Vitro®
Architectural Glass

Bird Vetted & Approved

The *BirdSmart*® Bird Safe Glass Story:
Best Practices for Testing and Evaluating
Bird Safe Glass Technology

Introduction

Promoting daylighting, views, occupant well-being, energy efficiency and decreased carbon in buildings, glass is a wonderful building material.

At the same time, typical glass facades are not friendly to bird wildlife. In North America, as many as 1 billion birds are killed every year flying into windows.

Fortunately, this is a solvable environmental issue with the development of bird safe glass technologies.

With any new product, it's very important to properly evaluate and test performance, not only for bird deterrence, but also to ensure the essential quality of the glass is not diminished by the addition of bird safe technology. Most product categories fall into an established set of standards and requirements; however as a newer technology, standardized guidelines for bird safe glass quality are still under development.

While Vitro is letting the wildlife experts handle bird deterrence, it has leveraged its expertise in glass product development and testing to develop its own rigid protocol of testing standards for its latest bird-safe product *BirdSmart*® glass.

The following white paper provides insights into bird-safe glass; related legislation, codes and standards; glass technology solutions, and how to conduct a rigorous bird safe glass testing process.

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A Little History

The occurrence of birds crashing into glass is not new. In fact, scientists and environmentalists have been studying this phenomenon for decades.

As compared to humans who have strong binocular vision which enhances depth perception, a bird's anatomy provides more spatial vision, enabling them to constantly scan their surroundings in search of food and places to land.

Whereas human eyesight clearly detects the presence of glass, birds cannot perceive glass as a barrier.

Unlike people, many bird species see ultraviolet light. Consequently, these UV rays, which are absorbed by most transparent and reflective glass, make the glass appear invisible to birds. For instance, a bird could see an indoor habitat like plants or wood elements and attempt to fly towards them, with no awareness that a glass façade or window is standing in the way.

Another issue is the fact that glass reflects the sky and surrounding trees. Birds confuse these illusions as reality and attempt to reach these destinations, again not seeing glass as a barrier.

Bird-Safe Legislation and Building Codes

As awareness of bird collisions has grown, at least 25 cities and states have enacted legislation requiring bird safe glass in buildings.

Toronto was the first, followed by New York City, currently the largest bird safe glass market. Examples of other cities with bird-friendly glass requirements include Madison, Wisconsin, Washington, D.C., Portland, Oregon and several cities in California.

On the state level, Minnesota, Michigan, Wisconsin, Virginia, Maryland and Maine have legislation in place for government buildings. The Canadian provinces of Ontario, Alberta and British Columbia also have passed legislation that applies to all buildings.

On the national level, the Federal Bird Safe Buildings Act could potentially mandate bird-friendly practices in federal buildings.

In addition, a number of sustainable building rating programs award credits for bird-friendly designs. For example, in the U.S. Green Building Council's latest LEED® v5, projects can earn a credit for the specification of bird friendly glass in the Sustainable Sites Biodiverse Habitat category.

Driven by code requirements, green building programs and voluntary bird-safe standards, the frequency of building owners asking architects to specify bird-safe glass for their projects is growing.

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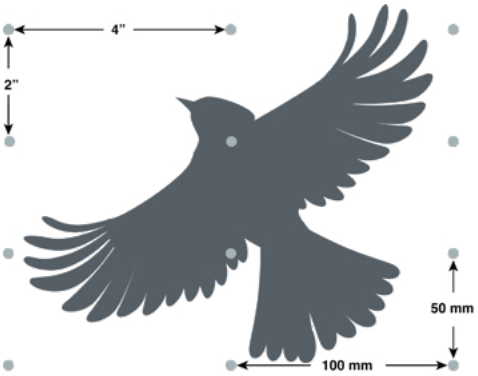
How Bird-Safe Glass Prevents Collisions

Bird-safe glass generally works by placing patterns carefully spaced on the glass to break up the optical illusion of open space and the continuous transparency of glass thereby enabling the birds to detect its presence.

