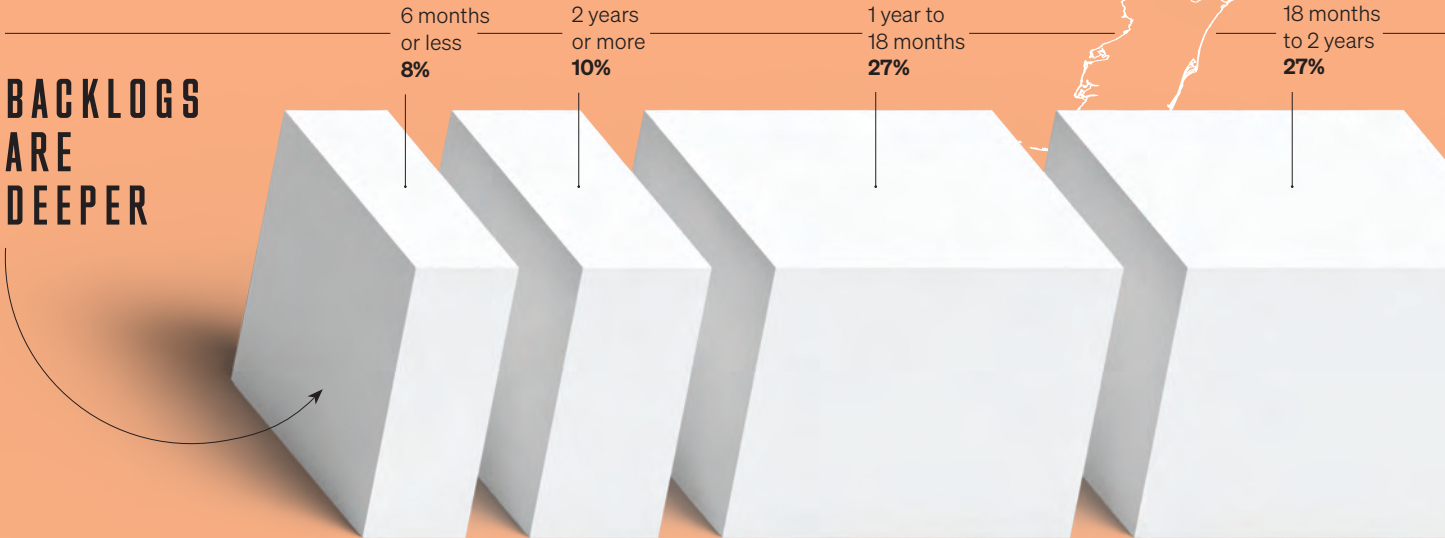
- 
1. Higher margins **26%**
 2. About the same **45%**
 3. Lower margins **29%**

BID LEVELS

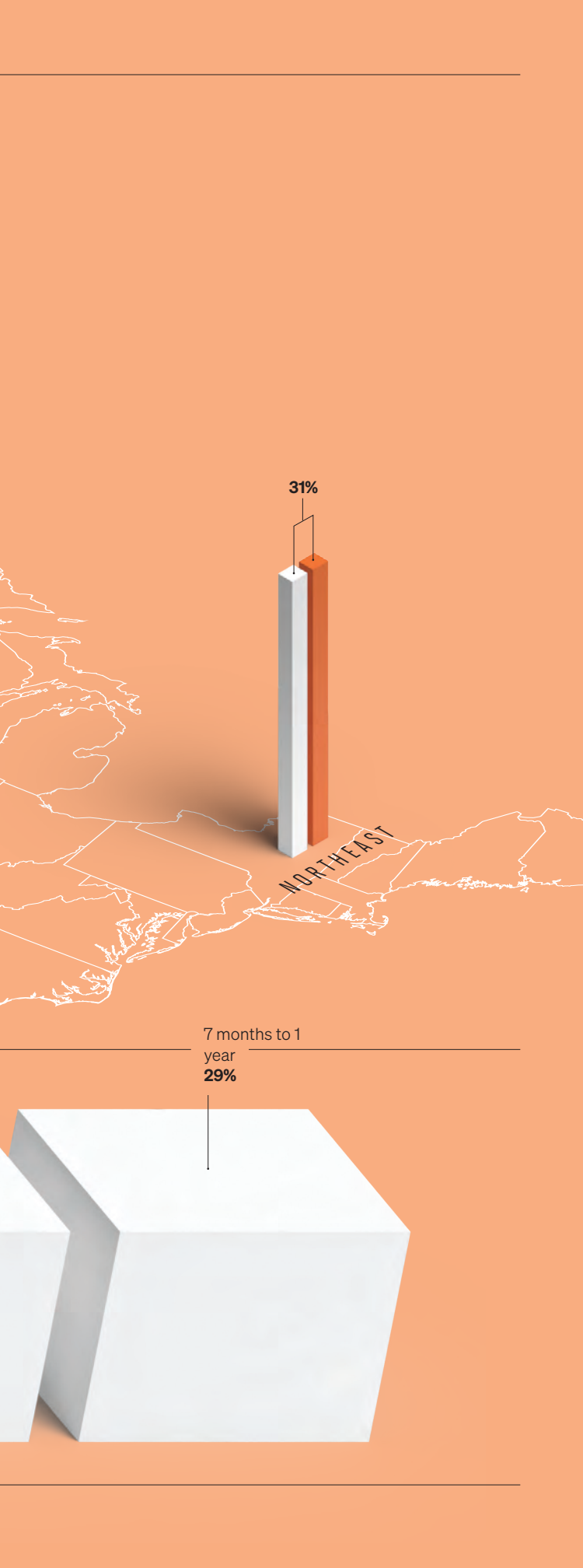
- 
1. Higher bid levels **45%**
 2. About the same **37%**
 3. Lower bid levels **18%**



