

# USGlass<sup>TM</sup>

METAL & GLAZING

THE MAGAZINE OF RECORD FOR ARCHITECTURAL GLASS INDUSTRY LEADERS

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## The Nation's Top Contract Glaziers



A Conversation with  
Vitro's Leadership

A  
**KM2**  
PUBLICATION

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LARGEST CIRCULATION OF ANY GLASS MAGAZINE

# Great



#1

The façade of Norfolk Southern's headquarters in Midtown Atlanta's Tech Square consists of Harmon UCW8000 curtainwall with horizontal and vertical brite-dipped anodized tubes. Pickard Chilton is the design architect and HKS is the architect of record.

**B**y most accounts, 2021 was a solid year for contract glaziers. While there were some decreases, most companies reporting for this year's **USGlass** magazine listing of the Top 50 contract glaziers showed sales increases—and hopefulness about the year ahead. Companies pointed to healthy backlogs, renewed market confidence and economic recovery, along with a hopeful end to the pandemic as reasons for optimism this year.

Despite the positives, companies still have some concerns. Not surprisingly, labor and supply chain issues topped the list of what had them worried about 2022. And for everyone optimistic that the worst of COVID is over, someone else is concerned about mandates, new variants and the overall health and well-being of their employees.

While there was some fluctuation

among the top five companies, there was also a new addition. Elicc Americas jumped to No. 5 from No. 15 on last year's list, with sales increasing from \$83 million to \$221.5 million. Also making a move, Permasteelisa stepped up to No. 2 from No. 3 with sales going from \$253 million to \$295.5 million. Harmon remained in the No. 1 position. The company's sales rose to \$340.8 million from \$286.4 million last year. Enclos dropped from No. 2 to No. 3, while Walters & Wolf remained in the No. 4 spot.

There were also some fluctuations in sales across the entire list. Massey's Plate Glass dropped from No. 10 to No. 13, with sales slipping from \$115 million to \$101 million. Ventana made a big move from No. 19 to No. 15, with sales increasing from \$65 million to \$95 million. And while Egan Co. saw a sales

increase from \$48.5 million to \$56.1 million, its spot on the list dropped a couple places from No. 28 to No. 30.

Another interesting addition, four of the top 20 companies this year are based in Ontario: Flynn Companies, No. 11; Gamma Windows and Wall, No. 14; The Architectural Glass Group (TAGG), No. 16; and Integro Building Systems, No. 20.

The information in this section was provided to **USGlass** by the companies included here. Combined annual sales listed include volume for both commercial and residential work only. A comparison of 2020 vs. 2021 is included for those companies that supplied their data both years. Backlog from 2020 to 2021 is listed only when provided by the companies.

Those companies marked with an \* are estimated based on data and field reports from Key Media & Research.

# Expectations

This Year's Top 50 Contract Glaziers Look Optimistically to the Year Ahead

1

## Harmon Inc.

**Bloomington, Minn.**  
[www.harmoninc.com](http://www.harmoninc.com)  
 President/CEO: Troy Johnson  
 Years in Business: 65  
 Number of Locations: 18  
 Number of Employees: 650  
 2021 Sales: \$340.8 million; 2020: \$286.4 million  
 % Commercial: 82.70%  
 % Residential: 3.20%  
 % Percent Other: 14.1%  
 Backlog change: Decreased by 8%

2

## Permasteelisa NA

**Mendota Heights, Minn.**  
[www.permasteelisagroup.com/america](http://www.permasteelisagroup.com/america)  
 President/CEO: Mike Kneeland  
 Years in Business: 24  
 Number of Locations: 5  
 Number of Employees: 499  
 2021 Sales: \$295.5 million; 2020: \$253 million  
 % Commercial: 68%  
 % Residential: 5%  
 % Percent Other: 27%  
 Backlog change: Increased by 25%

3

## Enclos Corp.\*

**St. Louis, Mo.**  
[www.enclos.com](http://www.enclos.com)  
 President/CEO: Steve Danke  
 Years in Business: 76  
 Number of Locations: 15  
 Number of Employees: 400  
 2021 Sales: \$280 million  
 Commercial: 100%

#5



**Elicc** was responsible for the façade installation of 9 Dekalb Ave. in Brooklyn, N.Y., a 73-story super-tall structure rising 1,066-feet.

