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ON THE COVER: Float glass being processed at Guardian Glass’s facility in Czestochowa, Poland. Photo courtesy of Guardian Glass.
Roto Patio Inowa

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METAL TRENDS
Glass and metal systems suppliers adapt their systems for less labor, greater sustainability

CAREER PATHS
Students explore the diverse world of construction trades, and what NGA has to offer

RESOURCES
NGA’s 80+ Glass Technical Papers cover all aspects of glass and glazing building products

ENERGY EFFICIENCY
Staying Current with Energy Codes
Lisa May, Wausau Window and Wall Systems

CODES & STANDARDS
ADA Design Considerations
By Mary Avery, Tubelite

FORECASTS
Top 5 Factors to Watch
By Katy Devlin, NGA

PROJECT SHOWCASE
Featured in Glass Magazine Weekly and on GlassMagazine.com. To submit projects or case studies, write Norah Dick, ndick@glass.org. Pictured: The interior of Penn Station in New York City, the busiest train station in the Western Hemisphere, underwent a significant renovation. The design features more than an acre of glass that Pulp Studio fabricated for the new mid-block canopies that complement the original arched windows of the Farley Building, as well as the interior Moynihan Train Hall. Columns feature mirror-backed glass colored in blue at the bottom to a gradually changing gradient of mirror at the top. Photo: Pulp Studio

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In this first edition of Glass Magazine in 2024, we present our Annual Construction Forecast, found on pages 56-68. To pull together the in-depth look at the year ahead, Glass Magazine’s Tara Lukasik waded through numerous prognostications from leading construction economists from Dodge Construction Network, the AGC of America, ConstructConnect, the American Institute of Architects, ITR Economics, and others. However, the takeaways are mixed.

**Recession or soft landing**
There is little agreement among economists about what 2024 will hold. They are split over whether the overall economy will enter recession—59% of economists say there is a 46% chance the U.S. will enter recession in 2024, according to Bankrate’s latest quarterly survey of economists, published in fall 2023. They are split over labor market expectations. Over interest rate projections. Over the future of inflation.

Construction economists are similarly split in their expectations for the coming year. During a presentation at 2023 GlassBuild America, Connor Lokar, senior forecaster, ITR Economics, projected that the overall U.S. economy will most likely enter recession in the coming months, with nonresidential construction beginning to feel the effects in late 2024. However, Richard Branch, chief economist, Dodge Construction Network, expressed confidence that the U.S. will remain “recession-free” and end 2024 “on much more stable footing.”

**Consensus in construction forecasts**
There are some areas of consensus. Most sector economists anticipate a softening in the commercial sector, a significant falloff in multifamily, but a rebound of single family. They also align over expectations for key market drivers, such as supply chains (expected to continue to normalize); material inflation (slowing, with “relief” in sight, says Dodge’s Branch); labor (still tight, with wages rising); and interest rates (turning around from their painfully high levels).

**On the ground**
Despite what forecasters say about the state of the economy, many in the glass industry say they are already feeling a slowdown in the market. The on-the-ground message I’m hearing from some is that backlogs are generally down. High inflation and interest rates have taken a toll, and credit is becoming less available. Many are looking to 2024 with some concern over the state of projects in the pipeline, their ability to get paid and to manage material cost increases. “Work is slowing down, and some players are getting caught crosswise on inflation,” said one glazier I spoke with in early December.

**Opportunity to focus**
Despite the uncertainty, economists note that slowing growth can offer business opportunities. A slowdown will give the construction industry its first “breather” before the pandemic, according to ITR’s Lokar. “You’ll have an opportunity to get the house in order. You’ve spent three to three and a half years surviving the pandemic, with unprecedented supply chain issues, inflation pressures and turnover. You’re going to be able to breathe. … Think about everything you’ve said ‘no’ to over the past two or three years. That’s what you can bring back to the front burner.”

**“Many glaziers are looking to 2024 with some concern over the state of projects in the pipeline, their ability to get paid and to manage material cost increases.”**

**EDITOR’S NOTES**

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GLASSBUILD AMERICA 2023 DRAWS MORE THAN 8,700 TO ATLANTA

GlassBuild America: The Glass, Window & Door Expo returned to the Georgia World Congress Center in Atlanta in October and November, attracting more than 8,700 registered attendees for its 20th year as the largest glass and fenestration industry trade show in the Western Hemisphere.

The three-day event, organized by the National Glass Association, drew attendees from the United States and internationally to see new product solutions, advanced machinery and equipment, innovative tools and components, and more. The 188,300-square-foot show floor included over 480 exhibitors, including international exhibitors, and over 90 first-time exhibitors.

“In Atlanta, we celebrated 20 years of GlassBuild America, delivering on our promise to bring buyers and sellers together for 2.5 days of incredible energy and connection-making,” says NGA President and CEO Nicole Harris. “Next year, we head to Dallas for the first time, and judging from the exhibitor sign-ups and attendee buzz, GlassBuild America 2024 is looking like another record-breaking show.”

In addition to a busy show floor, GlassBuild also offered a wide range of education opportunities: the 17th Annual Glazing Executives Forum; the Annual Construction Economic Outlook presented by Connar Lokar of ITR Economics; Main Stage sessions, including a gathering of women in glass and fenestration, panels on looming industry trends, mental health and suicide prevention, and building business and community through DEIB; and seismic performance considerations for fenestration and glass, and fenestration product certification from the Fenestration & Glazing Industry Alliance. Finally, a rodeo-themed party to hype GlassBuild 2024 in Dallas closed out the event.

CONSTRUCTION ECONOMIC OUTLOOK

The overall U.S. economy will most likely enter a recession in the coming months, with nonresidential construction beginning to feel the effects in late 2024, says Connor Lokar, senior forecaster, ITR Economics, who returned to the Glazing Executives Forum at GlassBuild to deliver the event’s popular annual economic forecast keynote presentation.

“We anticipate a recession in 2024,” says Lokar, who, for the first time brought his full-length forecast to the GlassBuild show floor, in a standing-room-only session at the Main Stage. The session was part of NGA’s 75th anniversary celebration.

GEF SPOTLIGHTS BEST PRACTICES

About 200 leaders from glazing contracting firms gathered on Oct. 31, 2023, at the 17th Annual Glazing Executives Forum for a day of education, networking and solutions sharing. This year’s event, hosted by NGA and held in conjunction with GlassBuild America, offered programming to help glaziers tackle some of their biggest ongoing challenges, including finding and keeping employees, managing risks on the job, and handling glass safely amid design trends for larger and more complex products.

INDUSTRY TRENDS TO WATCH

The GlassBuild Main Stage hub for education and industry insights kicked off its three-day schedule on Oct. 31, 2023, with “Industry Trends to Watch,” a seminal panel hosted by Max Perilstein of Sole Source Consultants, Ron Crowl of Cyncly, Shelly Farmer of Sightline Commercial Solutions, Alan Kinder of Guardian Glass, and Bruce Wesner of PGT Innovations. Artificial intelligence was a major topic, and panelists encouraged industry members to think of new tech development as an opportunity. “Play with AI,” said Crowl, encouraging industry members to see how the tool could work for their companies and processes.
MENTAL HEALTH AND SUICIDE PREVENTION

Kristen Petillo, Richard Bright, Cal Breyer and Bob Swanson spoke about mental health, suicide prevention and tough conversations in the construction industry. A culture of “male toughness,” job injuries that lead to opioid dependence, binge drinking and substance abuse all contribute to the high suicide rate within the industry. According to panelists, it’s vital to eliminate the stigma surrounding mental health and suicide. Talk to your friends and family. Open a conversation if you think something’s wrong.

BUILDING BUSINESS AND COMMUNITY THROUGH DEIB

The keynote panel “Building Better Business Through DEIB” featured industry leaders Ann McNeil, chair and founder of the National Association of Black Women in Construction, and Kelsi Queen-Robinson, CEO of Ebony Glass & Mirror. Moderated by NGA Operations Manager Alicia Hamilton, the panel focused on cultivating and maintaining a diverse workforce, and the barriers to success that people of color face in the construction and building industries.

NGA CODE AND REGULATORY UPDATES

NGA energy codes consultant Tom Culp and NGA Advocacy & Technical Services VP Urmilla Sowell presented updates to standards and codes impacting the glass and glazing industry. Culp covered the new Energy Star requirements, embodied carbon and Environmental Product Declarations, building performance standards and stretch codes, and glazing for on-site renewable energy production.

Sowell shared bird-friendly glazing requirements and NGA’s advocacy work, school security and enhanced forced-entry standards, and heat treatment and edge grinding, including NGA’s study on test procedures for edge grinding of laminates post-tempering with research on the thermal performance of spandrel glass. “What can we do as an association to address the rising issue of active shooters in the U.S.?” asks Sowell on school security. “We can address hardening schools. In an active shooter situation, time matters. Changing the codes to account for security and not just safety can make a difference.”