MARKET GROWTH



BACKLOGS ARE DEEPER



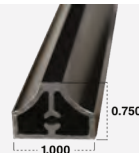
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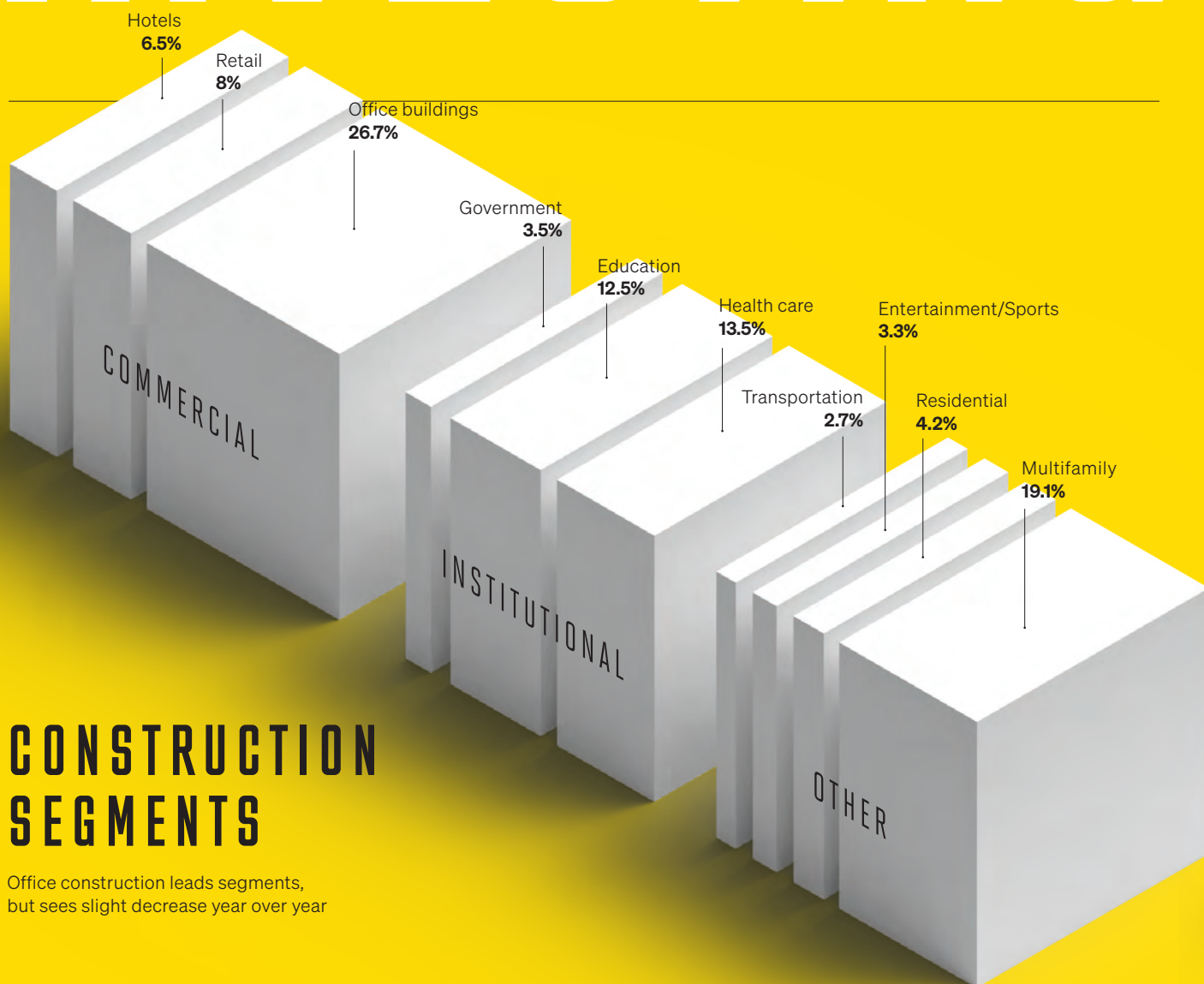
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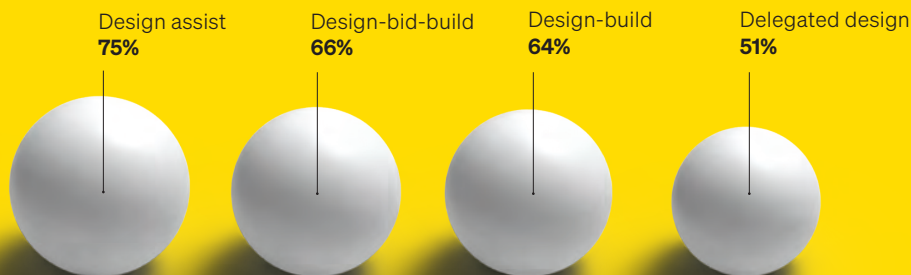


NEW CONSTRUCTION DOMINATES

- 1. New construction **78%**
- 2. Renovation **22%**



PROJECT DELIVERY



Construction segments shift, and glaziers take on in-house fabrication

● Top 50 Glazier respondents reported working in fairly similar, thought shifting, construction segments in 2021 as compared to the previous year. Office construction still leads the commercial market, though only 26.7 percent of glaziers' reported work was in this area in 2021, down from 31 percent in 2020 and 33 percent in 2019. Reported multifamily construction projects saw a slight increase to 19.1 percent from last year's 16 percent.

Project delivery methods shifted in 2021, as respondents posted a greater variety of project delivery types. Almost all, 98 percent, of last year's respondents said they had worked on a project with design assist, but that number fell this year to 75 percent. Design-bid-build rose 10 percentage points among this year's respondents.