4

## Walters & Wolf\*

**Fremont, Calif.**  
[www.waltersandwolf.com](http://www.waltersandwolf.com)  
 President/CEO: Randy Wolf  
 Years in Business: 43  
 2021 Sales: \$250 million  
 Commercial: 100%

5

## Elicc Americas Corp.

**Poway, Calif.**  
[www.eliccgroupp.com](http://www.eliccgroupp.com)  
 President/CEO: Yizeng Li  
 Years in Business: 7

## Top 20 Total Annual Sales

(In Billions of Dollars)

2011	\$1.2
2012	\$1.5
2013	\$1.5
2014	\$2.0
2015	\$2.5
2016	\$3.0
2017	\$2.8
2018	\$3.1
2019	\$3.2
2020	\$2.9
2021	\$3.3

Average backlog change: 15%

## Top 40 Total Annual Sales

(In Billions of Dollars)

2011	\$1.5
2012	\$1.8
2013	\$1.9
2014	\$2.3
2015	\$3.0
2016	\$3.4
2017	\$3.6
2018	\$4.0
2019	\$4.2
2020	\$3.9
2021	\$4.5

Average backlog change: 12%

# Top 50 Contract Glaziers

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#6



Photo: W&W Glass LLC

#9

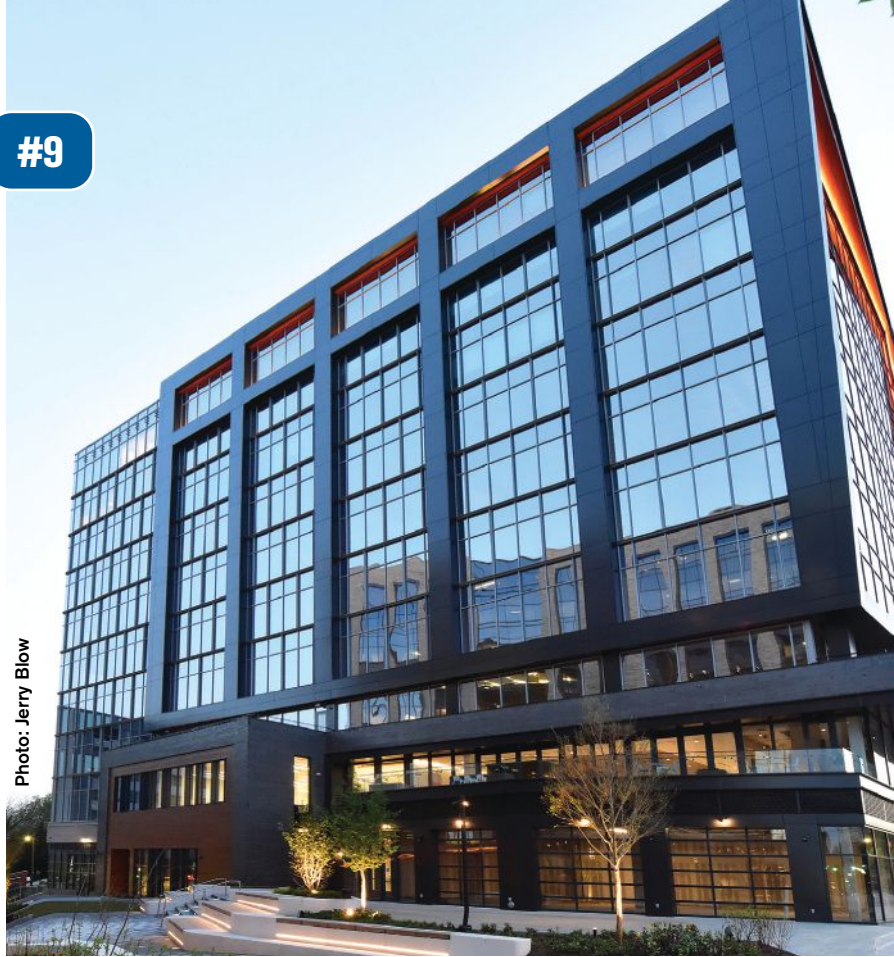


Photo: Jerry Blow

(left) Designed by Diller Scofidio + Renfro, W&W was responsible for the glazing installation at the Columbia Business School in New York. (Above) Binswanger Glass installed the exterior glazing systems for Tower II at Bloc[83] in Raleigh, N.C.

