

# the AviProtek® Toronto e-book of bird-friendly glass

# preface

Toronto has been at the forefront of bird-friendly building ever since it became the first city to establish bird deterrent requirements in 2010. Much has changed over the last twelve years, from those early rules to Toronto’s newest Green Standard (version 4), effective as of May 2022. This e-book will guide you through the new requirements in this innovative city.

Walker Glass has been seriously involved in the development, manufacturing and marketing of environmentally responsible bird-friendly glass since the topic gathered interest in the North American market, championed by Toronto. We made a decision then to be the leader in this space and have remained true to this goal. Our deeply held passions have translated into products that are well researched and conceived and offer the architectural community the industry’s most effective and comprehensive first-surface solutions that are HPD® and EPD certified.

On behalf of all those within our firm who have dedicated thousands of hours on the AviProtek® products in support of your project goals, thanks so much for taking the time to use this document as you see fit. I hope it helps.



**Charles Alexander**  
Vice-President of Sales and Marketing  
Walker Glass Company Ltd.

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Portions of this guide were produced in collaboration with  
[Vitro Architectural Glass](#).



Up to a billion birds die  
each year from collisions  
with glass.

**Learn more**



# why birds can't see glass



This section was authored by Dr. Daniel Klem Jr., Ph.D., D.Sc., professor of biology, and Sarkis Acopian professor of ornithology and conservation biology at Mulhenberg College.

## the issue

For centuries, glass windows have enriched human lives. However, while they contribute enormously to human health and culture, glass windows have been catastrophic for wild bird populations. Today's glass structures kill billions of birds worldwide each year, and up to one billion in North America alone. When faced with glass, birds don't see it as a solid surface the way we do. Instead, they're more likely to mistake it for an opening. When the glass reflects surrounding vegetation, birds mistake the reflection for an actual environment and may try to fly into it, with deadly results.

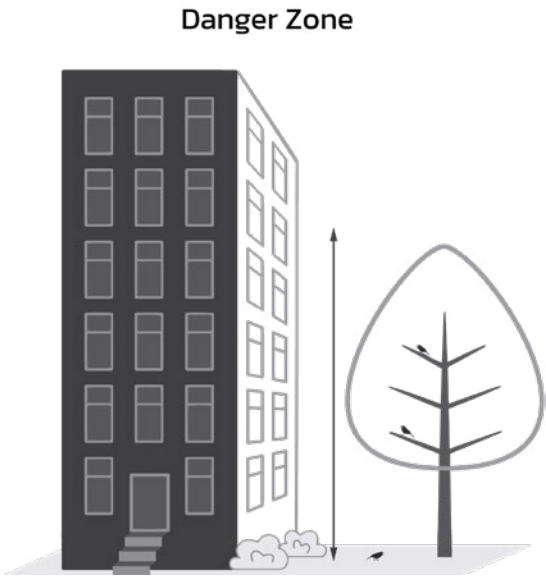
## where does it happen?

The first few stories of a building are a danger zone for bird strikes. That's because the trees and shrubs that make up birds' natural habitats are mainly within this range. Their reflections upon a building's lowest stories confuse birds, increasing strike incidents in this zone. It's easy to underestimate the risk of bird collision, but consider this: a small bird like a sparrow can build up deadly speed in as little as 1 m (3.3'). Lethal collisions are possible wherever birds and glass coexist.

## when does it happen?

Unlike predators, famine and disease, glass collision is an indiscriminate killer. Whether fit or sickly, old or young, all members of a species are at risk. Furthermore, birds are killed at all times of the day, in every season of the year, and under all weather conditions.

The key determinant of whether a bird will strike glass is not the bird or momentary conditions, but the glass and its surroundings. Certain environmental factors make glass especially hazardous to birds.



## risk factors

- **Reflection:** Glass is deceptive to birds because it reflects the nearby habitat, such as trees, vegetation, sky or clouds.
- **Transparency:** Collisions occur as birds attempt to reach vegetation, water sources and other attractants seen through clear glass.
- **Passage effect:** In certain light conditions, glass can appear black, creating the false impression of a safe passage for birds.

It is important to understand the threat that glass and nearby vegetation pose to birds. An inviting green roof becomes a danger to birds if the glass on lower levels is not made safe. Other structures such as bus or train shelters, balconies, guardrails, linkways (corridors), atriums and noise barriers can all be fatal obstructions if they are not made visible and safe to birds.



## first surface markers

Scientific experiments show that to make glass truly safe for birds, patterning must cover its entire surface. The elements making up the pattern, also known as visual markers, can be of any shape including dots, lines and rectangles.

Whether retrofitting or creating new panes of glass for remodelled or new structures, patterning must be applied to the outside facing glass surface, which architects refer to as first surface or surface 1, to be most effective. During daylight, when conditions are brighter outside than inside, windows of all kinds reflect the facing habitat and sky like a mirror. First surface markers will always be visible, but patterns on inner surfaces are hidden by these reflections. The reflections deceive birds and increase the risk of strikes.