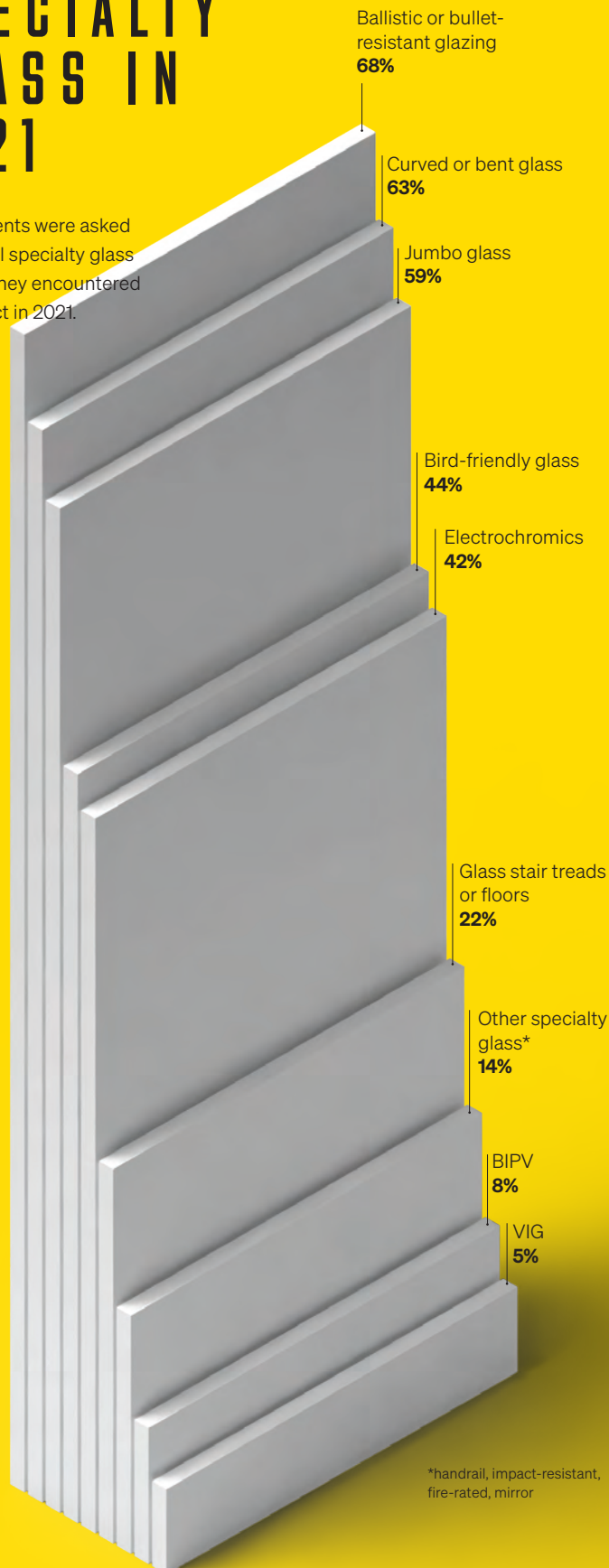
In-house curtain wall fabrication increased from last year, with 48 percent of fabricators saying they do manufacture the systems in-house. Glaziers report continued challenges to in-house work, both pandemic-related and not; as one respondent said, "lack of space, storage and transportation," all affect in-house curtain wall fabrication.

More respondents in the 2022 survey, 17 percent, also said they were fabricating glass in-house, up from 9 percent in the 2021 survey. Responses show that glaziers are supplying a range of common fabricated glass type—insulating, tempered, laminated and decorative—as well as mirror and other specialty glasses.

Capital investment trends remained somewhat similar among glaziers, though 10 percent more respondents reported investing in trucks this year, an expected shift given the shortage of transportation options and labor.

SPECIALTY GLASS IN 2021

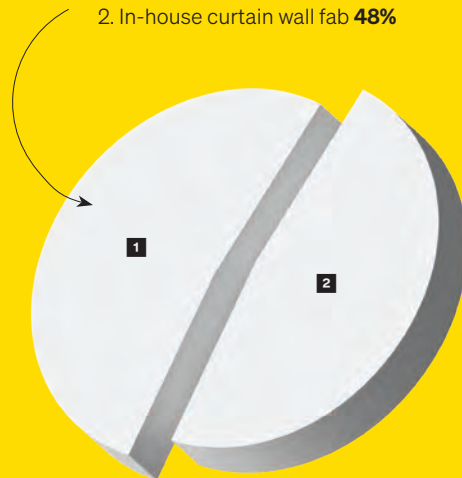
*Respondents were asked to select all specialty glass products they encountered on a project in 2021.