Number of Locations: 2  
Number of Employees: 132  
2021 Sales: \$221.5 million; 2020:  
\$83 million  
% Commercial: 100%  
Backlog change: Increased by 50%

6

## W&W Glass, LLC

Nanuet, N.Y.  
[www.wwglass.com](http://www.wwglass.com)  
President/CEO: Mike, Jeff, Scott,  
Howard Haber  
Years in Business: 43  
Number of Locations: 1  
Number of Employees: 200  
2021 Sales: \$215 million; 2020:  
\$200 million  
% Commercial: 100%  
Backlog change: Decreased by 20%

7

## Benson Industries

Portland, Ore.  
[www.bensonglobal.com](http://www.bensonglobal.com)  
President/CEO: Lance Howard  
Years in Business: 96  
Number of Locations: 9  
Number of Employees: 500  
2021 Sales: \$200+million; 2020:  
\$225 million  
Commercial: 100%  
Backlog change: Decreased by 5%

8

## Crown Corr Inc.

Gary, Ind.  
[www.crowncorr.com](http://www.crowncorr.com)  
President/CEO: Dennis Pilkington  
Years in Business: 61  
Number of Locations: 6

Number of Employees: 595  
2021 Sales: \$178 million (glass only);  
2020: \$170.7 million  
% Commercial: 100%  
Backlog change: 0%

9

## Binswanger Glass

Memphis, Tenn.  
[www.binswangerglass.com](http://www.binswangerglass.com)  
President/CEO: Mark Newsome  
Years in Business: 150  
Number of Locations: 56  
Number of Employees: 800  
Locations Closed in '21: 1  
2021 Sales: \$166 million; 2020:  
\$160 million  
% Commercial: 70%  
% Residential: 30%



Photo: Massey's Plate Glass

#13

Massey's Plate Glass completed the glass and glazing installation for the Seaport District of Boston project in 2021.

## 2021-2022 Top 5 Changes

### 2020

1. Harmon

2. Enclos

3. Permasteelisa  
North America

4. Walters & Wolf

5. Benson Industries

### 2021

Harmon

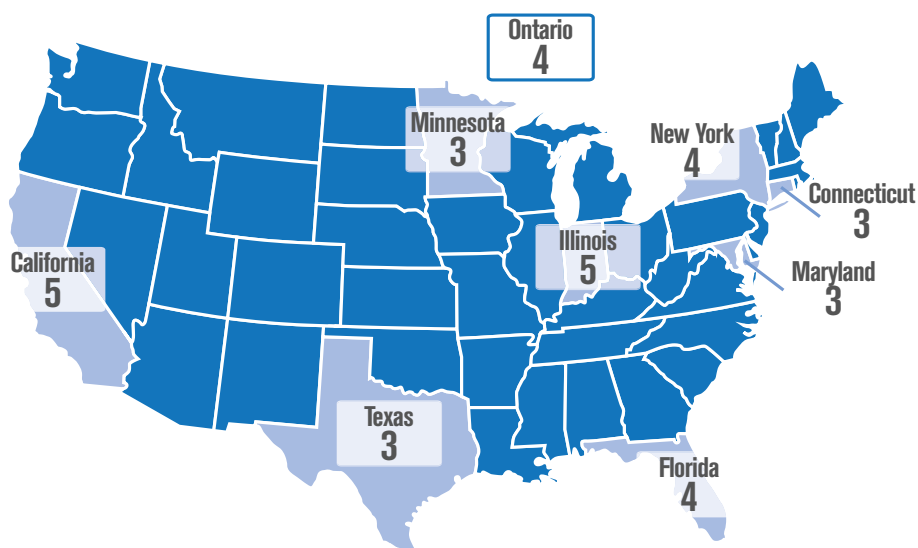
Permasteelisa  
North America

Enclos

Walters & Wolf

Elicc America

## Locations with the Highest Concentration of Top Contract Glaziers



10

### Flynn Group of Companies

Toronto, Ontario

[www.flynncompanies.com](http://www.flynncompanies.com)

President/CEO: Doug Flynn

Years in business: 43

Number of locations: 31

Number of employees: 6,000

2021 gross sales: \$154.9 million  
(glazing only)

% Commercial: 100

11

### Architectural Glass & Aluminum\*

Livermore, Calif.

[www.aga-ca.com](http://www.aga-ca.com)

President/CEO: John Buckley

Years in Business: 50

Number of Locations: 4

Number of Employees: 250

2021: \$150 million

Commercial: 76%

Residential: 24%

12

### Karas & Karas Glass Co.

South Boston, MA

[www.karasglass.com](http://www.karasglass.com)

President/CEO: Joseph Karas

Years in Business: 98

Number of Locations: 1

Number of Employees: 140

2021 Sales: \$112 million; 2020:

\$114 million

Commercial: 70%

Residential: 30%

13

### Massey's Plate Glass

Branford, Conn.