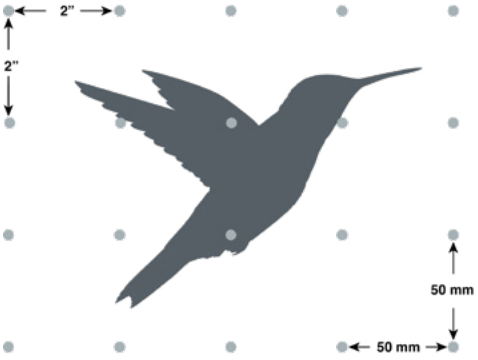
To create these patterns, etched glass is a popular solution.

To transform panes of glass into a surface perceived by birds, a maximum spacing of 2"x4" dots or patterns are etched into the glass. That is two inches horizontally in rows or 4 inches vertically in columns. The pattern is best seen when applied to Surface #1, otherwise the color and reflection of the glass can weaken the bird deterrence.

The 2x4 rule was originally established to cover any gaps small enough for the birds to attempt to fly through. But to protect smaller birds, such as hummingbirds, 2"x2" patterning has now been accepted as best practice. This is the requirement in Toronto.

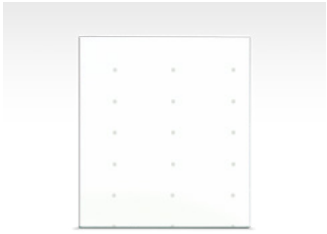


2"x4" Marking Pattern

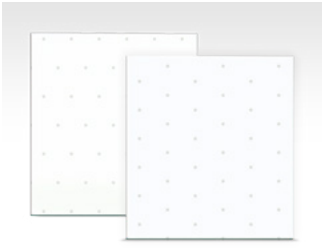


2"x2" Marking Pattern

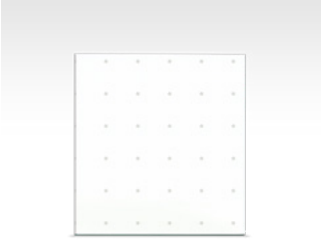
BirdSmart® Speck 6 Shift 2x4



BirdSmart® Speck 6 Inline 2x4



BirdSmart® Speck 6 Shift 2x2



BirdSmart® Speck 6 Inline 2x2

Types of Bird Safe Glass

There are several effective glazing solutions architects and designers can incorporate to deter birds and prevent future collisions.

Laser-Etched Bird Safe Glass

Laser-etched glass like *BirdSmart*® Bird Safe Glass by Vitro applies the markers on the first surface. The laser etching process is non-caustic and uses no harsh chemicals.

Unlike acid etching, which is performed in select plants, the laser-etching process can be done anywhere. Vitro laser etches glass in the same facility where the glass is produced and coated, making the laser etched bird-glass manufacturing process streamlined and efficient.

When laser etched glass is paired with low-e glass on the second surface it does not have any impact on the glass' solar heat gain or visible light transmittance (VLT). In fact, by combining *BirdSmart*® Bird Safe Glass with Vitro's family of *Solarban*® solar control low-e glass products in an IGU, architects can improve visibility for birds and achieve excellent solar performance for building owners. In addition, laser etching the exterior lite does not impact the strength, durability or cleanability of the glass as proven by rigorous testing.

Acid-Etched Bird Safe Glass

Acid-etched glass like *AviProtek*® E bird safe low-e glass by Walker Glass in partnership with Vitro is available in a variety of patterns. *AviProtek*® E glass has etched visual markers on the first surface of an insulating glass unit (IGU) with a *Solarban*® solar control low-e coating on the second surface. This configuration optimizes energy performance as opposed to ceramic frit bird-safe glass, which relegates the low-e coating to the third surface where solar performance levels are lower. Similar to laser etched glass, acid etched glass does not impact the glass' solar heat gain or VLT.

UV-Coated Laminated Glass

One other bird-friendly strategy is UV-coated laminated glass. Tuning in to birds' UV vision, laminated glass is visible to many bird species but is less perceptible to humans. While many birds can see UV rays, not all species do, making this option potentially less effective than etched glass, particularly at certain times of day.

