



BIRD-FRIENDLY GLASS

VIRACON TECH TALK

Glass facades deliver many benefits including daylight, views and dynamic aesthetics. A counterpoint is that birds do not perceive glass as an obstacle to their flight path. This document provides information to balance glass benefits with the adverse impact on birds.

Multiple organizations are involved in researching the ability of birds to perceive glass. The research has shown that adding a pattern can increase a bird's ability to perceive glass, thus reducing the likelihood of a collision. This awareness has led organizations, cities and states to develop bird-safe building guidelines, laws and official standards, such as Standards for Bird-Safe Buildings (San Francisco Planning Department 2011) and Bird-Friendly Building Design (Sheppard and Phillips 2015).

VIRACON'S INVOLVEMENT

As a glass fabricator, Viracon has been actively involved in the on-going research to understand various glass products' potential to reduce bird strikes. To date, our focus has been on finding practical solutions using conventional glass products with applied patterns.

Viracon's printed insulating glass units were tested during the fall 2010 and 2017 bird migration utilizing a tunnel test designed by the American Bird Conservancy (ABC), based on prior tests performed in Austria. The testing was performed at Powdermill Avian Research Center (PARC) in Pennsylvania. PARC is part of Carnegie Museum of Natural History's biological research station, Powdermill Nature Reserve. PARC has an extensive bird banding program, conducts bioacoustical research and evaluates avian perception of glass using the tunnel test designed by ABC.

Viracon is continually updating our product offering and evaluating new products as bird friendly laws and standards are established. Most recently, new standard print patterns have been created to reflect ABC's Prescriptive Rating Options.

THE TUNNEL TEST

Birds are released into one end of a test tunnel (Figure 1). They fly toward the opposite end of the tunnel where there is an opening with a clear control sample and a test sample with a pattern (Figure 2). Birds respond by flying toward the control sample or the test sample as they attempt to exit the tunnel (light netting is installed in front of the glass to prevent collisions with the glass). Researchers record each flight and study the response to score the test sample. The score for the sample is the percentage of birds tested that fly towards the clear glass (American Bird Conservancy 2012).

Product Scoring and Threat Factors

Scores from the ABC tunnel test are utilized by ABC and the U.S. Green Building Council® (USGBC) to assign a threat factor for each tested material. A lower threat factor means that the product deterred more birds in the tunnel test than a product with a higher threat factor.

Threat factors are a key component in comparing bird deterrence products and in achieving the bird collision deterrence Innovation credit in the LEED® for Building Design and Construction rating system. Designing a façade where all materials have a threat factor of 30 or less means the project is exempt from additional calculations. If any material with a threat factor >30 is used, then Bird Collision Threat Rating (BCTR) calculations are required (U.S. Green Building Council 2019).

A current list of product threat factors can be downloaded from USGBC's website: <https://www.usgbc.org/resources/bird-collision-deterrence-summary-threat-factors>



FIGURE 1: TEST TUNNEL EXTERIOR

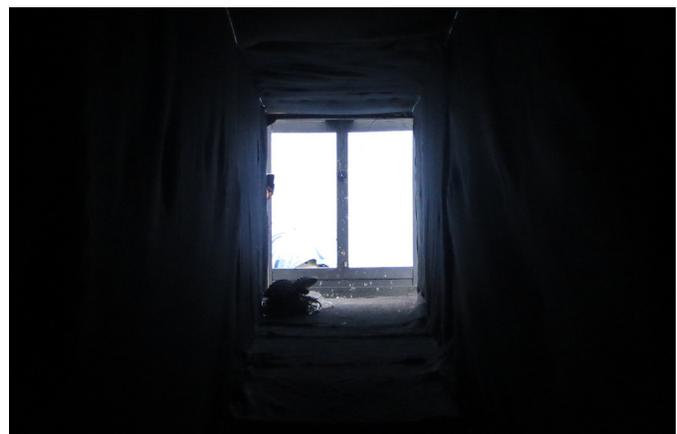
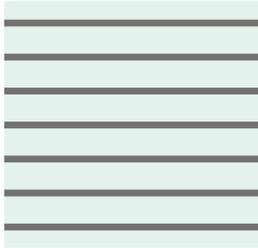


FIGURE 2: TEST TUNNEL INTERIOR

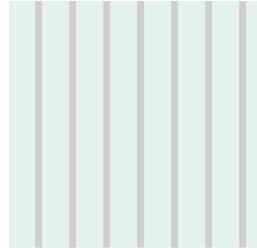
TESTED PRODUCTS

The Viracon patterns tested in 2010 and 2017 were incorporated into 1" insulating units. The outboard glass ply was 1/4" clear glass with a ceramic enamel frit pattern on the second surface, Viracon's VE-2M low emissivity coating applied over the pattern, a 1/2" space and a 1/4" clear glass inboard.