[www.masseysglass.com](http://www.masseysglass.com)

President/CEO: Bob Massey Jr.

Years in Business: 49

Number of Locations: 3

Number of Employees: 200

2021 Sales: \$101 million; 2020:

\$115 million

% Commercial: 100%

Backlog change: Decreased by 10%

14

### Gamma Windows and Wall Inc.\*

Concord, Ontario

[www.gammana.com](http://www.gammana.com)

President/CEO: William Yu

Years in Business: 53

Number of Locations: 7

Number of Employees: 325

2021: \$100 million

Commercial: 20%

Residential: 70%

Other: 20%

# Top 50 Contract Glaziers

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#23

#15

Photo: Ventana

Photo: Nic Lehoux



Ventana fabricated and installed its glazing systems for the One Chicago Square project in Chicago, designed by Hartshorne Plunkard Architecture.

15

## Ventana DBS LLC

Chicago, Ill.

[www.ventana.vc](http://www.ventana.vc)

President/CEO: Robert Trainor

Years in Business: 9

Number of Locations: 3

Number of Employees: 30

2021 Sales: \$95 million; 2020: \$65 million

Commercial: 77%

Residential: 23%

16

## TAGG Group of Companies

Mississauga, Ontario

[www.taggind.com](http://www.taggind.com)

President/CEO: Stephen Dulong

Years in Business: 35

Number of Locations: 4

Number of Employees: 250

2021 Sales: \$90 million

% Commercial: 100%

Backlog change: Increased by 14%

17

## NR Group

West Palm Beach, Fla.

[www.nrwindows.com](http://www.nrwindows.com)

President/CEO: Ali Shamshad

Years in Business: 32

Number of Locations: 2

Number of Employees: 120

2021 Sales: \$90 million

% Commercial: 80%

% Percent Other: 20%

Backlog change: Increased by 5%

18

## Dynamic Glass LLC

Houston, Texas

[www.dynamicglass.com](http://www.dynamicglass.com)

President/CEO: Rick Cieslewicz

Years in Business: 31

Number of Locations: 4

Number of Employees: 365

Locations Opened in '21: 1

2021 Sales: \$87 million; 2020: \$75 million

% Commercial: 100%

Backlog change: Increased by 58%



Neilson Library at Smith College in Northampton, Mass., features a timber-framed curved insulating glass curtainwall installed by Roschmann Steel & Glass.

## 19

### Pioneer Cladding and Glazing Systems Inc.

Mason, Ohio

[www.pioneerglazing.com](http://www.pioneerglazing.com)

President/CEO: Tom Heinold

Years in Business: 22

Number of Locations: 6

Number of Employees: 310

2021 Sales: \$83 million; 2020: \$70 million

% Commercial: 95%

% Percent Other: 5%

Backlog change: Increased by 5%

## 20

### Integro Building Systems\*

Toronto, Ontario

[www.integrobuild.com](http://www.integrobuild.com)

President/CEO: Christopher Liberta

Years in Business: 6

## Top 5 Companies by Number of Locations

Binswanger	56
Harmon	18
Enclos	15*
Granite State Glass	15
Benson	9
Gamma Windows and Wall	7*

\*Based on 2021 estimates

Number of Locations: 2  
Number of Employees: 150  
2020: \$80 million  
Commercial: 100%

## 21

### TSI Corporations

Upper Marlboro, Md.

[www.tsicorporations.com](http://www.tsicorporations.com)

President/CEO: Thomas Cornellier

Years in Business: 45

Number of Locations: 1

Number of Employees: 140

2021 Sales: \$75.4 million; 2020: \$63 million

% Commercial: 30%

% Residential: 60%

% Percent Other: 10%

Backlog change: Decreased by 10%

## 22

### Giroux Glass Inc.

Los Angeles, Calif.

[www.girouxglass.com](http://www.girouxglass.com)

President/CEO: Nataline Lomedico

Years in Business: 75

Number of Locations: 6

Number of Employees: 277

Locations Opened in '21: 2

2021 Sales: \$75.2 million; 2020: \$63 million

% Commercial: 97%

% Residential: 3%

Backlog change: Decreased by 35%

## Top 5 Companies by Number of Employees

Binswanger	800
Harmon	650
Crown Corr	595
Benson	500
Permasteelisa	499

## 23

### Roschmann Steel & Glass Constructions Inc.

New Haven, Conn.