Inner-surface patterning can be effective in situations where light is equal on both sides of the glass, such as walkways and railings. However, for most window and cladding applications, it is important to use glass with first surface patterning.





# 2x4 and 2x2 rules

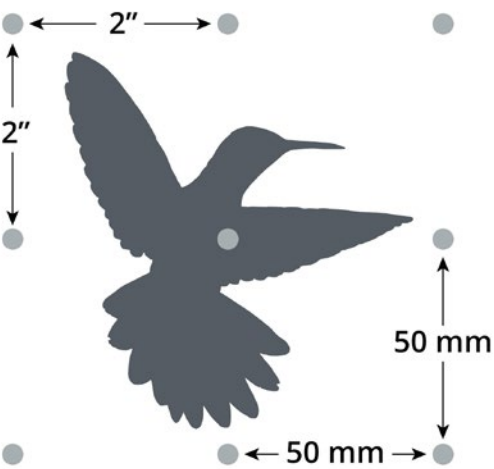
## history and definition

As my doctoral dissertation topic from 1974 to 1979, I conducted the first comprehensive study of bird-window collisions and how to prevent them. This study led to my development of the 2x4 rule.

The 2x4 rule describes the distance between elements making up a pattern applied to windows for the purpose of bird deterrence. It stipulates that markers be spaced no more than 2 inches apart vertically, and no more than 4 inches apart horizontally. Although birds cannot see glass, they see the markers and avoid collision.

For best results, patterns should be placed on the first surface of the glass.

Example of a pattern following the 2x2 rule



## CSA A460:19

I have been involved in developing many bird-friendly initiatives over the past decades, including the [CSA A460:19 standard](#) for bird-friendly building design. This standard calls for first-surface markers following 2" x 2" (50mm x 50mm) spacing. This approach is commonly known as the 2x2 rule, an offshoot of the original 2x4 rule used in many bird-friendly legislations. The tighter spacing of the 2x2 rule deters smaller bird species, which are often the victims of window collisions.

## Toronto Green Standard

Version 4 of [Toronto's Green Standard](#) also requires 2" x 2" spacing of visual markers for bird deterrence. This choice will help to protect small bird species like Ruby-throated Hummingbirds, a species which suffers upwards of 250,000 deaths per year in the Greater Toronto Area.

## in the end

Half of the bird species in North America are in decline, and bird populations the world over are undergoing similar depressions. Glass windows threaten birds regardless of their fitness, age or location. Local legislations are steps in the right direction, requiring and guiding responsible construction practices to make our built environment safer for birds.

*Daniel Klem Jr.*

## About Dr. Daniel Klem, Jr.

Daniel Klem, Jr., Ph.D., D.Sc. is a professor of biology, and Sarkis Acopian professor of ornithology and conservation biology at Muhlenberg College in Allentown, PA.

Recent accomplishments include the book, *Solid Air, Invisible Killer: Saving Billions of Birds from Windows*. You can find his interview with John Rowden, Audubon's Senior Director of Bird-Friendly Communities, at [audubon.org/news](#)

Learn more about Dr. Klem's work at [danielklemjr.org](#)



- **Glass:** AviProtek® 6mm Optiblu® with pattern 215 on surface 1
- **Bird Deterrence:** 5mm dots, 2x2in spacing. Meets Toronto Green Standard version 4.
- **VLT:** 51%
- **SHGC:** 0.38





# bird-friendly legislation in Toronto

## leading the way

Located on the shoreline of Lake Ontario, at the convergence of two major bird migration routes, Toronto is a world leader in bird-friendly building legislation and is certified as a Bird-Friendly City through Nature Canada. This is partly due to its active conservationist community. Groups like [FLAP Canada](#) lead the movement to make the city safe for wild birds. Their efforts include public educational initiatives and consultation with municipal bodies to develop bird deterrent legislation. Bird advocates have even filed lawsuits against building owners who fail to take adequate precautions against bird strikes.<sup>1,2</sup>

The latest version of the Toronto Green Standard, version 4, is the culmination of many years of conservationist efforts. It combines bird deterrent glazing with tactics for material choices and dark sky lighting to greatly reduce the risk of bird collisions.

The City of Toronto accomplishes something more than making its own city safer for birds. As a leader in bird deterrent legislation, Toronto continues to inspire numerous cities and organizations across North America to adopt similar efforts in their own regions.

## Ontario Bill 23

Bill 23, also known as the “More Homes Built Faster Act”, was adopted in late 2022 in Ontario. At the time of completing this document, and after consultation with city officials, it is believed that the Toronto Green Standard, which includes bird friendly and energy requirements, will continue to be enforced as prescribed, despite concerns that the new bill would limit the enforcement of environmental standards.



1. Liat Podolsky (“EcoJustice”) v. Cadillac Fairview Corp. et al., <https://ecojustice.ca/wp-content/uploads/2013/11/Podolsky-v.-Cadillac-Fairview.-Ont-Ct-of-Justice.-Green-J.-final-version.2013.02.14.pdf>  
2. Protecting migratory birds from collisions with office buildings, <https://ecojustice.ca/case/migratory-birds-building-collision/>

## bird collision deterrence

The following text is an excerpt from [Toronto Green Standard](#) version 4, found under **Ecology & Biodiversity**.