WOMEN ENCOURAGE REPRESENTATION, SUPPORT

In the much-anticipated follow-up to last year’s GlassBuild gathering, the Women in Glass and Fenestration Breakfast Meetup on Nov. 2 focused on representation and building other women up. Colleen Pritchett, president, Aperture Solutions—U.S., Cornerstone Building Brands, identified keys for flexibility and gender diversity in companies during the keynote, Flexibility and Gender Diversity. “Empower women employees through mentorship and supportive culture; give access to education and training; offer flexibility in the workplace, including leave and childcare; and offer unique opportunities, and [encouragement] for women to ask for and go after those opportunities.”
YOUR ASSOCIATION AT WORK

MYGLASSFAB LAUNCHES

NGA launched its MyGlassFAB training platform for production personnel at GlassBuild, offering demos throughout the show. Powered by NGA’s MyGlassClass.com, MyGlassFAB provides companies with consistent, core training for glass fabrication employees. The new platform combines online courses with skills-based activities to help ensure production personnel have the fundamental skills necessary to perform their duties safely and accurately.

“Consistent training can be a challenge when companies rely primarily on informal, one-one-one instruction,” says Jenni Chase, NGA vice president of workforce development. “MyGlassFAB offers training that fabricators can deploy and track across their entire workforce.” Learn more at myglassfab.com.

NEW NGA BOARD OFFICERS

New board officers of the National Glass Association took office for the 2023-24 term on Oct. 30, 2023, prior to the start of GlassBuild America. Board officers are Chair Ron Crowl, FeneTech, a Cyncly Company; Chair-elect Rick Locke, Montana Sash & Door; Treasurer Tim Kelley, TriStar Glass Inc.; and Immediate Past Chair Brian Hale, Hale Glass Inc.

Returning board members are Tara Brummet, Vitrum Glass Group; Silas Koonse, Koonse Glass Co. Inc.; Courtney Little, Ace Glass; Jodi Martinez, AllStar Glass Co. Inc.; Syndi Sim, Diamon-Fusion International; Jim Stathopoulos, Ajay Glass; and Kyle Sword, Pilkington North America.

EVENT UPDATES

NGA will again co-locate the 2024 Building Envelope Contractors Conference and Glass Processing Automation Days—taking place March 3-5 and March 5-6, 2024, respectively—at the Omni Hotel in downtown Nashville, Tennessee. Both events share programming, including a joint session on March 5 addressing supply chain challenges faced together by fabricating and glazing companies.

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The National Glass Association offers Glass Technical Papers (GTPs) free for the industry on a wide range of topics pertaining to the commercial/residential glass and residential window and door industries. GTPs are developed by NGA's dedicated member volunteers and subject matter experts. Below, we present the second half of the list of all GTP titles available. The first half of the list appeared in the November/December 2023 issue of Glass Magazine.

FB46-15 (2022) Assessment of the Weatherability and Durability of Decorative Glass
FB49-17 (2022) Performance Improvements of IGUs
FB50-17 (2022) Building Energy Performance
FB51-17 (2022) Building Envelope Commissioning
FB52-17 (2022) Guidelines for the Production of Heat-Treated Architectural Flat Glass
FB53-17 Benefits of Decorative Glass in Daylighting Applications
FB54-17 (2022) Guidelines and Best Practices on How to Manage Color Variance of Decorative Glazing
FB55-17 LEED© White Paper – Decorative
FB56-18 Heat Soak Testing
FB57-18 One Optical Number Does Not Fit All
FB58-18 (2023) Understanding Reflective Distortion in Mirror Installations
FB59-18 Heat-Treated Laminated Glass Exposed Edges
FB61-19 Tornado-Resistant Glazing
FB62-19 Mitigating Thermal Stress Breakage in Heat-Treated Spandrel Glass
FB63-19 Products for Energy Applications
FB65-20 Glass for Personal Protective Barriers
FB66-20 Introduction to Vacuum Insulating Glazing
FB67-20 Guidelines on How to View Decorative Glazing Products in Interior and Exterior Applications
FB68-20 Guidelines for Measuring Color of Decorative Glazing Materials in the Field
FB70-20 Best Practices for Installed Painted Decorative Glass
FB71-21 School Security Glazing
FB72-21 Introduction to Hybrid VIG Fabrication
FB73-22 Types of Decorative Glass
FB74-22 Alignment in US Energy Conservation Codes ASHRAE 90.1 and IECC
FB75-23 Compatibility Testing of Insulating Glass PIB Primary Sealant with Respect to Glazing Materials
FB76-23 Fire-Rated Glazing 101
FM01-08 (2020) Approximate Weight of Architectural Flat Glass
FM02-07 (2017) Flat Glass Industry Standards
FM02-09 (2020) Protecting Glass Against Weld Splatter
FM03-10 (2023) LEED® Recycled Content for Glass
FM04-12 (2019) Daylighting
FM05-12 (2023) Physical and Mechanical Properties of Typical Soda Lime Float Glass
FM06-20 General EPD Education
FM07-21 Flat Glass Environmental Transparency Documents
IN01-06 (2020) The Top 10 Items Commonly Missing from Fenestration System Shop Drawings
IN02-09 (2022) Bid Considerations for Contract Glazing Proposals
IN03-12 (2023) Key Elements of Fenestration System Shop Drawings
IN04-14 (2020) Safety Guidelines for Deglazing Structural Silicone
IN05-17 (2022) Overview of Building Information Modeling (BIM) for Glass and Glazing Systems
TB-1601-95(14) Guidelines for Use of Capillary Tubes
TB-1250-19 PIB Primary Sealant

ALL GTPS ARE FREE TO DOWNLOAD IN NGA’S ONLINE STORE.
Heat-Treated Glass Surfaces Are Different: Learn the Process, Properties and Cleaning Procedures

Heat-treated glass is a critical component of high-performance coated, insulating, laminated, spandrel, safety glazing, bullet-resistant, blast-resistant and hurricane-resistant fenestration products. Heat-treated glass usage has increased in recent years as a result of changes in the building codes requiring safety glazing in more applications, the need to meet higher thermal stress loads due to the use of more high-performance glass and coatings with increased heat absorbing and/or reflecting properties, larger glass sizes, and increased design loads.

Heat-strengthened, fully tempered
There are two types of heat-treated glass as defined in ASTM International's C1048 Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass. The two types are heat-strengthened and fully tempered.

Heat-treatment process
Both types of heat-treated glass are produced using the same equipment, typically horizontal roller hearth ovens using either a batch or continuous process. To prepare annealed glass for the heat-treatment process, it is cut to the required final size, the edges are treated according to the specified finish (commonly seamed or polished) and the glass is washed. The glass is then transported on horizontal rollers through an oven, where it is heated to approximately 1150 degrees Fahrenheit (621 degrees Celsius). Upon exiting the oven, the glass is rapidly cooled (quenched) by blowing air uniformly.

Acceptable cleaning procedures are available free from the National Glass Association and the International Window Cleaners Association.

Proper Procedures for Cleaning Architectural Glass Products

Construction Site Protection and Maintenance of Architectural Glass
onto both surfaces simultaneously. The cooling process leaves the surfaces of the glass in a state of compression and the central core in compensating tension (see Figure 1).

**Properties of heat-treated glass**

The color, clarity, chemical composition, light transmission, hardness, specific gravity, expansion coefficient, softening point, thermal conductivity, solar optical properties and stiffness remain unchanged by the heat-treating process. The properties that change are improved flexural and tensile strength and resistance to thermal stresses and shock. Under uniform loading, heat-treated glass is stronger than annealed glass of the same size and thickness. The heat-treating process will change the break pattern of glass that has been treated to a higher level of compressive stress, i.e., fully tempered glass that is designed to meet the industry safety glazing standards will break into relatively small pieces, thereby greatly reducing the likelihood of serious cutting or piercing injuries.

**Heat-treated glass surfaces**

The heat-treating process typically involves the transport of very hot glass on rollers. As a result of this soft glass-to-roller contact, some glass surface changes will occur. Minute glass particles (fines) from the glass cutting, edging and washing processes; typical manufacturing plant airborne debris or dust; refractory particles from the tempering oven roof; and external airborne dirt and grit carried into the plant by the large volumes of quench air used in the process may adhere to one or both glass surfaces. Also, the physical contact of the soft glass surface with the rollers may result in a marking or dimpling of the glass surface.

Glass quality specifications contained in ASTM C1036 Standard Specification for Flat Glass establish the size and number of glass imperfections allowed based on specific visual inspection criteria.