<https://roschmann.group/en/>

President/CEO: Tamas Katona

Years in Business: 70

Number of Locations: 4

Number of Employees: 300

2021 Sales: \$68.5 million; 2020: \$61.4 million

% Commercial: 90%

% Residential: 10%

Backlog change: Increased by 20%

## 24

### GM&P Consulting and Glazing Contractors Inc.

Miami, Fla.

[www.gmpglazing.com](http://www.gmpglazing.com)

President/CEO: Giovanni Monti

Years in Business: 12

Number of Locations: 3

Number of Employees: 67

2021 Sales: \$65 million; 2020: \$89 million

Commercial: 100%

## 25

### Cherry Hill Glass Co. Inc

Branford, Conn.

[www.cherryhillglass.com](http://www.cherryhillglass.com)

President/CEO: Kevin O'Neill

# Top 50 Contract Glaziers

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#31

Photo: Chris Shin, EGA



#30

Photo: Egan Company



**For the mixed use MXD Gateway, a 37-story tower in downtown Minneapolis, Egan's InterClad team installed a variety of curtainwall products, doors, glass railings and more.**

Years in Business: 31  
Number of Locations: 1  
Number of Employees: 180  
2021 Sales: \$61 million; 2020: \$61 million  
% Commercial: 90%  
% Residential: 10%  
Backlog change: Decreased by 5%

26

## Kovach Enclosure Systems

Chandler, Ariz.  
[www.kovach.net](http://www.kovach.net)  
President/CEO: Scott Bourdo  
Years in Business: 53  
Number of Locations: 4

**Eastern Glass and Aluminum installed exterior façade products as well as interior glazing products for the Ascent Peachtree Apartments in Atlanta.**

Number of Employees: 260  
2021 Sales: \$60 million; 2020: \$60 million  
Commercial: 100%

27

## Best Contracting\*

Gardena, Calif.  
[www.bestcontracting.com](http://www.bestcontracting.com)  
President/CEO: Sean Taba  
Number of Locations: 2  
Number of Employees: 300+  
2021 Sales: \$60 million

28

## Reflection Window + Wall LLC\*

Chicago, Ill.  
[www.reflectionwindow.com](http://www.reflectionwindow.com)  
President/CEO:  
2021 Sales: \$60 million



The Duda Paine-designed 301 Hillsborough St. project in Raleigh, N.C., which has no flat vertical walls, was a unique installation for SPS Corp.

## 29

### Alliance Glazing Technologies\*

Romeoville, Ill.  
[www.allianceglazing.com](http://www.allianceglazing.com)  
 President: Brian Filipiak  
 Years in Business: 29  
 2021 Sales: \$60 million  
 Commercial: 100%

## 30

### Egan Company/InterClad

Champlin, Minn.  
[www.eganco.com](http://www.eganco.com)  
 President/CEO: James Ford  
 Years in Business: 24  
 Number of Locations: 1  
 Number of Employees: 75  
 2021 Sales: \$56.1 million; 2020:

\$48.5 million  
 % Commercial: 70%  
 % Residential: 15%  
 % Percent Other: 15%  
 Backlog change: Decreased by 45%

## 31

### Eastern Glass and Aluminum

Norcross, Ga.  
[www.buildega.com/ega/](http://www.buildega.com/ega/)  
 President/CEO: Peter Kim  
 Years in Business: 26  
 Number of Locations: 3  
 Number of Employees: 135  
 2021 Sales: \$55.7 million; 2020: \$47.6 million  
 % Commercial: 100%  
 Backlog change: Increased by 17%

## 32

### Momentum Glass

Spring, Texas  
[www.momentum-glass.com](http://www.momentum-glass.com)  
 President/CEO: Omar Maalouf  
 Years in Business: 11  
 Number of Locations: 5  
 Number of Employees: 170  
 Locations Opened in '21: 2  
 2021 Sales: \$54 million  
 % Commercial: 90%  
 % Percent Other: 10%  
 Backlog change: Increased by 20%

## 33

### SPS Corp.

Apex, N.C.  
[www.spscopy.com](http://www.spscopy.com)  
 President/CEO: Michael J. Russo  
 Years in Business: 40  
 Number of Locations: 2  
 Number of Employees: 85  
 2021 Sales: \$52.5 million; 2020: \$51 million  
 % Commercial: 90%  
 % Residential: 10%  
 Backlog change: Increased by 3%