Scenario 1: Threat Factor 6

Color: VBC2109 Dark Gray
Pattern: 1/8" Horizontal Lines
alternating with 1/2" Spaces
(Print #2256), 20% Coverage



Scenario 2: Threat Factor 10

Color: V953 Medium Gray
Pattern: 1/8" Vertical Lines
alternating with 1/2" Spaces
(Print #2256), 20% coverage



Scenario 3: Threat Factor 41

Color: V951 White
Pattern: 1/8" Dots, 1/4" On-Center
(Print #5065), 20% Coverage



Scenario 4: Threat Factor 24

Color: V951 White
Pattern: 1/8" Dots
(Print #5006), 40% Coverage

Alternate Products

In addition to testing glass with Viracon's ceramic enamel, ABC has tested products with alternate methods of creating a pattern such as ultraviolet (UV) reflective coatings. Ultraviolet reflective coatings are intended to be visible to birds because many can see in the ultraviolet spectrum. These coatings are much less visible to the humans, who are not able to perceive UV light.

In tunnel testing and prescriptive evaluations, acid etch on the #1 surface and ceramic frit/ink on the #2 surface achieve the same or better threat factors as compared to the ultraviolet reflective products. UV patterns may also be ineffective for many species that are not able to see UV light such as raptors and pigeons. UV light levels on overcast days and UV glass in shaded areas may make these patterns less visible to birds. Depending on the product and pattern, ultraviolet reflective coatings have a threat factor range of 12-42. (American Bird Conservancy 2023).

UNTESTED PRODUCTS

Bird collision researchers acknowledge that additional product testing will continue to develop our understanding of which patterns are the most effective. At the same time, researchers acknowledge it isn't practical to test every pattern. To address this practicality, researchers have used existing research to develop prescriptive rating guidelines described as 1) 2x2 Rule, 2) 2x4 Rule and 3) Patterns spaced <2". (American Bird Conservancy Prescriptive Rating Guidelines for Bird-friendly Materials 2023)

American Bird Conservancy's Prescriptive Method for Determining Threat Factor

ABC has developed a prescriptive standard for determining threat factors. When specific criteria are met, a Threat Factor of 20 or 25 may be assigned to the glass. Viracon offers a variety of standard patterns that comply with the 2x2, 2x4 and <2" Spacing Rule. The patterns range in coverage from 1% to 20% and can be applied to the same surface as Viracon's Low-E coatings that comply with the guidelines.



FIGURE 3: SPRINGBROOK EXTERIOR



FIGURE 4: SPRINGBROOK INTERIOR

Figure 3 and Figure 4: Springbrook Nature Center’s designers developed a pattern that consists of 1/8” white vertical lines, 4” on center.

Prescriptive Method - Pattern Surface Options

Determine which surface the Bird-friendly pattern will be applied to, then determine which Prescriptive Pattern Rule is required:

Surface #1 Acid Etch Patterns

- Exterior Reflectance of the overall glass assembly (excluding visual markers): No limit
- Clear, mid-iron, low-iron or tinted glass
- Gloss reading of etch markers (60°) ≤ 6

Surface #2 Ceramic Patterns

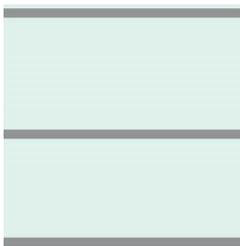
- Exterior Reflectance of the overall glass assembly (excluding visual markers): $\leq 15\%$
- Any color of opaque ceramic enamel
- Clear, mid-iron or low-iron glass

Option 1: Prescriptive 2x2 Pattern Rule - Threat Factor 20

The 2x2 Rule indicates patterns with lines or shapes spaced no more than 2” apart can deter collisions. (American Bird Conservancy Prescriptive Rating Guidelines for Bird-friendly Materials 2023)

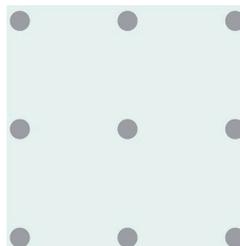
Surface #1 Acid Etch and Surface #2 Patterns must also meet:

- All low-e coatings must be behind the pattern
- A pattern that is made up of one of the following elements:
 - a. Continuous solid lines at least 1/8” wide, no more than 2” apart measured edge to edge.
 - b. Circular, square or irregular solid shapes no more than 2” from another shape measured horizontally or vertically edge to edge. Each shape must have 1/4” (6mm) diameter minimum.