MORE GLAZIERS FABRICATE CURTAIN WALL IN-HOUSE

*compared to prior year

1. No in-house curtain wall fab **52%**
2. In-house curtain wall fab **48%**

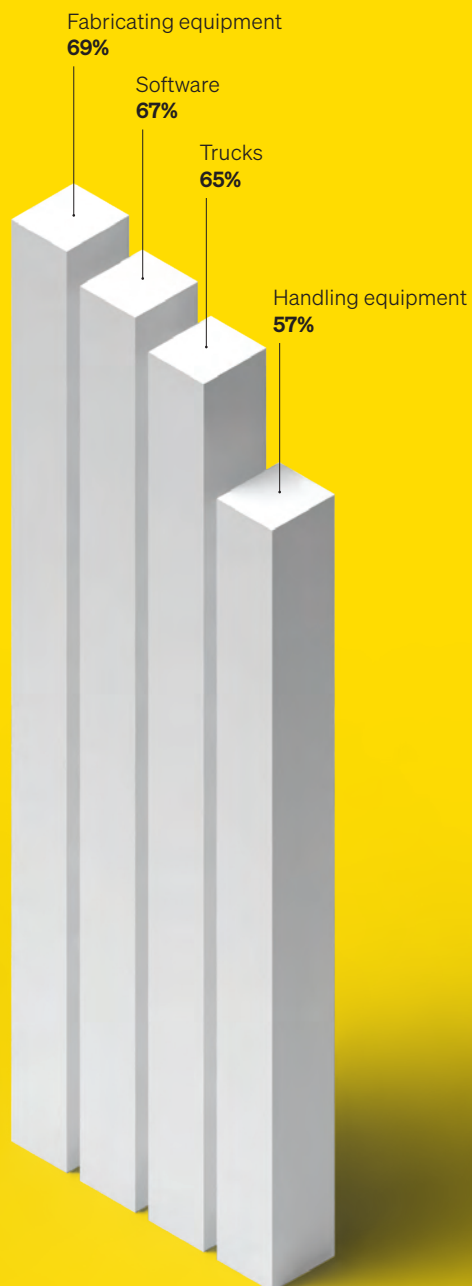


MORE GLAZIERS FABRICATE GLASS

*compared to prior year

1. Not fabricating glass **83%**
2. Fabricating glass **17%**

2021 CAPITAL ACQUISITIONS



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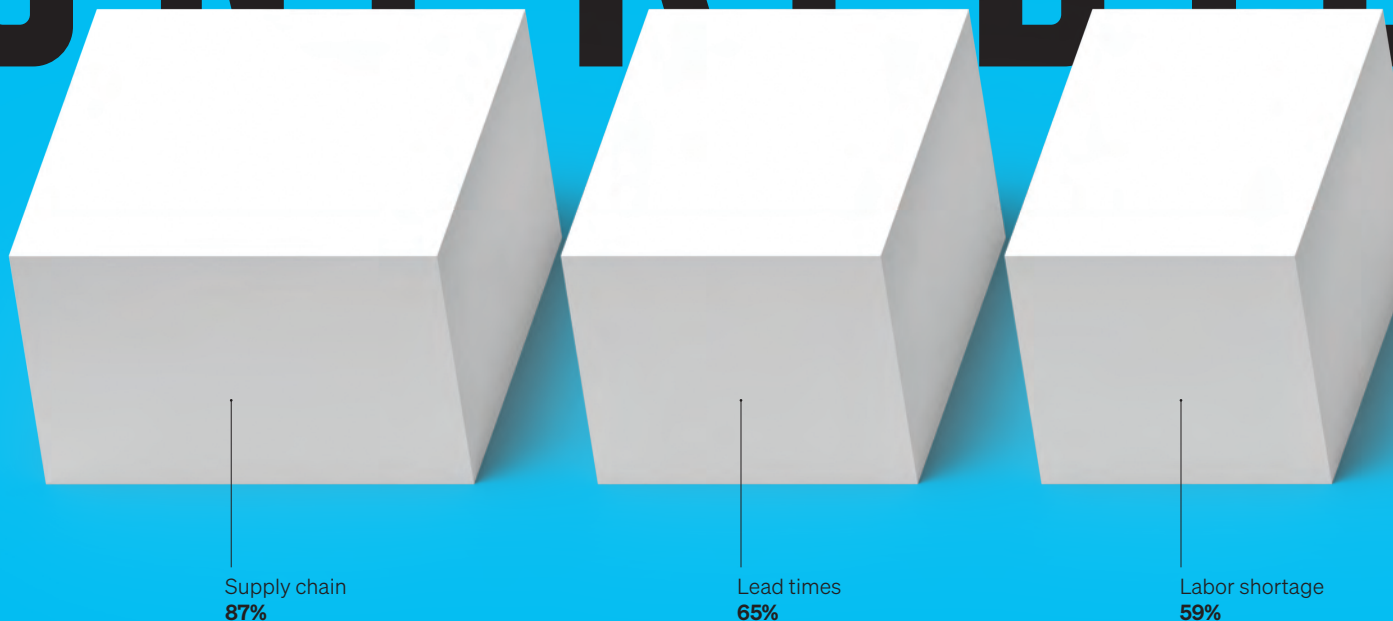
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WORKING AROUND

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SUPPLY CHAIN ISSUES TOP CHALLENGES*

*Respondents were asked to check all that apply.

● Supply chain troubles became this year's largest challenge for glaziers, a stark change from last year's report, when only half of glaziers said they were experiencing supply chain issues. This year, 87 percent say that it will remain a major headwind for 2022, followed by lead times and the ongoing, and

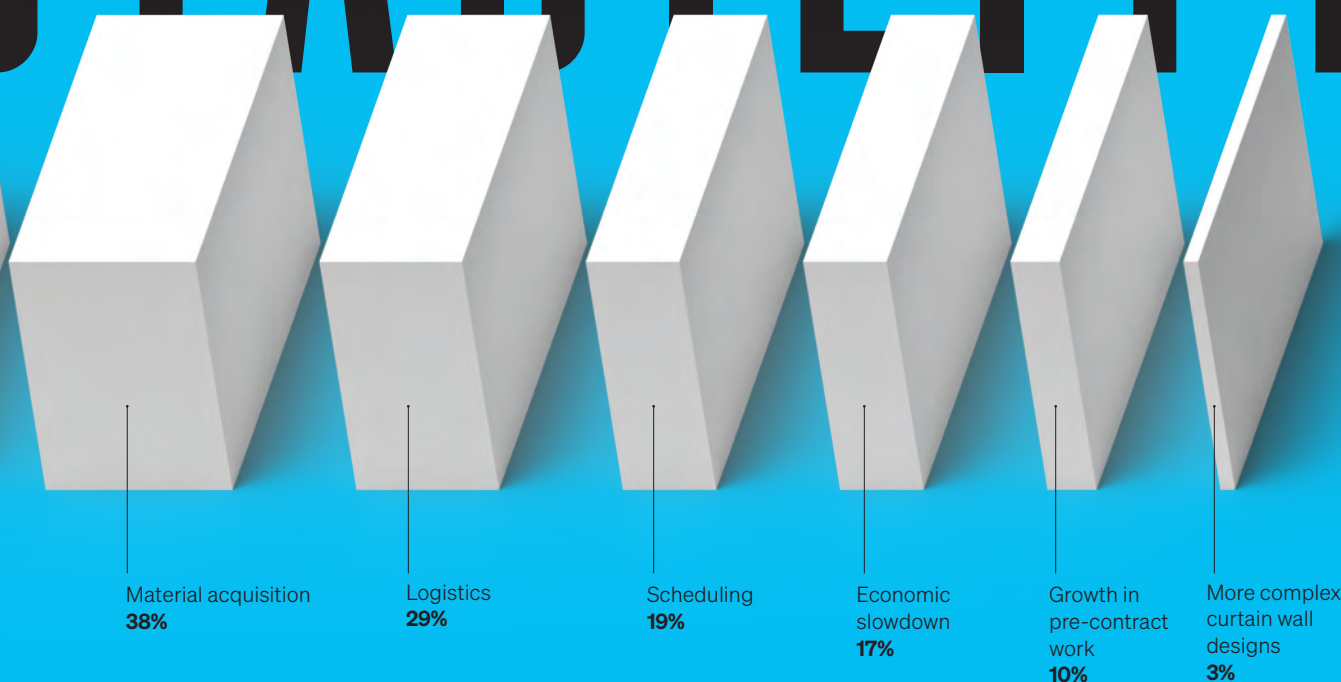
worsening, labor shortage.