## 34

### Above All Storefronts Inc.

Hauppauge, N.Y.  
[www.aboveallstorefronts.com](http://www.aboveallstorefronts.com)  
 President/CEO: John Cashel  
 Years in Business: 29  
 Number of Locations: 2  
 Number of Employees: 185  
 Locations Opened in '21: 1  
 2021 Sales: \$51 million; 2020: \$45 million  
 % Commercial: 100%  
 Backlog change: Increased by 30%

## 35

### RankerAMG Inc.

Sacramento, Calif.  
[www.rankeramg.com](http://www.rankeramg.com)  
 President/CEO: Dave Ranker  
 Years in Business: 16  
 Number of Locations: 2  
 Number of Employees: 142

#41



Photo: Corey Gaffer

For the 11-story, 370,000 square-foot City of Minneapolis Public Service Building, Architectural Wall Systems installed a sleek, glass and metal panel curtainwall system for floors three through 11, with double-height, all-glass areas at the interior staircases.

2021 Sales: \$48.6 million; 2020: \$45.56 million.  
Commercial: 100%

36

## All Glass & Windows LLC

Sarasota, Fla.  
[www.allglasswindows.com](http://www.allglasswindows.com)  
President/CEO: David Fleeman  
Years in Business: 11  
Number of Locations: 1  
Number of Employees: 108  
2021 Sales: \$45 million  
% Commercial: 14%  
% Residential: 86%  
Backlog change: Increased by 58%

37

## Synergi LLC

Elkridge, Md.  
[www.synergillc.com](http://www.synergillc.com)  
President/CEO: Jim Admiraal  
Years in Business: 36  
Number of Locations: 4

Number of Employees: 80  
Locations Opened in '21: 2  
2021 Sales: \$45 million  
% Commercial: 100%  
Backlog change: Increased by 50%

38

## Granite State Glass

Gilford, N.H.  
[www.granitestateglass.com](http://www.granitestateglass.com)  
President/CEO: William Marcotte  
Years in Business: 39  
Number of Locations: 15  
Number of Employees: 235  
2021 Sales: \$43 million; \$40 million  
% Commercial: 35%  
% Residential: 50%  
% Percent Other: 15%  
Backlog change: Decreased by 10%

39

## C/S Erectors Inc

San Ramon, Calif.  
President/CEO: Mike Carvin

Years in Business: 35  
Number of Locations: 1  
Number of Employees: 64  
2021 Sales: \$42 million; 2020: \$42 million  
% Commercial: 100%  
Backlog change: Decreased by 10%

40

## Ranger Specialized Glass Inc.

Houston, Texas  
[www.rangerglass.com](http://www.rangerglass.com)  
President/CEO: Robert Malone  
Years in Business: 38  
Number of Locations: 3  
Number of Employees: 145  
2021 Sales: \$41 million; 2020: \$34 million  
Commercial: 100%

41

## Architectural Wall Systems LLC

Des Moines, Iowa  
[www.archwall.com](http://www.archwall.com)



Photo: Glass Solutions Inc.

The recladding of the Amway Grand Plaza was the first reverse set (top down) unitized curtainwall project for Glass Solutions Inc. The company installed 95,000 square feet of its UCW3400 series exterior unitized curtainwall framing.

President/CEO: Adam Boeckmann  
 Years in Business: 31  
 Number of Locations: 2  
 Number of Employees: 90  
 2021 Sales: \$40.1 million; 2020: \$49.9 million  
 % Commercial: 100%  
 Backlog change: Decreased by 19%

42

**Glass Solutions Inc.**

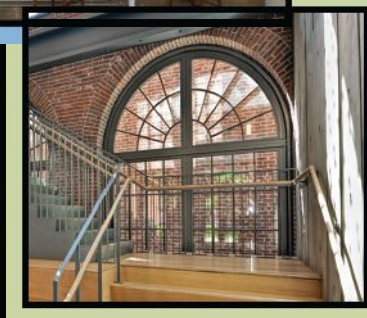
Itasca, Ill.