The glass surface conditions described above are not usually visible to the eye under normal viewing, do not threaten the product’s structural integrity and are not a reason for rejection of the glass based on the industry ASTM consensus standards.

However, such surface conditions may be detectable to the touch despite being invisible. This difference in “feel” between annealed and heat-treated glass can lead to issues during cleaning of the glass, as glass cleaning workers attempt to remove microscopic particles. With the best intentions, they may attempt to scrape particles that can be felt but not seen and may end up scratching and chipping the glass surface.

Additionally, once the glass is delivered to the construction site and/or installed, construction materials and debris may be deposited on the glass surface. Paint, stucco, concrete, adhesives and other materials may be splattered on the glass and left for long periods of time.

**How to clean heat-treated glass**

The recommended cleaning procedures for heat-treated glass are identical to those for annealed glass. Scrapers, abrasives and harsh chemical cleaning agents are not recommended for any glass product because they can cause irreparable damage. Despite the best intentions, window cleaners may attempt to remove construction dirt and debris from the glass surface by scraping the surface. This can lead to glass damage, such as scratching and chipping, if microscopic particles adhering to the surface become dislodged and are transported across the glass surface during the scraping process.
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Vitro Architectural Glass Rescales Operations at PA Plant to Meet First Solar Contract Demand, Expands MSVD Coating Capabilities
Vitro Architectural Glass and First Solar, a U.S.-based solar panel manufacturer, expanded their contract. This expansion aims to provide the glass front sheets used in advanced thin-film photovoltaic solar panels manufactured by First Solar.

Considering the requirements of this expansion, Vitro will invest an estimated $180 million to upgrade one of its furnaces at the Meadville plant, located in Pennsylvania, and adapt additional existing facilities to support First Solar’s growing manufacturing capacity in the U.S.

As a result, Vitro announced that it will temporarily idle one of its raw-glass production lines at its Carlisle, Pennsylvania, plant in the first quarter of 2024, affecting approximately 90 positions.

After the first line is shut down, it will be reconfigured to produce solar panel glass for First Solar. Line 2 at Carlisle will continue manufacturing various products for Vitro’s commercial and residential glass customers.

Vitro’s plants are strategically located to meet First Solar’s needs and already have the required raw materials for production. Production is expected to commence in the first quarter of 2026.

To meet a growing demand for magnetron-sputtered vacuum deposition products in North America, Vitro Architectural Glass also launched a new MSVD coater, Coater 8, at its Mexican facility in Baja California, Mexico. The unit will apply Vitro’s solar control low-emissivity coatings to architectural, automotive and oversized glass in sizes up to 130 by 240 inches.

The MSVD coating process enables glass manufacturers to apply ultra-thin layers of silver to glass to create low-e coatings that deflect solar energy and transmit high daylight levels.

AGC Successfully Demonstrates Glass Production Using Hydrogen as Fuel and Test of Solar Glass Recycling
AGC announced that it has succeeded in a demonstration test of glass production using hydrogen as fuel. This is AGC Group’s first conducted test using hydrogen in an actual production furnace.

In this test, AGC verified the technological issues for utilizing hydrogen-fueled oxygen combustion technology in glass production, including glass quality, effects on furnace materials, flame temperature, furnace temperature and nitrogen oxide emissions control. Aiming for full-scale deployment, AGC will conduct scaled-up tests of the combustion capacity of the hydrogen combustion burner and consider demonstration tests at AGC Group’s global sites to determine the scope of application of hydrogen combustion technology.

AGC also announced that it has succeeded in a demonstration test for the first time in Japan to recycle about 24 tons of used solar panel cover glass into raw material cullet.

The test was conducted at AGC Yokohama Technical Center’s figured glass production furnace. For the recovery of glass from solar panels, the test used the heat-treatment technology of the commercial solar panel recycling production line of Mitsubishi Chemical Group company Shinryo Corp.

NSG Solar Glass Production Begins in Malaysia
NSG Group announced the warm-up of a newly converted, transparent, conductive oxide facility in Malaysia. In this investment, an existing float line at the Johor Bahru factory of Malaysian Sheet Glass SDN BHD, a member of NSG Group, has been converted to begin producing TCO glass. This investment supports First Solar’s expansion strategy, which has a long-standing strategic partnership with NSG Group. The float line will supply glass to First Solar’s Southeast Asia manufacturing footprint.

PGT Innovations Establishes Glass Company, Western Window Systems Unveils Design Studio
PGT Innovations established Triple Diamond Glass, a PGT Innovations company. Triple Diamond Glass will offer solutions to window and door manufacturers in energy efficiency, security and sound-abatement applications. The initial products to be produced include Tri-Ultra thin-triple insulating glass units and Diamond Glass laminated glass units. The operations for Triple Diamond Glass will be housed in a facility in Prince George, Virginia, just south of Richmond.

The company’s products will be available for window and door manufacturers to incorporate into their existing products by the end of the first quarter of 2024.

Western Window Systems, part of the PGT Innovations family of brands, recently unveiled its new architectural design studio in California. Located in Santa Monica, the new 2,800-square-foot architectural design studio doubles as a showroom, and will serve as an
St. Petersburg, Florida is renowned for its vibrant art scene, featuring over 600 street murals. GGI contributed to this artistic landscape by fabricating 32 custom glass panels for a new public art display for the SunRunner Bus Rapid Transit system. As part of a $44 million project to enhance the city, nationally recognized artist Catherine Woods was commissioned to design 16 art installments to be placed in bus shelters across a 10-mile corridor, capturing the essence of the surrounding neighborhoods. Having worked with GGI on past projects, Woods knew GGI could bring her visions to life with Alice® Direct to Glass Printing.
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HMI Closes West Coast Locations
HMI has decided to close its West Coast locations due to the current labor shortages and changes in the shower glass market in these regions. HMI facilities in Cerritos and Livermore, California, and Reno, Nevada, are closed. The company says that this is a strategic decision that allows it to streamline its operations, strengthen its infrastructure and focus on those areas of the country that it can support with certainty.

HMI currently has locations in Louisville, Kentucky; Whitinsville, Massachusetts; Arlington, Texas; Spokane, Washington; and Aiea, Hawaii.

IGE Collaborates with Digital Printing Manufacturer KeraJet
IGE Glass Technologies announced a new collaboration with KeraJet S.A., a digital printing manufacturer based in Valencia, Spain. IGE will serve as KeraJet’s exclusive North American distributor for their digital printing technology in the flat glass fabrication industry.

Lisec Opens Engineering Center
A new engineering center opened at the Lisec site in Seitenstetten, Austria. The company added around 140 additional workplaces to an area of 21,500 square feet and four floors. Construction work began in April 2022. More than $7.5 million was invested in the construction project. Trends in office spaces, such as collaboration spaces or shared desks, were incorporated into the design.
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Jansen Announces New Subsidiary, Jansen America Inc.

Swiss company Jansen AG, a provider of steel profile systems, expanded its presence in the North American market via a new subsidiary, Jansen America Inc. Based in New York City, Jansen America is ready to directly service the North American market. Jansen plans a growth strategy in 2024, including a localized product portfolio, certifications and additional partnerships.

The Glass Guru Opens Pennsylvania Location

The Glass Guru announced the launch of its newest franchise location: The Glass Guru of Levittown. Yogesh Patel will launch the new store location at 3580 Progress Drive, Unit A-1, in Bensalem, Pennsylvania. Serving Levittown and the surrounding communities, the new location aims to expand The Glass Guru’s reach and appeal to a new community.

People

Halio appointed Doug Schendt as the company’s new CEO. Schendt replaces Bruce Sohn, who retires after serving as CEO since 2020. Schendt, who previously led Halio’s Asia operations, is excited to head the company globally and lead it into its next phase of growth. Sohn says this is an exciting time for the company and he believes Halio is in great hands as Schendt continues the mission to bring products to customers worldwide.

PGT Innovations appointed Craig Henderson as senior vice president and chief financial officer. As CFO, Henderson will lead the company’s finance strategy, budgeting and planning, accounting, financial reporting, and investor relations functions. Henderson has been serving as interim CFO since February 2023. Henderson has over 20 years of finance leadership experience in manufacturing and tech companies.

Anders Dahlblom resigned from his position as the CEO of Glaston Corp., due to personal reasons, according to a company announcement. The board of directors has started the search for a new CEO, but in the meantime, Glaston’s board nominated Antti Kaunonen as interim CEO.

PermaSTEELisa named Nigel Wood as group commercial director. Wood is an accomplished commercial director, say officials, focusing on productivity, efficiency and delivery of outstanding results. He has led groups of companies, business units and major projects across construction, infrastructure and specialist engineering businesses, including J Murphy & Sons and Laing O’Rourke.