"Supply chain issues, longer lead times and labor shortages are the top threats to our business next year. We are growing and will need to be able to overcome these challenges to succeed," says Scott Coulter, chief financial officer, Dynamic Glass.

Lead times and material costs

posed a significant challenge, not least because of the unpredictability. "Obtaining commodity materials such as aluminum and glass have exponentially gotten more difficult—lead times have increased and continue to do so. Projects are rapidly starting back up, so the demand is up for such items, and this poses challenges in locking

STABILITY



in on inventory and cost,” says Ray Crawford, president, Crawford-Tracey Corp.

Labor remains a barrier to growth, and 53 percent of respondents said they had more difficulty finding workers last year, compared to only 36 percent in 2021. Field labor remains the most difficult to find, and

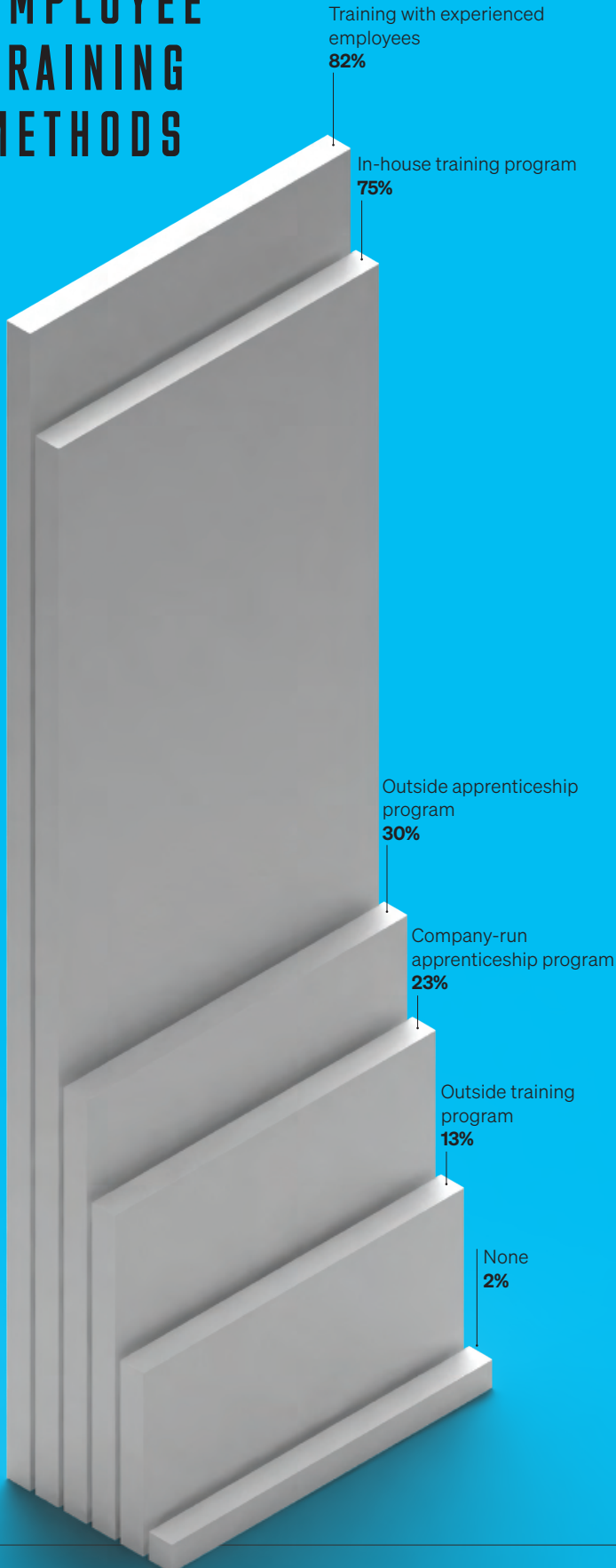
more companies this year found it difficult to hire project managers, as compared to last year’s report.

Training new staff, necessary for employees lacking relevant skills, may also stress the existing labor force. “We have found some success in hiring under-experienced people and developing them to the roles

we need them in, however, this has put a huge strain on the manager who trains them,” says Matt Aragon, director of preconstruction, Aragon Construction.

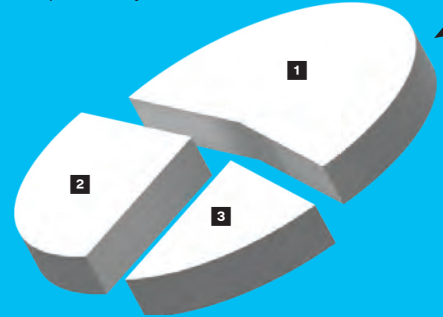
Slightly more respondents, 23 percent this year versus 14 percent in 2021, said their company offers a company-run apprenticeship program.