[www.gsichicago.com](http://www.gsichicago.com)

President/CEO: Andrew Hill



# Historic Integrity



**st. cloud window**

[stcloudwindow.com](http://stcloudwindow.com)

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# Top 50 Contract Glaziers

continued from page 47

Years in Business: 22  
Number of Locations: 1  
Number of Employees: 100  
2021 Sales: \$37 million; 2020: \$43 million  
% Commercial: 100%  
Backlog change: Decreased by 11%

**43**

## Ajay Glass Co.

**Canandaigua, N.Y.**

**www.ajayglass.net**

President/CEO: Steve Stathopoulos;  
President: Demetrios Stathopoulos,  
CEO

Years in Business: 63  
Number of Locations: 3  
Number of Employees: 145  
2021 Sales: \$ 33.4 million; 2020:  
\$38.3 million  
Commercial: 100%

**44**

## ACME Glass

**Orlando, Fla.**

**www.acmeglassorlando.com**

President/CEO: Walter Basso, Jr.  
Years in Business: 114  
Number of Locations: 3  
Number of Employees: 168  
2021 Sales: \$31.2 million; 2020: \$31 million  
% Commercial: 85%  
% Residential: 10%  
% Percent Other: 5%  
Backlog change: Increased by 40%

**45**

## Kensington Glass Arts

**Ijamsville, Md.**

**www.kensingtonglass.com**

President/CEO: John Reichlin  
Years in Business: 46  
Number of Locations: 5  
Number of Employees: 250  
Locations Opened in '21: 2  
2021 Sales: \$31 million; 2020: \$49 million  
% Commercial: 98%  
% Residential: 1%

% Percent Other: 1%  
Backlog change: Increased by 2%

**46**

## Alexander Metals Inc.

**Nashville, Tenn.**

**www.alexandermetalsinc.com**

President/CEO: Alec T Estes  
Years in Business: 30  
Number of Locations: 1  
Number of Employees: 100  
2021 Sales: \$26 million; 2020:  
\$35 million  
% Commercial: 100%  
Backlog change: Increased by 30%

**47**

## seele Inc.

**Long Island City, N.Y.**

**www.seele.com**

President/CEO: Andreas Hafner  
Years in Business: 21  
Number of Locations: 1  
Number of Employees: 25  
2021 Sales: \$23.5 million; 2020:  
\$23 million  
% Commercial: 90%  
% Residential: 10%  
Backlog change: Increased by 20%

**48**

## National Enclosure Company LLC

**Ypsilanti, Mich.**

**www.nationalenclosure.com**

President/CEO: David Sauld  
Years in Business: 13  
Number of Locations: 3  
Number of Employees: 80  
2021 Sales: \$23.2 million; 2020:  
\$34.2 million  
% Commercial: 100%  
Backlog change: Increased by 60%

**49**

## Metropolitan Glass Inc.

**Denver, CO**

**www.metroglass.com**

President/CEO: Sean Moore

**#47**



seele was responsible for the glazing installation of the 33rd Street Penn Station entrance, which features both flat and curved glass, in New York City.

Years in Business: 59  
Number of Locations: 1  
Number of Employees: 85  
2021 Sales: \$22.5 million; 2020:  
\$23.5 million  
Commercial: 95%  
Other: 5%  
Backlog change: Decreased by 5%

**50**

## 8G Solutions

**Riverside, Mo.**

**www.8g-solutions.com**

President/CEO: Chuck Mowrey  
Years in Business: 37  
Number of Locations: 3  
Number of Employees: 101  
Locations Opened in '21: 2  
2021 Sales: \$20 million  
% Commercial: 100%  
Backlog change: Increased by 5%

**USG**



## THE VIEW

by Nataline Lomedico

# Follow the Curves

## Considerations for Bent Glass Installations

**F**rom an architectural perspective, bent glass applications have a stunning visual impact, adding dynamism, flow, and captivating lines to the constructions in which they appear. From a glazing standpoint, bent glass requires special considerations in manufacturing and installation to ensure the design is executed as planned.

### Material Considerations

Bent glass is more expensive to produce than standardized glass units due to the amount of labor required. Prior to production, the radius and other dimensions of the curved installation must be laid out to correspond with on-site references or control points. All parties involved in this stage of preparation must communicate effectively to ensure that the proposed configuration is as accurate as possible, and to minimize any wasted time or material.

Fabrication involves its own set of detailed processes, and additional costs may be incurred at every stage. Due to its custom curvature, bent glass may require multiple rounds of fabrication to achieve the radial dimensions required for the project's design. The bending process may also warp or damage the surface of the glass, causing optical distortions on the finished product that may require re-fabrication. Depending on the size or composition of the bent glass, the product may have to be sourced overseas. Foreign products require longer lead times overall, which may be further compounded if any of the glass arrives damaged, or in the incorrect configuration.