Apogee Enterprises appointed Brent C. Jewell as president of Apogee’s architectural glass segment. Jewell will succeed Nick C. Longman, who was concurrently named president of Apogee’s architectural framing systems segment. Jewell has served as president of Apogee’s architectural framing systems segment since August 2019. Longman joined Apogee as president of the architectural glass segment in 2021.
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Can building codes be privately owned? Questions surrounding ownership of building codes and standards have been a source of ongoing legal debate for many years. A seemingly straightforward question of “who can own the law” is complicated when privately produced, industry consensus standards are incorporated into legislative or government agency actions.

Standards creation
Organizations like ASTM International, ASHRAE and the National Fire Protection Association spend countless hours engaging volunteers and industry participants to create standards, which the organization then copyrights. This allows the organizations to protect their work, sell copies of the standards and license access.

The quality of these standards is rarely subject to dispute, and it’s common for governmental bodies and agencies to incorporate standards and their methods into codes and performance requirements for projects with government oversight. This has created problems for the organizations that issue these standards.

Courts and legislatures typically hold that no one can own the law but have been slower in defining who can control the publication of that law. Efforts to provide free public access to standards incorporated into laws have resulted in lawsuits and contests from those claiming ownership or a right to reproduce the materials and charge for them.

Many courts have found that when a legislature enacts a law, they speak on behalf of that state’s people. With people as the authors, laws are matters of public domain that cannot be copyrighted. This holds true even where a third-party industry standard, such as a code or safety compliance requirement, has been adopted into law.

Project-specific impacts
In response, some standards organizations have provided separate means of access or developed materials specifically for incorporation, which may

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give the essential points of a standard but can lack certain background or the expanse of data or considerations available in the full, copyrightable version. Technical questions of standards copyright can have project-specific impacts for designers, architects and trades. Beyond avoiding the risks of unauthorized use of third-party standards, the hidden exposure rests in “meet code” clauses and undefined project specifications.

Nearly every project contract includes generic language and undefined terms to ensure compliance with applicable building codes and local standards. The lack of detail and defined scope in the crossover with copyrighted standards and legislative codes can present a downstream risk. When details of applicable codes and specifications are not spelled out in a contract, builders and tradespeople must independently find and research these obligations. Where codes incorporate third-party standards, controlling and owning those standards can impact the effort to determine what the code requires and, by extension, what the contract compels. This means trades must find the applicable code and ensure they are using the proper version of that code and its standards, which can also entail an outlay of monies to purchase the relevant technical documents so that the entirety of the code is available.

Managing contract risks
Uncertainty and ambiguity in contracts are risk points where legal exposure lives. Managing the risk of incorporated third-party standards, applicable codes and vague contracts can be daunting; however, a practical mitigation strategy can start with a few simple detail-focused acts.

Consider bid packages: whether a request for proposal or a quote, establishing the applicable codes, providing specifications on relevant standards and listing specific incorporated third-party standards helps build in required costs, sets expectations early in the process, and provides greater certainty in the contract and negotiation of what those terms mean to the bottom line from monetary and risk management perspectives.

Beyond project needs is continuing education of industry standards and best practices. Access resources on material, performance and investigative standards issued by third-party industry organizations that can help ensure current practices are targeted toward the best methods. Then, when those standards are incorporated into governmental requirements, there will be fewer surprises, regardless of who owns the code.

Matt Johnson is a member of The Gary Law Group, a Portland-based firm specializing in legal and risk issues facing manufacturers of glazing products.
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A thorough and detailed inspection of architectural glass and the condition of glazing are vital in maintaining the safety and visual appeal of both commercial and residential structures.

Glass will pass through multiple levels of quality inspection during the manufacturing process, and the glass industry has unique requirements for edge inspection, broken glass detection, glass thickness calculation, as well as film thickness, spectral reflectance, absorption and color (L*a*b*) measurement, to name a few.

As the science and application of measurement, metrology is a results-driven approach that ensures glass products consistently meet both quality and throughput requirements. So, how does glass metrology work?

**Common problems, custom measurements**

Metrology for glass and thin film combines state-of-the-art light sources, lasers, optics and detectors coupled with advanced software algorithms and machine learning to measure and analyze a variety of signals and features. Together, these deliver actionable insight into product performance and glass aesthetics.

Here are some common measurement challenges facing the glass industry, and how metrology is used to remediate each concern.

**Edge inspection.** Glass breakage can lead to potential hazards in the work environment and significant downtime due to equipment damage and maintenance. Real-time analysis of glass breakage and defects lets manufacturers quickly scrap defective product and identify upstream manufacturing issues immediately. For edge inspection, in particular, the metrology tool is configured to detect small chips, cracks or other debris and abnormalities along the edge, as well as measure sub-millimeter changes in panel thickness, width and radial profiles. All while communicating results to the factory floor to deliver improved yield and performance.

**Color calibration.** For commercial glass manufacturing, accurate color measurement is crucial. Achieving this—with every single panel—typically entails custom solutions through spectral and imaging analysis.

**Film and coating thickness.** Thin films and coatings are improving everyday products by tuning optical, electrical and structural properties of glass and semiconductor surfaces and interfaces. Determining correct film thickness typically requires a non-contact, non-destructive, thin-film characterization sensor—one that relies on spectral analysis of light reflectance or transmittance. This effort is achieved via a custom optical metrology system that acquires spectral data and determines thickness in real time, all without interfering with the production line.

Likewise, spectral techniques are used to identify and quantify other film and coating characteristics. For example, an absolute spectral reflectance metrology tool is used to characterize various films.

**Measure it, manage it**

As famed Austrian American management consultant Peter Drucker said, “If you can’t measure it, you can’t manage it.” And if you can’t manage it, you may never reach your manufacturing goals. Lean manufacturing at scale—and with a healthy margin—requires glass metrology.

Still, it’s important to note that metrology does not stand alone. Metrology tools must be designed so they integrate into the existing manufacturing environment, both its physical layout and digital infrastructure.

Dave Winarski is the Technical Sales Engineer at k-Space Associates Inc.
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You can’t predict, but you can prepare.

The past year was turbulent and full of unsettling financial news. We had bank failures, increasing interest rates, growing inflation, geopolitical conflicts and a troubled real estate market—all clear indicators that serious trouble is on the horizon, if not already here.

Experts discussed their economic forecasts in interviews, which didn’t help our understanding of the situation as most of them contradicted one another in their changing interpretations of risk probabilities. Rates and inflation were predicted to go up, sideways or possibly down, and depending on who you believe, the economy was headed for either a hard or soft landing.

These circumstances are challenging for construction company managers. With numerous potential outcomes and changing forecasts, how do you prepare your companies for 2024 in an environment full of uncertainty and potentially extreme outcomes?

Managing financial uncertainty

I usually manage complex and uncertain circumstances by simplifying them. My preferred approach is to consider the extremes, which provide a good framework of potential outcomes.

With one extreme, the economy could perform better than expected. The problems are not as bad as forecasted, and we could have a normal year.

The other extreme is more concerning. In this scenario, the forecasts with the worst outcomes prove correct: a prolonged recession, real estate problems and other issues. This environment could put many companies out of business.

The best strategy

I don’t know how the economy will perform, and I suspect that most economic forecasters don’t know either. For me, this uncertainty rules out trying to forecast the near-term future; the best strategy is to prepare.

The safest approach is to develop a strategy that offers protection against the worst-case scenario. Your plan should be flexible enough so you are well-positioned to capitalize on opportunities if things turn out better than expected.

I also suggest developing a robust “information filter” and focusing only on forecasts that could alter your opinion or strategy. Everything else is noise that only adds to the uncertainty.

01. Build cash reserves

A sizeable cash reserve is essential for the survival and success of every company. Reserves enable you to handle problems quickly so they don’t develop into expensive emergencies. Opinions differ on the proper size of a company’s cash reserve, but the amount depends on your company’s particulars and risk tolerance. While I prefer larger reserves that offer a better margin of safety, a three- to six-month reserve works well for most companies. A reserve that is smaller than one month is too risky.

02. Evaluate customer credits

When cash is tight, most companies delay paying their vendors, which
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creates problems for vendors expecting those payments to cover business expenses. Increase your chances of getting paid on time by running credit reports on your commercial clients to help reduce invoice delinquencies and improve cash flow. Always run credit reports before offering net-30 terms to clients. A company’s credit quality can change quickly, so examine long-term clients’ credit reports quarterly, not just at the start of a contract.

03. Clean up expenses

Unnecessary expenses, like unneeded, ongoing maintenance contracts, seldom-used services, subscriptions, etc., often accumulate over time. Each of these costs tends to be small and go unnoticed, but collectively, and over time, they can add up to a substantial amount. Examine your company’s expenses and determine if any can be cut or modified.