Product: *BirdSmart*® Bird Safe Glass + *Solarban*® 65 Glass
Location: Pittsburgh, PA — USA
Photographer: Scott Witalis

The National Aviary — Wetlands
Products: *Starphire Ultra-Clear*® Glass, *AviProtek*® Pattern 214 Glass by Walker Glass
Location: Pittsburgh, PA — USA
Architect: Montgomery Smith
Glass Fabricator: Isoclima Specialty Glass
Photographer: Jim Cunningham

The Importance of Rigorous Testing

As a fairly new product category, the industry has yet to develop a comprehensive set of standards for testing bird safe glass performance and durability.

Regardless, when introducing a new product to the market, the value of due diligence through rigorous testing cannot be understated. Consequently, it behooves glass manufacturers to thoroughly vet key characteristics of bird-safe glass before bringing the product to the market. This includes a variety of experts scrutinizing and reviewing the product, in addition to the testing process.

Glass Testing Best Practices

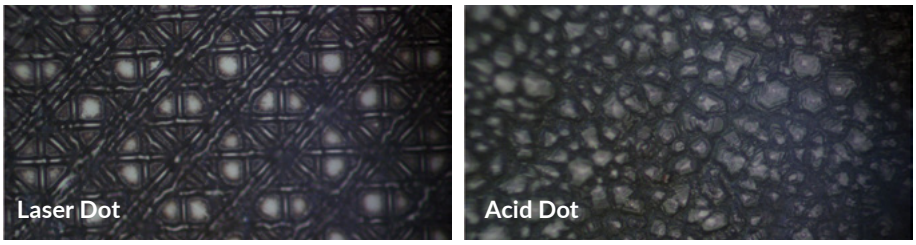
Applying knowledge of current and potential bird-safe glass-related ASTM standards, Vitro's team of experts mapped out what it expects will eventually be the industry-required battery tests for bird safe performance. *BirdSmart*® Bird Safe Glass was then rigorously tested in the following five categories: Gloss, Taber Abrasion, Stain, Strength and Weathering.

Gloss

Measuring the level of shine on the surface of the etched area, the gloss was measured at a 60-degree angle per American Bird Conservancy (ABC) industry standard tunnel testing requirements.

Measuring the level of gloss of the dots gives a good indication of how easily a bird can see them. The ABC associates a threat factor with the gloss measurement that indicates how likely birds are to perceive the dots. The test measures the threat factor of a glass pane from 1 to 100. If the glass is under 30, it passes.

A standard pattern of 6mm laser etched dots on a 2x4 grid on clear glass was submitted to ABC for testing. The glass received a threat factor score of 25 which makes it a bird friendly material for codes where threat factors apply. Additionally, the appearance of the laser etch was noted to be very matte compare with acid etch. This can be attributed to the precision symmetrical etching process that removes the glass from the surface uniformly.



Vitro's laser etch dots are created with a symmetric removal of material from the surface; see micrograph on the left. The resulting etch is very smooth to the touch and creates a matte finish on the glass.

Taber Abrasion

For this ASTM C501 scratch test, two pads of sandpaper were run over the *BirdSmart*® laser-etched dots, and the level of scratching on the glass was observed. In this case, the laser-etched glass performed just as well as clear glass. This is proof that the laser-etched glass can withstand typical exposure and handling on the project site and no extra precautions are needed to prevent scratches.

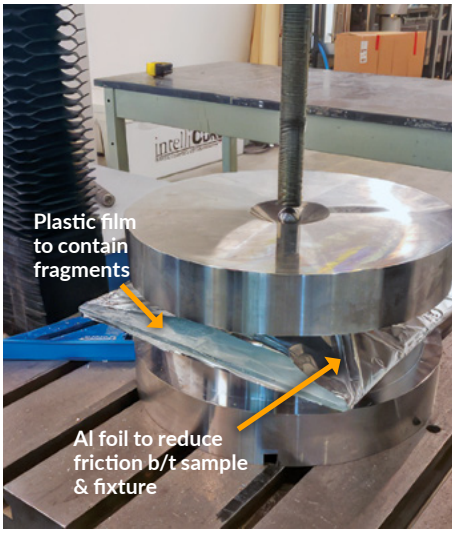
Strength

This widely accepted ASTM C158 test was performed to establish the strength of the laser etched-glass. The test showed that the integrity of the glass was not compromised by the etching.