If the bent glass does not arrive in time, contract glaziers typically work with the general contractor and project owner to determine an effective substitute material. To prevent any po-

tential schedule delays, we recommend the use of acrylic, epoxy, or polycarbonate as temporary substitutes. These can be manufactured to custom radii more efficiently than glass. These temporary substitutions can be manufactured to the exact dimensions and design of the bent glass components, and provide a suitable temporary stand-in, or in some instances, permanent alternative to the bent glass in the projects.

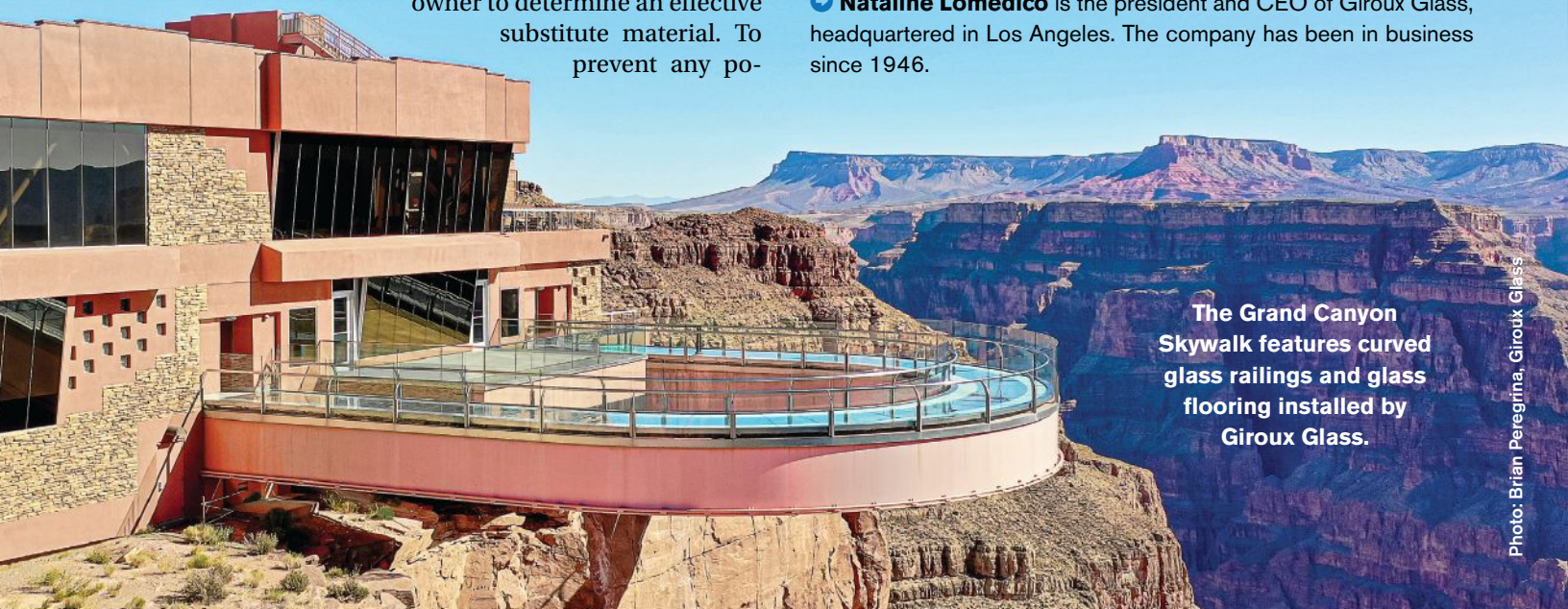
### Installation

Installation of bent glass presents its own unique set of considerations. Transporting curved pieces to the worksite requires larger crating and hoisting equipment than standard flat glass. Coordination with other trades is also essential, especially if another subcontractor will be interacting with the bent glass in their work. Finally, we execute the installation with extreme caution, as there is less, and sometimes no room for error based on the glass radius, compound bend, or bite when matching a radius frame. The less we need to adjust the glass into position, the better, as bent glass frames contain fewer removable stops to guide the pieces into place.

### Rewards

Bent glass applications can be used to expand the form and function of a space, provide wider and more scenic viewing experiences, and add visual interest to facades and interiors alike. When it comes down to it, bent glass expands the possibilities of design through glass, and makes the world—and our work—more interesting as a result. **USG**

➔ **Nataline Lomedico** is the president and CEO of Giroux Glass, headquartered in Los Angeles. The company has been in business since 1946.



The Grand Canyon Skywalk features curved glass railings and glass flooring installed by Giroux Glass.