EMPLOYEE TRAINING METHODS



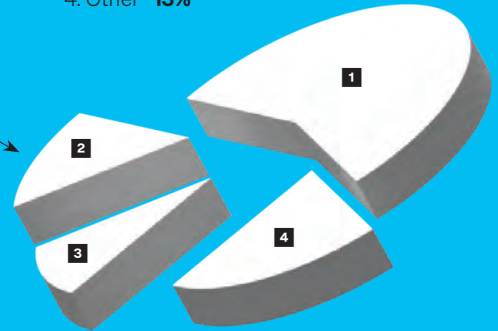
EMPLOYERS STRUGGLED MORE TO FIND WORKERS

1. Harder to find workers in 2021 compared to 2020 **53%**
2. Not harder to find workers **29%**
3. About the same as the previous year **18%**



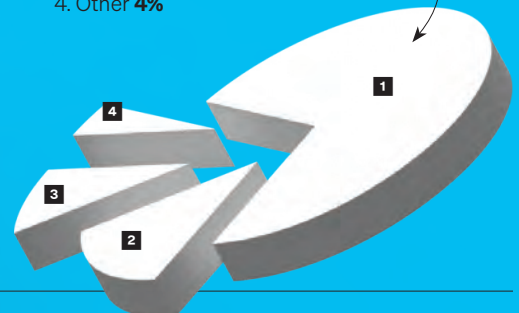
PROJECT MANAGERS WERE HARDER TO FIND

1. Project managers were hardest to find **54%**
2. Estimators **20%**
3. Office staff **11%**
4. Other* **13%**



BIGGEST LABOR CHALLENGE

1. Recruitment was the biggest labor hurdle **70%**
2. Training **16%**
3. Retaining employees **9%**
4. Other **4%**



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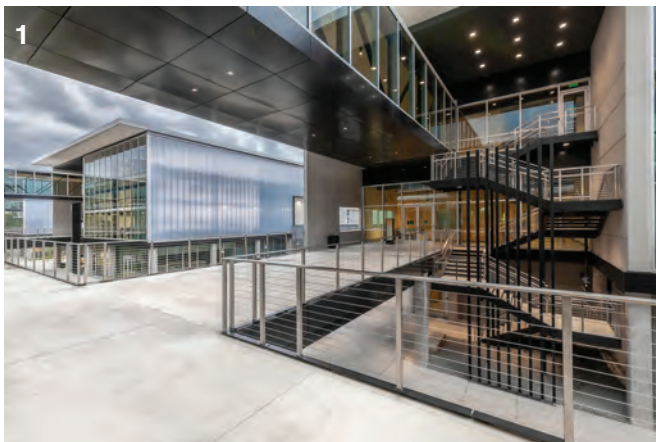
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against slips on glass walkways, or accidental impacts on rails, walls. It can offer acoustic protection and daylighting to advance healing. There are even specialty glass products that block harmful radiation from x-rays.

The projects featured on the following pages demonstrate the wide ranging abilities of glass to protect people. Learn more about these projects at GlassMagazine.com.



❶ Collin College Technical Campus, in Allen, Texas, features AW64 True Extruded Aluminum Fire-Rated Curtain Wall Framing System from Alufam that matches non-rated curtain wall systems. Dynamic Glass was the glazing contractor.

❷ Tristar Glass Inc. supplied its Sentry Guard laminated glass for forced-entry resistance at Emerson Elementary in Tulsa, Oklahoma. The glazier was Advantage Glass. Photo by Cambell Boulanger.

❸ The Ritz-Carlton Residences in Sunny Isles Beach, Florida, features Glassec GV128 insulated laminated hurricane-impact glass from Glassec, Viracon's Brazilian subsidiary. The glazier was Continental Glass. Photo courtesy of Viracon.

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❶ Global Security Glazing, now part of Isoclima Specialty Glass LLC, provided multiple security glazing configurations to a Tennessee education center. The glazing includes Childguard security laminates, insulating glass units including Solarban R100 on Solargray and Childguard security glazing, translucent white Childguard and Secur-Tem + Poly SP311 bullet-resistant glass/polycarbonate laminates produced with and without the high performance Solarban R100 on Solargray substrate.

❷ Bullet-resistant UL 752 vision lite kits from Glassopolis.

❸ The Emerald in Seattle features the Technical Glass Products Fireframes ClearView System with Pilkington Pyrostop fire-rated glass and Fireframes Heat Barrier Series perimeter

frame and doors. TGP also supplied Pilkington Profilit channel glass system for the project. Photo courtesy of TGP.

❹ The New York-Presbyterian David H. Koch Ambulatory Care Center features radiation shielding/lead X-ray glass. The Corning® Med-X® glass, supplied by McGrory Glass, shields against X-rays from equipment operating in the 80 to 300 kV range. Photo copyright 2022 Halkin Mason Photography LLC | All Rights Reserved.

❺ A mixed-use development in Tampa, Florida, features a range of hurricane-impact glazing systems including the CGIC 3250 SlimFront from CGIC Architectural Products and Slimpact Doors from Faour Glass.



**MIDWEST
GLASS**
FABRICATORS

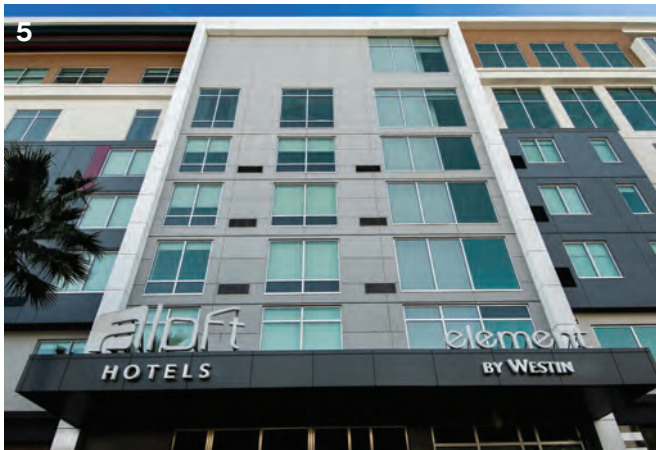
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- ❶ The Scottish Rite for Children Orthopedic and Sports Medicine Center in Frisco, Texas, features digitally printed laminated glass stairs with digitally printed slip-resistant ceramic ink on the first surface for traction control. Standard Bent Glass was the glass fabricator; The Beck Group was the glazing contractor. Kuraray supplied the interlayer, and Vitro Architectural Glass supplied the low-iron glass.
- ❷ The new Union Square Station in San Francisco features an artistic 2-hour fire-resistive glass floor from Safti First. The GPX FireFloor System is a complete fire-resistive glass and framing assembly that meets ASTM E-119/UL 263 up to 2 hours.
- ❸ Nove at Knox is an 18-story residential development at North Central Expressway and Oliver Street in Dallas. The project

features Guardian Glass Sun-Guard SNX 51/23 on clear in an insulating glass unit with a sound control PVB interlayer. Tristar Grand Prairie was the fabricator. Photo by Guardian Glass.