04. Examine capital expenditures

Consider delaying any large capital expenditures until the economic outlook stabilizes. The last thing you want is to buy additional equipment (at expensive rates) that will be underutilized.

05. Anticipate financing

Lenders are tightening their credit standards and strictly enforcing covenants, making getting—and keeping—a loan more challenging. If you anticipate needing financing in 2024, and I suspect it will be harder to get mid-year, consider accelerating the application timeframe and preparing your accounting before applying for financing to increase your chance of success.

These conservative strategies focus on protecting against a bad outcome and can be changed if conditions improve.

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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North American float glass manufacturers explore partnerships with solar panel producers, and stay ahead of the curve with low-carbon products.
What a difference a year can make. That was true of the North American, and indeed global, float glass industry in 2023. As inflation continues to depress commercial and residential building, a new segment of the float glass industry is emerging: glass for solar panel production. In this uncertain environment, North American producers are having to set their sights both short-term and long-term; meeting customer demands for increasingly stringent energy performance while improving and updating manufacturing processes for sustained pushes toward industry decarbonization.

Pictured: The Parkland Moody Outpatient Center, a LEED Gold-certified health care facility in Dallas Texas, features natural daylighting thanks to Vitro Architectural Glass’s Solarban 90 Acuity glass. HK Architects specified the product for its transparency, color neutrality, solar control and visual light transmittance. Partners included fabricator Hartung, and glazier IWR North America. Photo by Tom Harris.

For information on float plant locations worldwide, download the updated World of Glass float plant database at glass.org/store.
While the float glass supply in 2022 was tight, that changed in 2023 due to economic slowdown, says Stephen Weidner, president and head of architectural glass North America and solar products, NSG Group. Unprecedented inflation and interest rates have depressed both the commercial and residential markets in North America, and the “domino effect” of the pandemic continues to affect commercial building, including office and retail construction and even institutional builds, he says.

While the dip in demand might have led to overcapacity, says Weidner, the expansion of glass supply to solar panel, or photovoltaic, production has balanced this out. “This growth in the solar [panel market] has absorbed a lot of this under-utilized capacity that we would have historically seen in the market from all these negative impacts,” he says.

Glass for solar panel production grows to 5% of the market

Weidner says glass for solar panels is now a significant sector of the raw glass market, joining the commercial/architectural, residential and automotive segments. To demonstrate the sector’s rapid growth, demand for glass from the solar panel market has risen from 0% five years ago to 5% of the market in 2023,
Architect Gensler specified Solarban 60 Starphire glass for the newly upgraded midtown Manhattan office building, 135 West 50th Street in New York. Designers chose the glass for its balance of clarity and energy efficiency. Photo by Robert Deitchler, courtesy of Gensler.

To demonstrate the sector’s rapid growth, demand for glass from the solar panel market has risen from 0% five years ago to 5% of the market in 2023.

says Weidner. About three North American float lines are now fully dedicated to the segment, he says, and that’s just the beginning. “If you look at next year, it’s going to be four lines, and the year after that will be five or six lines.”

Both NSG Group and Vitro Architectural Glass supply First Solar, a solar panel manufacturer. NSG’s Luckey, Ohio, plant supplies First Solar in the U.S., and the company announced in November 2023 that a float line at its Rossford, Ohio, plant will install online coating capacity and will start shipping transparent conductive oxide glass for solar panel manufacture in the first quarter of 2025. The company has also increased glass supply to the sector globally; it converted a float line at its factory in Johor, Bahur, Malaysia, to produce TCO glass. “NSG is also considering expanding further capacity for solar energy glass in the U.S., to ensure it meets solar glass demand by First Solar,” say officials in the announcement.

Vitro’s partnership with the company accelerated in 2023; they announced their first contract in April and another in October of that year. Vitro is rebuilding its second line at its Meadville, Pennsylvania, plant to supply the contract; the float line had been idled due to low capacity and the prohibitive cost of rebuilding it at the start of the pandemic.

Following the company’s second contract with First Solar, Vitro announced that it would idle line 1 at its Carlisle, Pennsylvania, plant in order to reconfigure it to produce glass for solar panels. Line 2 at Carlisle will continue to manufacture glass for commercial and residential applications. Overall, the company is investing about $180 million to refurbish the Meadville and Carlisle plants to produce glass for First Solar, according to officials.

“The agreement further strengthens our supply chain, not only in the U.S. but also in North America,” says Paul Bush, vice president, technical services, sustainability and government affairs, Vitro Architectural Glass. “Our Meadville plant already has the necessary raw materials, and its strategic location is well-suited to accommodate First Solar’s production.”

Solar panel producers expand in the North American market

First Solar itself is also expanding. In September 2023, the company broke ground on a new facility in Louisiana, with plans for further expansion in Alabama and Ohio. The Inflation Reduction Act has incentivized the production of PV panels, and several companies have announced new locations in the North American market, including Canada-based Heliene; Meyer Burger Technology AC, based in Switzerland; Italian energy company Enel; and Vikram Solar, an India-based solar module producer.
This last year continued to see major global challenges. As of this writing, a new conflict in the Middle East has compounded global tensions already running high due to the war in Ukraine. In June 2023, NSG Group disposed of its joint venture in Russia, and Guardian Glass sold its two Russian float facilities the previous summer.

Global challenges may imperil industry growth around the world

Canadian Premium Sand, which in 2021 announced plans to build a new float plant, continues to develop manufacturing capacity for a patterned solar glass facility to be located in Selkirk, Manitoba, Canada, slated to be operational in 2025. An update on the project in August 2023 noted that the expansion of solar panel manufacturers in the North American market represented “an additional 29 gigawatts” of potential incremental demand for patterned solar glass and brings CPS’s current estimate of market demand to over 100 GW by 2027.”

Glass supply remains a headwind for future growth of solar panel production

Other than Canadian Premium Sand, the new market is unlikely to be supplied by new U.S. float plants soon, says Cardinal Corp.’s Bowie Neumayer, vice president of sales and marketing. “Economics make it very hard to build a float plant today. The cost is very hard to justify,” he says. Inflation has even further dampened float producers’ ability to build new lines, says NSG’s Weidner. “The inflation we’ve seen in the last couple years has impacted the cost of building a new line, and to repair existing ones. That’s impacting the industry in general, and not just in North America,” he says.

Assuming no new significant capacity in North America, the increased supply of raw glass for solar panel production may pinch supply for other sectors, says Weidner. While he hopes for the rebound of the commercial and residential markets, once they do return, it will likely mean a very tight glass market. “I do see that the demand will outstrip North American supply at some point,” he says, possibly a year to three years in the future, a development that may result in increased overseas imports.

Ongoing conflicts have the potential to disrupt the glass supply for North America. Although about 97% of North America’s leading fabricators source glass from North America, according to Glass Magazine’s 2023 Top Glass Fabricators report, 29% also source glass from Europe and 24% from Asia.

Wassim Khalil, commercial manager, Sphinx Glass, one of three float producers based in Egypt, says the regional float glass market is robust. “The glass market is growing, and it will definitely grow more because of the growing population in Egypt, Africa and the Middle East. There’s a demand for glass there.”

That growth will depend on regional stability, he says. “When I say stability, I mean economic stability and political stability in our region, so we can invest more in the coming five years to meet the demands of the market,” he says. “If there is no stability, I doubt that any one of us will put more money into that sector in the industry.”

Representatives at Xinyi, a major float producer headquartered in Asia, say the Asian market is also seeing “robust growth.” “Around 80% of the world’s production capacity is concentrated in Asia, underscoring the region’s significant market influence,” says Harold Wang, head of the international sales division, Xinyi Float Glass.

The company is currently opening a new float plant in Indonesia, scheduled to be operational within the next year, says Wang, and is looking to expand further. “In an effort for global business expansion, Xinyi remains open to partnerships with reputable local partners.”
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FLOAT PRODUCERS CONTINUE TO LOWER EMBODIED CARBON THROUGH SUSTAINABLE MANUFACTURING

In 2023, NSG Group became the latest float glass producer to offer a low-carbon, flat glass product, Pilkington Mirai. Mirai represents a 50% reduction in embodied carbon compared to standard float glass, according to the company, which was accomplished using biofuel. The range joins low-carbon offerings, including Planibel Clearlite by AGC and Oraé by Saint-Gobain.

Using alternative fuels to power float glass production requires significant technical consideration and is a complex process, says NSG’s Weidner. “The availability of some of these other sustainable fuel sources is rather limited because the market hasn’t created need from a demand perspective,” he says. Beyond availability and cost, the company also has to consider the impact of different fuels on production equipment, he says.