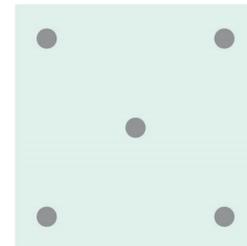
Surface #2: 2X2 Example 1

Pattern: 1/8” Lines, 2” On-Center Horizontal or Vertical (Print #2824), 6% Coverage



Surface #2: 2X2 Example 2

Pattern: 1/4” Dots, 2” Inline (Print #51777), 1% Coverage



Surface #2: 2X2 Example 3

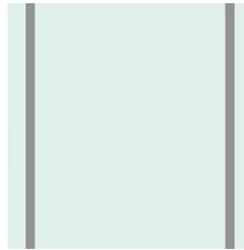
Pattern: 1/4” Dots, 2x2 Staggered (Print #51767), 1% Coverage

Option 2: Prescriptive 2x4 Pattern Rule - Threat Factor 25

The 2x4 Rule indicates patterns with horizontal lines or other shapes spaced no more than 2" apart or vertical lines spaced no more than 4" apart can deter collisions. (American Bird Conservancy Prescriptive Rating Guidelines for Bird-friendly Materials 2023)

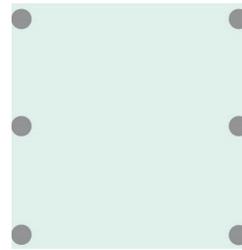
Surface #1 Acid Etch and Surface #2 Patterns must also meet:

- All low-e coatings must be behind the pattern
- A pattern that is made up of one of the following elements:
 - a. Continuous solid lines 1/8" wide, no more than 2" apart for horizontal or angled lines, or 4" for vertical lines
 - b. Circular, square or irregular solid shapes no more than 2" from another shape vertically and no more than 4" from another shape horizontally. Each shape must have 1/4" (6mm) diameter minimum.



**Surface #2: 2X4
Example 1**

Pattern: 1/8" Vertical Lines, 4" On-Center
(Print #20566), 3% Coverage



**Surface #2: 2X4
Example 2**

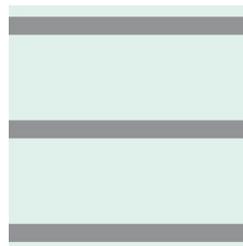
Pattern: 1/4" Dots, 2x4 Inline
(Print #51205), 0.6% Coverage

Option 3: Prescriptive <2" Spacing Rule - Threat Factor 25

(American Bird Conservancy Prescriptive Rating Guidelines for Bird-friendly Materials 2023)

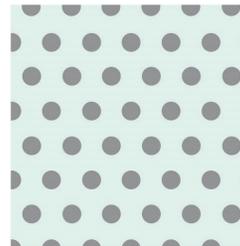
Surface #1 Acid Etch and Surface #2 Patterns must also meet:

- All low-e coatings must be behind the pattern
- A pattern that is made up of one of the following elements:
 - a. Continuous solid lines at least 1/4" wide and spacing equivalent to line width, measured edge to edge, up to < 2".
 - b. Circular, square or irregular solid shapes at least 1/4" (6mm) diameter, with spacing between shapes no less than diameter of pattern elements and no more than 2" measured edge to edge.



**Surface #2: <2" Spacing
Example 1**

Pattern: 1/4" Lines, 1 1/4" On-Center
Horizontal or Vertical
(Print #2070), 20% Coverage



**Surface #2: <2" Spacing
Example 2**

Pattern: 1/4" Dots, Staggered
(Print #50956), 20% Coverage

CONCLUSION

While on-going testing is necessary to further understand patterns, coatings, acid etch and ceramic enamel colors, it is evident based on current testing to date that ceramic enamel patterns applied to the second surface of a glass makeup can be an effective way to reduce bird collisions with glass.

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VIRACON®

GLASS IS EVERYTHING™

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