❹ The Loutrel Hotel in Charleston, South Carolina, features three types of impact windows designed to meet requirements for historical standards. The systems, provided by Wincow Window, include the 3250 Steel Rep window, projected casement 1150s Series and NC-82 Terrace Doors. Glasscorp was the glazing contractor. Photo by Keen Eye Marketing.

❺ An Aloft hotel features impact glazing systems with Kawneer 1600 Wall systems from Kawneer Co. and CGIC 3550 systems from CGIC Architectural Products. Rhino Glass was the glazing contractor.

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❶ The ACI Jet Center in San Luis Obispo, California, by architect Nelson Worldwide, features Vetrotech Saint-Gobain's VDS, VDS Doors, Contraflam and Contraflam Structure. Photo by Eric Reed.

❷ Twindows Inc. was glazing contractor for the new Solomon Solis-Cohen Elementary School in Philadelphia. The project features laminated insulating glass with Kuraray Trosifol SentryGlas interlayer in its exterior curtain walls, windows, storefronts and doors to provide an added layer of security from outside threats. Photo by Joe Eckert, Eckert Productions.

❸ The Easton Readiness Center in Easton, Maryland, features UL 752 Level 5 protection from the ground to above the doors,

and blast protection above that point. The glazing used was UL 752 Level 5 Blast, glass clad polycarbonate insulating glass units with Solar Blue Solarban 60 low-e. U.S. Bullet Proofing supplied the blast glazing.

❹ The El Camino Health Behavioral Health Services Taube Pavilion in Mountain View, California, features Winco Window's Series 8800 psychiatric window system. The windows were used in patient rooms to allow natural light and healing views of the patient gardens and beautiful trees. Photo by Jeremy Bittermann / JB SA.

❺ An installation of Riot Glass Inc. ballistic glass and framing in Los Angeles. The project features 5,000 square feet of bullet-resistant glazing.

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SOLUTION: RETROFIT SECURITY APPLICATIONS FOR GLAZING

In a world filled with frequent riots, looting and natural disasters, protecting people and property is paramount. But when it comes to building perimeter security, glass is the weakest link. Easily broken, glass is the first victim of active shooters, rioters, thieves and looters, and natural disasters.

Thankfully, there are cutting-edge solutions that can retroactively harden glass and improve building safety and security. NGS offers a tiered approach to glazing security that can be customized based on budget and risk level.

Tier 1: Safety and Security Window Film

3M™ Ultra 800 Window Film is the first tier in our layered security system. With the use of premier tear-resistant technology and multilayer bomb blast mitigation, this product shields victims from shattering glass upon forced entry into a building. The addition of the 3M™ Impact Protection Adhesive completes the system by anchoring the film and the glass to the frame for improved performance.

Tier 2: TRI-SHIELD®

Our forced-entry protection system, TRI-SHIELD®, has been proven effective



Riot Glass® installed on a federal courthouse.

at resisting, delaying, and preventing attackers from stepping foot inside targeted businesses. TRI-SHIELD® uses proprietary encapsulation on both sides of the glass surface allowing the system to maintain the advantage of the strength of the glass and the flexibility of the film through a prolonged break-in attempt.

Tier 3: Riot Glass®

In a category all its own, Riot Glass is a patented framing and clear ArmorPlast shield system made from a combination of polycarbonate and plastics that denies access to unwanted intruders. Riot Glass passed the Miami-Dade Large Missile Impact Test, showcasing its powerful hurricane-rated protection.

KEY FEATURES

IMPROVE GLAZING
SECURITY

DELAY OR DENY
UNWANTED ACCESS

MITIGATE DAMAGE
FROM NATURAL
DISASTERS

Tier 4: Ballistic Glass

Our Ballistic Glass is a strong and optically transparent material that is particularly resistant to penetration by projectiles.

These solutions help protect against forced entry, looting, riots, bomb blasts, and natural disasters such as windstorms and seismic events. And with a tiered approach, it's possible to maximize protection while minimizing cost.



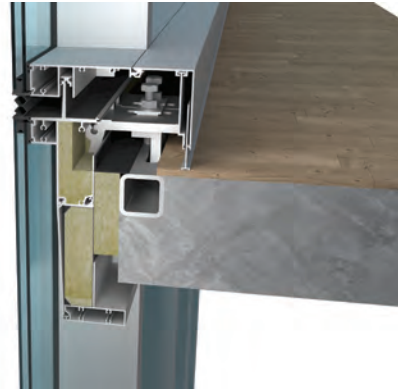
Learn more

Scan the QR code to watch an on-demand webinar about how NGS' Retrofit Security

Applications for Glazing can harden glazing and improve building perimeter security.



01



02



03



04

01. Sunshade

The new CRL 8010 Series Single Blade Sunshade provides flexibility in managing solar exposure. Blade angles can be adjusted from 0 to -35 degrees in 5-degree intervals with special brackets that attach to storefront and curtain wall frames, either horizontally or vertically. The versatile and easy-to-install 8010 Single Blade Sunshade comes in airfoil and rectangular shapes with a 12-inch depth. Splice joints are available where long blade spans are required.