Guardian explores furnace alternatives towards sustainability

Guardian Glass is exploring power alternatives like electric melting, or “boosting,” through a partnership with Glass Futures, a global non-profit research and technology organization that aids companies in decarbonization by encouraging knowledge-sharing across the supply chain. The partners have created a pilot float line with a furnace capable of using electric melting to provide up to 60% of the energy required to melt glass, says Rick Zoulek, executive vice president, Americas, Guardian Glass.

“The challenge is for us to transfer these projects from the concept stage to full production without disrupting our operations,” says Zoulek. “The Glass Futures pilot line will provide an opportunity to try out some of our concepts on a furnace so we can de-risk the implementation of new technologies onto our float furnaces.”

Guardian also recently completed a successful cold tank repair of its furnace at its Bascharage, Luxembourg, facility. The furnace is now the most energy-efficient the company has, Zoulek says, consuming 25% less natural gas when compared to traditional furnace methods.

Floaters communicate material transparency through EPDs

Embodied carbon and global warming potential continue to be of interest to architects. Environmental Product Declarations, or EPDs, remain one of the main ways companies can express material transparency and global warming potential to the design community. “EPDs are technically voluntary, but they’re really a necessity,” says Alan Kinder, director, commercial segment, Guardian Glass. “You can’t walk into an architect’s office without it.”

Guardian plans to release an updated North American flat glass EPD in early 2024, with a cradle-to-gate embodied carbon value that will meet the top 20% limit in the General Service Administration’s Low Embodied Carbon Material Standard.

Vitro released updated EPDs for flat and fabricated glass in June 2023. The updated glasses now contain 6% lower embodied carbon than the National Glass Association’s industry-standard figure. Vitro officials say more efficient use of batch material, furnace efficiency and oxy-fuel technology all aided in the carbon emission reduction. Oxy-fuel can reduce energy consumption in glass melting furnaces by as much as 20% and cut greenhouse gas emissions in half, say officials. The company also offers sustainability resources on its website, including a Cradle to Cradle Certified Material Health Certificate, a LEED Recycled Content Letter, Material Safety Data Sheets and a Living Building Challenge Red List of Materials.
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THE 2024 FORECAST: TOP TAKEAWAYS

BY TARA LUKASIK
ECONOMIC UNCERTAINTY HANGS OVER 2023 AND IS CARRYING OVER TO 2024, BUT MANY INDUSTRY EXPERTS REMAIN CAUTIOUSLY OPTIMISTIC ABOUT THE YEAR AHEAD, PREDICTING A STRONGER AND MORE CONSISTENT CONSTRUCTION MARKET.

**Editor’s Note:** The following is based on forecast presentations from the 2024 Annual Outlook Forecast Conference from Dodge Construction Network, the Construction Economy Outlook semiannual webcast by ConstructConnect, and Connor Lokar’s annual economic forecast keynote presentation from GlassBuild America 2023.

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**Economy on edge, economists split on recession predictions**

In looking at the macroeconomic pressures facing the U.S. economy, including stubborn inflation, high interest rates, tight lending standards, labor shortage, rising energy prices and geopolitical turmoil, it’s impressive that the economy has remained recession-free. Resilient consumers, a healthy labor market, and public funding for manufacturing and infrastructure helped, but the challenges of 2023 will shift over into 2024, according to Richard Branch, chief economist for Dodge Construction Network.

“We’re anticipating that 2024 will bring about more consistent growth as well as more opportunity in the construction sector,” says Branch, “but the economy will remain challenged at least over the next three to six months. Still, we’re remaining confident that the U.S. economy will remain recession-free.”

However, Branch adds that this is dependent on the assumption that the Federal Reserve is done raising interest rates. Dodge forecasts that the Fed will start cutting rates around the midpoint of 2024. “The takeaway here is we know the construction sector is an extremely interest-rate-sensitive portion of the economy, particularly in sectors like the residential market,” says Branch. “We think that by the end of the year, the U.S. economy is going to be on much more stable footing, which should create more opportunity in the construction market.”

Other economists are not as optimistic. During a presentation at 2023 GlassBuild America, Connor Lokar, senior forecaster,
ITR Economics, projected that the overall U.S. economy will most likely enter recession in the coming months, with nonresidential construction beginning to feel the effects in late 2024. Lokar anticipates the recession will be mild but will demand that companies plan for a downturn to ensure they are protected, and may even offer time for them to explore new opportunities during the slower business cycle. “This is not going to be as bad as 2008 or 2009. The businesses that will get into trouble are those that don’t plan for it,” he says.

Extras
- Dodge estimates that U.S. gross domestic product growth will slow in 2024.
- The Congressional Budget Office forecasts GDP to speed up, averaging 2.4 percent a year from 2024 to 2027, in response to projected declines in interest rates.

**Inflation is still volatile but slowly stabilizing**

In terms of major economic indicators, inflation has remained at the top of the list over the past year. “We’ve seen significant progress over the last year,” says Kermit Baker, chief economist, American Institute of Architects. “A year ago, [the numbers] were a little over 8%. A few months ago, we saw them hit a low of 3%; they’ve come down dramatically. Generally, we’re moving in the right direction, even though we’re not done with the inflation issue yet.”

Alex Carrick, chief economist, ConstructConnect, shares the sentiment on falling rates. “As interest rates stabilize and then begin to decline after Q1 or Q2 of next year, the homebuilding sector will revive.”

“What we’re seeing from an interest rate perspective, it’s hard for developers to make the returns, and they’re going to seek returns elsewhere,” says Jay Bowman, principal, FMI Corp., referencing private construction.

**Material price inflation about to turn**

Talk in the construction industry has been dominated by the issue of bid and material prices, and Dodge’s Branch says that the industry will continue to

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**OVERALL CONSTRUCTION STARTS ARE EXPECTED TO RISE 7% IN 2024, FOLLOWING A 1% INCREASE IN 2023, ACCORDING TO THE DODGE FORECAST. THE 2023 INCREASE WILL BRING TOTAL STARTS TO AN ESTIMATED $1.124 TRILLION, WITH $1.206 TRILLION FORECAST FOR 2024.**

<table>
<thead>
<tr>
<th>Total construction starts</th>
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<tr>
<td><strong>2023</strong></td>
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<td><strong>$1,124B</strong></td>
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see good news. “[The composite index of building materials] is contracting after that steep run-up that we saw in the wake of the pandemic. And bid prices are starting to be essentially flat from where they were last year. We’re going to see continued relief in bid prices, contracting a little over the coming months through Q1 and maybe even early Q2 of 2024, but that contraction is also going to be brief, and we’ll start to see them re-accelerate. They’ll return to more normal growth, somewhere in the 3% to 5% year-over-year range.”

Supply chains also improved in 2023, with the Global Supply Chain Pressure Index hitting a historical low in October 2023 and almost all material divisions seeing stable or improving lead times, showing that supply disruptions are in the rear-view mirror, for now, according to real estate and investment management JLL Capital Markets. In 2024, slowing private-sector construction starts should keep supply chain pressure manageable, but the current pipeline and increase in publicly funded construction is anticipated to prevent price reductions.

Labor challenges continue

Limited labor availability is expected to persist for the long term, according to the U.S. Bureau of Labor Statistics. Due to ongoing shortages and an increase in people leaving the industry, overall growth of the construction labor force will slow from its current, already inadequate, pace in 2024, severely limiting how many projects owners and developers can take on. While advancements in technologies can ease some of these pressure points caused by the labor market, it cannot fully replace the need for labor.

“The number of people hired has been tailing off. You might think that indicates a declining demand for workers, but I think it indicates how hard it is to find workers to fill those positions,” says Ken Simonson, chief economist, Associated General Contractors of America. “The unemployment rate in construction has come all the way down to the same level as the overall economy, to 4% or less, and that’s really exceptional.”

In North America, as the industry faces skilled labor shortages and falling productivity, competency and efficiency will be increasingly valuable among the workforce. Retention and upskilling are critical for the next year and beyond.

“The big challenge for contractors is going to continue to be finding workers,” says Simonson. “And I think that will be with us for many years.”

Companies may wish to take advantage of broader incentives, like the Inflation Reduction Act tax credits available for companies who hire registered apprentices, which may build demand for apprenticeship programs, potentially expanding workforce training opportunities and benefitting employers.

Extras

• The BLS projects that the labor force participation rate will continue to decline in 2024, although at a slower rate than that seen before the onset of the 2007–09 recession, falling 2.0 percentage points to 60.9% in 2024.

• Simonson forecasts that construction wages will rise 5% to 7% over the next year.
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Geopolitical conflicts and trade tensions loom

The Israel-Hamas conflict raises concerns about potential wider Middle East tensions, possibly impacting energy and other raw material prices. U.S. sanctions on Iran and possible retaliatory actions, including threats to the Strait of Hormuz, could further escalate these issues. And the ongoing tensions between the U.S. and China could also stoke inflation.