The pane of glass was pressed from the top and bottom to test the level of force that it can endure before breakage.

A control test for unetched glass was performed as well as laser-etched 2"x 2" dots, the most condensed amount of area with laser-etching on the glass. Per the ASTM requirements, and to record the most accurate representation of performance, the test was performed on 80 samples of glass.

Contradicting the misnomer that the etching might compromise performance, the tests proved otherwise. **The laser etched glass was found to be just as strong as clear glass, essentially proving the etching doesn't compromise the structural integrity and protection against breakage.**



Strength Testing – Ring on ring ASTM C1499

Stain

Per ASTM C1378, this test measures how easily six common stains from environmental contact can be removed from the dots on the bird-safe glass. The staining agents include contrasting grout, black carbon lamp, black waterproof ink, washable ink, potassium permanganate solution, and methylene blue solution.

For this test, the glass sat for 24 hours in the stains. Then, up to four increasingly abrasive methods of cleaning were applied until the stain came off. The four levels are as follows:

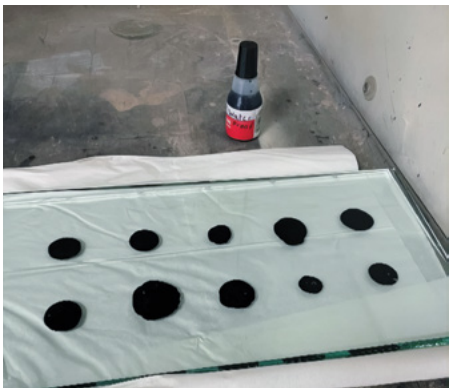
A. Running hot water for 5 minutes, then wiping with a dry cloth.

B. Hand cleaning with a weak cleaning agent using a nonabrasive sponge or cloth, rinsing with running water and wiping with a dry cloth.

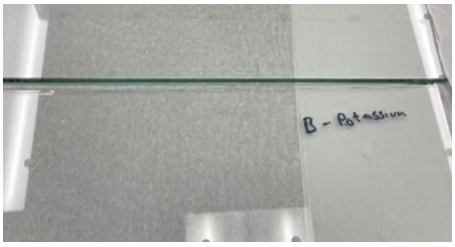
C. Hand cleaning with a strong cleaning agent using a brush with hard bristles for two minutes, then rinsing with running water and wiping with a dry cloth.

D. Immersion in a solvent like Acetone for 24 hours.

In most instances, **the stain on the *BirdSmart*® glass was easily removed with hot water** and wiped clean resulting in an average of a Grade A rating for all the tests and indicating the etched glass is as resistant to stains as clear glass.



Before Stain Test



After Stain Test

Weathering

There is not an established ASTM test for weathering that applies to a first surface etching. However, Vitro has been performing accelerated weather testing on glass for decades. The Vitro tests include both the Cleveland Condensation Chamber test and natural weathering of samples left outside.

The Cleveland Condensation Chamber test exposes the etched side of the glass to high heat and humidity for one week. The color and gloss of the dots were monitored over the week of exposure, and **there was little change to the dots**.

Similarly, the etched glass was subjected to outside weathering—i.e., humidity, heat and freezing—for 36 weeks to predict year-long exposure, and **there was no significant change observed to the dots**.

Both tests were performed for annealed, non-tempered glass, along with acid-etched glass, and the panes were placed at both a 45-degree and 90-degree angle. In all instances, the etched glass was proven to be as resistant to weather conditions as clear glass.

90° F Testing in Progress

Cleveland Condensation Chamber

Moving Forward

As bird preservation and bird-friendly architecture continues to gain traction, architects and building owners will be seeking high quality products and solutions to prevent bird collisions while maintaining the strength and glazing performance characteristics of glass.

The vetting and testing process of *BirdSmart*® glass serves as a valuable resource to the industry for evaluating bird safe glass performance.

For more information on Vitro bird-safe solutions, visit vitroglazings.com/BirdSmart.

vitroglazings.com

1-855-VTRO-GLS (887-6457)

Vitro® Architectural Glass