800/421-6144 | CRLAURENCE.COM

02. Fire-rated system

Reflection Window and Wall earned a public Listing# STI/ BPF 180-02 for its notched curtain wall system, the UWall U8000. The U8000 assembly underwent an exhaustive fire-testing process, without glass or other infills, conducted by Intertek Laboratories and overseen by Specified Technologies Inc. This peer-reviewed public listing proves RWW's cladding system can be used in glass applications.

773/772-5343 | REFLECTIONWINDOW.COM

03. Glass lifter

SmartGroup America will partner with Sykreach Equipment to distribute its SmartGroup Lift, a smart glass manipulator. All outdoor SmartGroup Lifts, including the smallest SG450, are designed to raise 18 feet, 6 inches high, making it possible to install second-story windows from the ground. The SG450's maximum lift capacity is 992 pounds. A load cell monitors the safe weight and position of materials being lifted. An LED indicator tells when the unit is approaching its maximum load capacity.

877/742-6374 | SMARTGROUPAMERICA.COM

04. Windows

Crystal Window & Door Systems introduced its newest heavy-commercial window line. Featuring superior thermal and structural performance, the new Crystal Series 9200 is a high-end aluminum polyamide thermal barrier window capable of meeting today's energy, operating and aesthetic demands. The Series 9200 is available in tilt-and-turn, or dual action, in-swing casement, and fixed/picture window models and is well-suited for all applications, especially mid- and high-rise buildings.

718/961-7300 | CRYSTALWINDOWS.COM

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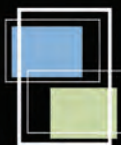
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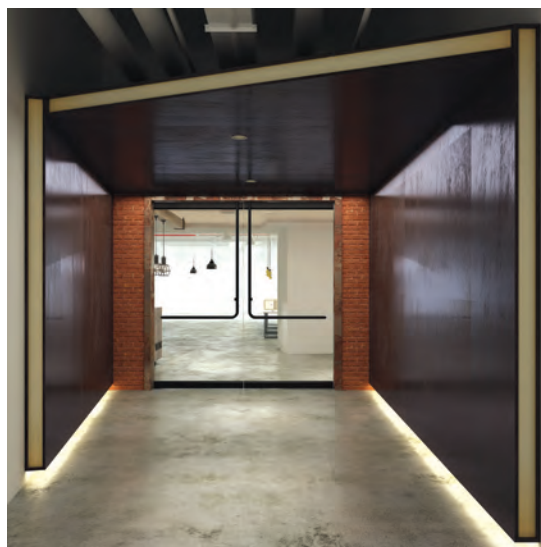
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PRODUCTS



01



02

01. Door lock

INOX introduced the PD3000 Narrow Profile Mortise Lock for Sliding Doors, a commercial-grade narrow stile lock with a self-latching function that easily retrofits into existing narrow profiles. The new lock is a self-latching deadlock/deadlatch for wood sliding doors in health care facilities, such as ICU doors. The hook bolt remains retracted until the door is closed, and the built-in actuator contacts the strike, which automatically self-latches the bolt into the strike.

916/388-1888 | INOXPRODUCTS.COM

02. Door handle

The Frameless Hardware Co. introduced the FHC Steincraft ML 100 Magnalink Electromagnetic Egress Handles, which are UL Listed with Underwriters Laboratories. The handles are available in six architectural finishes, without wire loops to conceal wiring, and they are fully tamper-proof. The Magnalink handle operation is magnetically coupled to a header-mounted actuator, creating an invisible connection that eliminates the need for electrical current in the door handle.

888/295-4531 | FHC-USA.COM

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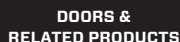
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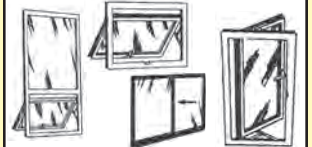
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TAKING GLAZING ONLINE: GLAZIER'S TOOL FIELD APP FOR SERVICE GLASS COMPANIES



A Q&A WITH
STEVEN ALBERT



An S. Albert Glass Co. employee uses Glazier's Tool at a jobsite.

Slowly but surely, the use of digital technology is becoming more common in every part of the glass industry.

Seeing this growth in the use of technology, and the potential in using mobile devices in the field, Steven Albert, sales manager of the service and maintenance division for S. Albert Glass Co., a D.C.-area contract glazier, set out to develop a web application for employees to use. Now called Glazier's Tool, the app is an all-in-one tool that can be used on any platform, including phone, tablet, PC or web browser.

Q How and why did you develop this app?

Being younger and in the industry, I noticed how all the other trades have networks and apps supporting them, while there were very few supporting the service glazing industry.

When I started to develop the app, my goals were to not only streamline and standardize the process of onsite info gathering, but also to create a good training tool to help glass companies, which is what we ended up doing. My

goal in developing the app was to help the team grow, to make our processes easier, more efficient and repeatable, resulting in the ability to produce more accurate quotes that can be turned into sales in a fraction of the time.

Q How does the app work?

When the customer calls S. Albert Glass Co. with their issue—like broken glass, a door repair or foggy window—an employee then creates a ticket for the job in the app. From there, service managers can assign tickets to estimators out in the field, or estimators can assign it to themselves. Now that we've been using the app for a while, teams know to check to see if service calls in their areas are assigned to them. That way, if a new ticket is next door to their current job, nearby or on their way home, they can route themselves to do a site field inspection, instead of waiting until the next day.

When the employee arrives at the customer's location, the app then guides them through the estimating

process: what to measure, multiple glass types, thicknesses and insulating glass combinations. The app also provides templates with graphics and drop-down menus to streamline the process. All of this information can then be sent to vendors to obtain quotes.

Q What kind of training is required?

Our newer hires have been younger, and the way the app is written, it requires very minimal training. As long as we continue to build and update the app with the same cues as other modern interfaces, we've barely had to train new people on the app itself. I may need to train them on the products we use, but I don't really train them on how to use the app, because we use so many industry-standard functions.

The app itself trains employees on our shop processes, because of all of the functions in Glazier's Tool. I'm also very collaborative in how I update the program—if employees who use it every day say, "We'd like it to work like this, or you need to add this feature," we do it. ■

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