In February 2023, the Aluminum Extruders Council reported on the White House proclamation adjusting imports of aluminum into the U.S. and significantly increasing costs for aluminum smelted or cast in Russia. Tariff rates on most metals and metal products will double from 35% to 70%. U.S. imports of unwrought aluminum and alloys from Russia amounted to 191,809 tons, or roughly 4.4% of the more than 4.4-million-ton total last year, compared with 8.9% in 2018 and 14.6% in 2017.

Rising energy prices and geopolitical tensions are new risks added to the matrix that Dodge examines. Branch also cited rising tensions in Russia, Ukraine and the Middle East as possible obstacles in the coming year. “Geopolitical risk remains intense,” he says, but Dodge forecasts that “tensions will start to ease in the coming three to six months.”

Extras
• The U.S. initiated a 200% tariff on all Russian-made aluminum in February 2023, which applies to about $2.8 billion worth of materials.
• Chinese materials used in the glass, glazing and metal industries are still subject to the 10% tariff that went into effect September 2018, despite a U.S. International Trade Commission report that found American importers have borne most of the costs.
• In June 2023, the Aluminum Extruders Council asked the Commerce Department to reform its tariff exclusion process for U.S. aluminum extrusion products.

Commercial construction edges lower

The commercial sector, which includes stores, offices, warehouses and hotels is expected to fall 6% to $156 billion in 2023, then another 2% to approximately $153 billion in 2024, Dodge predicts. “If you pull the warehouse sector out of that minus 2%, construction starts for commercial are actually positive,” says Branch.

Connor Lokar, senior forecaster, ITR Economics, who delivered the annual economic forecast keynote presentation at GlassBuild America concurs on nonresidential construction lags. “For companies on the non-residential side, it has been great. ... And next year should be great, or at least good. But be careful of what comes next,” Lokar says. “You’ll be in recession by end of 2024.”

Market conditions may not be especially supportive right now. “What this says to me, is that projects are going into the queue, working their way through the planning cycle... moving slowly to start... to make sure that the market conditions in 2024 will be supportive,” says Branch. “It could be due to labor, costs or materials challenges, but if the signs indicate a good market, they want to be ready to move those projects forward. Once the economy is a little more stable, these projects will start moving through to groundbreaking.”
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Office construction under stress

Offices are expected to decline slightly, at a rate of 2%, in 2024, following two years of growth at a rate of 30% in 2022, and an additional 5% in 2023. While demand for traditional office space still suffers in the wake of the pandemic, data centers are expected to have “aggressive growth” in 2023 and 2024, says Branch. “When we pull out data centers, the 2% drop in overall office construction drops further by 6%.”

“If you look at office occupancy, it’s been sitting around 50 percent,” says Branch. “Office vacancy rates are 18%, up 140 basis points from where they were a year ago. Core office construction never gets back to where it was in 2019. We continue to believe here that remote and hybrid is going to continue to be a driving force in the employer employee relationship.”

Retail construction starts edge up

“Retail is probably the strongest link between the residential sector and the nonresidential sector,” says Branch. “There’s a 12-month lag between the start of single family and the start of a retail development. But e-commerce kind of broke that. There’s still a lot of retail to residential development going on, relative to what we saw in the wake of the Great Recession.”

Dodge officials believe that the slow residential market is holding back retail starts, but that will change in 2024 with an increase of 9%, both from renovations and additions to existing buildings of top retail chains and the growing trend of residential construction moving from urban areas into the suburbs and even further out into the rural areas of the country.

“Rural construction for nonresidential has actually picked up to about $10 billion in activity over the last couple of years,” says Branch. “It’s an area where the building stock has not kept up with the current population growth, and we’re seeing a lot of retail activity. We think that continues in 2024 with another gain here in retail starts, but project mix is very important.”

Hotels

Hotel starts are down 5% in 2023 but will increase 16% in 2024. An extremely competitive sector, in the wake of the Great Recession, hotel starts accelerated, but interest rates and tightening lending standards choked off development in 2023.

“Hotel fundamentals are very solid,” says Branch, particularly in the high-end market. “I hate to call anything recession proof, but those luxury and upscale projects are moving ahead whether the economy is slowing or not.”

Branch thinks that hotel chains are betting on a big return in business travel, that business travel will continue to grow, but will stay well below pre-pandemic levels. “The lower-middle hotels where most business travelers stay and extended-stay class of hotels, I think those are more about value,” adds Branch. “I think that comes into play more in 2024.”
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Institutional building to ease in 2024

Institutional construction starts are projected to increase 3% in 2024, following the upward trend of 7% in 2023 and 23% in 2022. “There’s a lot more diversity here in project type, project size and geography too,” says Branch. “To me, this says a lot more about stability in the institutional market.”

Education

K-12 starts larger, but more volatile than university

The largest institutional construction sector, K-12, colleges and universities, and educational laboratories, libraries and museums are a mixed story, according to Dodge. “Mostly state and local funding drives [them] and those budgets are in really solid shape,” says Branch. “On the bad side, demographics are shrinking on the school age population and mixed-college construction. Overall, demographics are weaker for colleges and universities than they are for K-12.”

“Looking at the total market,” adds Branch, “if I were to rank the three by growth opportunity, I would put the K-12 market at the top. I think the strongest growth market in education is the laboratory market, but it’s a smaller portion of the total overall. The college sector is much like the hotel sector; it’s extremely competitive on who has the best facilities.”

Healthcare

Clinics, hospital construction to fuel 2024

Among the stronger sectors is health care, which FMI forecasts will end 2023 up 9.4%, with an additional increase of 5.6% in 2024. While hospital construction has been relatively flat, medical office buildings have had a “meteoric rise” in the past 10 years, says Bowman. Once just representing one-fifth of the amount spent on construction of hospitals, he adds: “I believe [by] 2027 that we will have more spending on medical office buildings than we will on hospitals.”

Dodge predicts that clinic and hospital construction will fuel 2024, increasing 5%, and ranking clinics as the strongest and above trend, with hospitals right at trend, and the nursing home sector bringing down the average. Urgent-care centers, located mostly in suburban strip malls, are part of the retail growth happening in the suburbs, and signal a positive sign for healthcare clinic construction.

“We are starting to see reinvestment in the health care and hospital market. Clinics are looking more stable, much like hospitals, and both have been relatively flat over the past few years in terms of construction activity,” says Branch. “The nursing home side has fallen significantly, with construction about half of what it was pre-pandemic.”

Extras

- Dodge expects corporate campuses to pick up strength again in 2024.
- In 2022, square feet for K-12 was nearly five times the size of the post-secondary market.

“Commercial construction pretty much moves lock-step with the economy, and follows the single-family market,” says Branch. “The economy slows down construction, and commercial starts slow down with it.”

High rates, lending standards hurting residential starts

Single-family construction organically leads the construction sector into decline or recovery, according to Branch. “Residential leads commercial buildings, like retail leads institutional buildings like hospitals and schools.”

The total dollar value of residential starts is expected to end 2023 down 13%, before rising 11% in 2024.

“The residential market split, with single family going one way towards a pseudo recovery, and multifamily going the other, peaking in December 2022, and falling since,” adds Branch.

ConstructionConnect’s Carrick believes that falling rates are the key to a thriving residential market. “As interest rates stabilize and then begin to decline after Q1 or Q2 of next year, the homebuilding sector will revive.” ConstructConnect’s forecast predicts a 4.4% increase in 2024 for total residential starts, with a more robust 15% increase expected the following year.

Single family

Starts tied to mortgage rate pressures

In the residential sector, Dodge predicts single-family construction will end 2023 down 12%, measured in units, before climbing 3% in 2024. Branch notes that while the bottom for single-family starts has passed, mortgage rates need to ease before the sector will see stronger growth.

“New home sales, tightly correlated to new home construction starts, are up 5% on a year-to-date basis,” says Branch. “With mortgage rates where they are, we’re not going to see a big run up in single-family construction anytime soon. People are still buying homes right now even with mortgage rates where they are.”

Branch believes that downward pressure on mortgage rates will come
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in Q1 2024, creating more stability and propagating single-family construction through late 2024 and 2025. “The market needs lower interest rates for people to consider selling their homes that they refinanced when rates were low,” Lokar says.

**Multifamily**

Recalibration and increase for 2024

Multifamily work is expected to follow a similar pattern, dropping 13% by the end of 2023, with a 3% increase in 2024. Following a peak at the end of 2022, starts in this sector have declined, due in part to tightening credit standards for multifamily and commercial properties, as well as slowing household formation, with younger people cohabitating or living with family, lowering demand. Still, says Branch, this is simply a fall from the peak of activity. “[Before 2021], these are the highest levels for multifamily construction, going back to the ‘80s,” says Branch. “There’s still a lot of activity going on, so perhaps this is just a recalibration or a realignment following a little rush of development in 2021–2022.”

Companies that leaned into multifamily contracts during the sector’s boom of the last several years should prepare for slowdown in the near term, Lokar says. “If you’ve been living off multifamily, [the sector] is entering recession,” he says. “Starts were down 28.1% in the last quarter, and permit pulls have cratered.”

“Credit is hard to get for multifamily construction... that’s going to push up vacancy rates, and higher vacancy rates will suppress construction,” says Branch. “The point I want to make in multifamily is that even though the national market and some of the indicators are suggesting weakness, there are pockets of opportunity and growth in the multifamily space,” adds Branch. “I think that recovery [going into] 2024 is going to develop later for the multifamily market. Single family goes first, multifamily comes after.”

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Connor Lokar, Senior Forecaster, ITR Economics

**Eye on the horizon, sectors to watch**

Energy advocates are keeping an eye on the 2024 U.S. election to inform how it may shape, or re-shape, energy transition policy. In its 2024 Engineering & Construction Industry Outlook, Deloitte believes that sustainable practices and technology advancements are likely to shape the industry in 2024, as key pieces of the Infrastructure Investment and Jobs Act, the Inflation Reduction Act, and the CHIPS Act flow into the industry. The U.S. is also prioritizing sustainable construction through its Federal Buy Clean Initiative, which specifies more than $2 billion for the procurement of lower-carbon construction materials for use in federally funded projects.

Additionally, aviation projects are taking off. Large airport expansions in Colorado, Texas, Montana, Missouri, Iowa and Minnesota are boosted by cash infusions from the Infrastructure Investment and Jobs Act, which designates $15 billion over five years for terminals, safety and sustainability efforts, and airport-transit connections. Of that, $2.89 billion became available for airport projects in fiscal year 2023.
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<thead>
<tr>
<th>Illumination and detection channels</th>
<th>Brightfield channel transmission</th>
<th>Darkfield channel transmission</th>
<th>Brightfield channel reflection</th>
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<td>Simulation of a bright diffuse sky</td>
<td>Simulation of lateral sunlight</td>
<td>Simulation of direct light reflection</td>
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<td>bvbproducts.com</td>
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<td>C.R. Laurence Company, Inc.</td>
<td>9</td>
<td>800/421-6144</td>
<td>email: <a href="mailto:showers@crlaurence.com">showers@crlaurence.com</a></td>
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<td>C.R. Laurence Company, Inc.</td>
<td>96</td>
<td>800/421-6144</td>
<td>email: <a href="mailto:entrance.partitions@crlaurence.com">entrance.partitions@crlaurence.com</a></td>
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<td>Cardinal Glass Industries</td>
<td>42-43,44-45</td>
<td>cardinalcorp.com</td>
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<td>Curved Glass Distributors</td>
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<td>888/288-9129</td>
<td>curvedglasscreations.com</td>
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<td>Dependable Glass Works</td>
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<td>800/338-2414</td>
<td>dependableglass.com</td>
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<td>Erdman Automation Corp.</td>
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<td>763/389-9475</td>
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<td>Ergo Robotic Solutions</td>
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<td>F. Barkow, Inc.</td>
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<td>800/558-5580</td>
<td>barkow.com</td>
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<td>FHC, The Glazing Supply Company</td>
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<td>888/295-4531</td>
<td>fhc-usa.com</td>
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<td>GDS Estimating</td>
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<td>858/538-4375</td>
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<td>GGI</td>
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<td>800/431-2042</td>
<td>generallglass.com</td>
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<td>Glass Magazine Employment Center</td>
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<td><a href="https://jobs.glassmagazine.com">https://jobs.glassmagazine.com</a></td>
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<td>Glass Processing Automation Days</td>
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<td>Glassfab Tempering Services, Inc.</td>
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<td>glassfabusa.com</td>
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<td>Glasswerks LA Inc.</td>
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<td>888/789-7810</td>
<td>glasswerks.com</td>
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<td>Global Security Glazing/Isoclima</td>
<td>78</td>
<td>866/412-6977</td>
<td>isoclimasg.com / security-glazing.com</td>
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<td>GuangDong Kin Long Hardware Products Co., Ltd.</td>
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<td>800/254-3643</td>
<td>email: <a href="mailto:mail@kinlong.com">mail@kinlong.com</a></td>
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<td>HoLampCo International</td>
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<td>800/875-6268</td>
<td>holampresources.com</td>
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<td>Jordon Glass Machinery</td>
<td>87</td>
<td>800/833-2159</td>
<td>jordonglass.com</td>
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<td>Joseph Machine Co.</td>
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<td>717/432-3442</td>
<td>josephmachine.com</td>
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<td>Liberty Glass &amp; Metal Industries</td>
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<td>800/843-2031</td>
<td>lgminc.net</td>
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<td>Magid</td>
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<td>800/867-1083</td>
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<td>Olde Good Things</td>
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<td>Orchard Lock</td>
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<td>PAC-CLAD</td>
<td>Petersen Aluminum</td>
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<td>800/722-2523</td>
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<td>Pilkington North America, Inc.</td>
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<td>800/221-0444</td>
<td>pilkington.com/na</td>
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<td>Precision Glass Bending Corp.</td>
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<td>e-bentglass.com</td>
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<td>repurposedMATERIALS</td>
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<td>Roto North America</td>
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<td>Salem Fabrication Technologies Group Inc.</td>
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<td>SGC International Inc.</td>
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<td>Viprotron North America Inc.</td>
<td>70–71</td>
<td>313/384-3855</td>
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<td>Viraco</td>
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<td>Vitro Architectural Glass</td>
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<td>970-861-861</td>
<td>vitroglazings.com/solarban</td>
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<td>Wood’s Powr-Grip</td>
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<td>XYG North America</td>
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<td>905/947-8801</td>
<td>xygna.com</td>
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<td>YKK AP America, Inc.</td>
<td>59</td>
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ATTENTION JOB SEEKERS

Use the Glass Magazine Employment Center to Help Find Your Next Job in the Architectural Glass Industry

Visit jobs.glassmagazine.com to learn more!
Trade shows are a sizeable investment to exhibit at and to attend. But when you factor in the opportunities presented, it’s priceless in terms of value to your company and individual career. So, how can you leverage and capitalize on said investment?

Getting "social"
Take a look at the free tools that exist to maximize the commitment you’ve already made. You can do this through the avenues you’re already scrolling through, like LinkedIn, and disseminate that across other channels you or your marketing team are already using, like Twitter (X), Facebook, TikTok and Instagram.

“We view social media as a marketplace of ideas. Across all social platforms, we’re able to provide valuable information that supports our initiatives. Social media does not live in a vacuum but when used strategically, social content will bring new leads to your door,” says Crista Tekstra, vice president of brand and product marketing, C.R. Laurence.

The pregame
Let people know ahead of time that you’ll be under the same roof. This is your chance to meet people face-to-face. Tell them you’ll be there and what your intentions are. That could be a corporate email blast with a free promo code, or a direct outreach/ping just to let people know you’ll be in the vicinity.

If you have a product to show, blast it on social media to let people know you’re going, and what solution you have to offer or are seeking. You’ll either connect with people already planning to be there more efficiently, or you might sway folks that weren’t planning to be there to show up.

During and after the show
You’re now boots on the ground and ready to mingle and conduct business. Post something on your platform of choice and let folks know where you are in the building. Whether it’s at a specific booth, food vendor or main entrance, be findable. They won’t set an appointment if they don’t know you’re there. Build and cultivate that genuine rapport so that transactions can happen from a place of familiarity and trust. But first, make your presence known and be easy to locate.

After the show, reinforce those connections with follow-through. If you shook a hand or snagged a business card, follow up. Reiterate that it was awesome meeting them at the show, include details specific to the interaction, and ask questions or deliver the info you said you would.

Best practices
Throughout the show, share content that is relatable, informative and actionable. People love seeing projects and processes they can relate to.

Cite your sources and tag/attribute accordingly and selectively, and don’t plagiarize. Give credit where it’s due, but too many tags will stunt your social performance. Random tagging is clunky and will bury your post.

Prioritize quality over quantity. Don’t post bland content for the sake of posting daily, and don’t get hung up on trying to be an influencer. Be authentic and communicate clearly about the things you know.

“Having a strategy or niche that allows you to create fresh content, differentiate yourself and become a thought leader are great ways to utilize the benefits of social media,” says Syndi Sim, vice president of marketing and business development, Diamond-Fusion International.
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