### EC 5.1 Bird-Friendly Glazing

Use a combination of the following strategies to treat a minimum of 85% of all exterior glazing within the greater of the first 16m of the building above grade or the height of the mature tree canopy:

- Visual markers, such as acid etch, applied to the **1st surface** (exterior) of glass with a maximum spacing of 50mm x 50mm;
- Building-integrated structures to mute reflections on glass surfaces; or,
- Non-reflective glass.

Areas where visual markers are required include:

- Balcony railings and fly-through conditions;
- Elevations facing a High Hazard Area.

### EC 5.2 Rooftop Vegetation

Treat the first 4m of glazing above the feature and a buffer width of at least 2.5m on either side of the feature using strategies from EC 5.1.

### EC 5.3 Grate Porosity

Ensure ground level ventilation grates have a porosity of less than 20mm X 20mm (or 10mm x 50mm).

### EC 5.4 Exterior Lighting

All exterior fixtures must be Dark Sky compliant. Rooftop and exterior facade architectural illumination must be directed downward and turned off between the hours of 10 pm. and 6 am.

## CSA A460:19 – a national solution

Canadian architects working on projects outside the city of Toronto should refer to the [CSA A460:19 standard for bird-friendly building design](#). While compliance this standard is voluntary, its content is being incorporated into bird-friendly building legislations across the country.

# energy efficiency in Toronto

## Toronto’s approach to energy requirements

In addition to meeting the bird deterrence legislation detailed on the previous page, architects, specifiers and building owners are challenged to meet increasingly stringent energy efficiency mandates for fixed windows and commercial building envelopes.

Toronto Green Standard version 4 does not set any prescriptive requirements for window performance. Instead, it specifies limits for **whole-building greenhouse gas intensity (GHGI)**.

These limits apply to all new construction projects and major renovations, and are calculated using whole-building energy modelling. Limits are set to become stricter over the coming years with the goal of reaching net zero emissions. Energy efficient glazing can help improve a building’s GHGI by reducing the **Thermal Energy Demand Intensity (TEDI)**, thereby easing the heating and cooling load inside the building.



### Toronto Green Standard v4 Greenhouse Gas Intensity Limits

for mid- to high-rise residential and non-residential new developments

Greenhouse gas intensity (GHGI) is calculated as (kg CO<sub>2</sub>e/m<sup>2</sup>/yr).

GHGI must meet the limits listed below.

building type	Tier 1 mandatory	Tier 2 voluntary high performance	Tier 3 voluntary near zero emissions	net zero emissions Mandatory for city- owned facilities
all residential	15	10	5	0
commercial office	15	8	4	0
commercial retail	10	5	3	0
mixed use	calculated using a weighted average of the above			

1. GHG limits are derived from the [City of Toronto Zero Emissions Buildings Framework, 2017](#)

For more information on emissions reductions in Toronto, please see page 4 of the [Toronto Green Standard](#) version 4.

Many thanks to the City of Toronto for their help with this section.

For questions about energy efficiency requirements in Toronto, please reach out to [sustainablecity@toronto.ca](mailto:sustainablecity@toronto.ca).

## paths to success

Whole-building emissions limits can be confusing, as there are many moving pieces that affect the final GHGI output. In order to simplify the matter and give an example of what works, the City of Toronto provides archetypes of different building types in its [Zero Emissions Buildings Framework](#).

### ZERB building archetypes

These archetypes model buildings which can successfully meet greenhouse gas emission limits under TGSv4.

glazing factor	high-rise MURB <sup>1</sup>	low-rise MURB	commercial office	commercial retail
SHGC	0.35	0.35	0.40	0.35
U-value	0.30	0.20	0.30	0.30
window-to-wall ratio	40%	40%	40%	20%

1. MURB: multi-unit residential building.

## Ontario building code

The current Ontario Building Code (OBE) follows ASHRAE 90.1 2013 and the National Energy Code of Canada for Buildings (NECB) 2015. The provincial building code contains prescriptive limits that Toronto projects must meet, as well as satisfying the requirements of the Toronto Green Standard.

glazing factor	max value
SHGC	0.40
overall thermal transmittance in W/(m <sup>2</sup> YK)	1.90 (equivalent to U-value 0.335)
window-to-wall ratio	40%

Please see [table 5](#) for examples of Solarban® low-e coatings from Vitro Glass that can help meet performance targets under the Toronto Green Standard and the Ontario Building Code.



# AviProtek® bird-friendly glass

## bird deterrent solutions

Toronto's Green Standard version 4 requires that glass patterning conform to the [2x2 rule](#) to be considered safe for birds. AviProtek® bird-friendly glass offers many patterns suitable for use under the Green Standard. Viable solutions include stripes, dots, scattered squares, and Walker Textures® full-surface options.

Please see [table 1](#) for a selection of qualifying products.

## first surface treatment

Toronto regulations specify first-surface visual markers for bird deterrent glazing. This is because first-surface placement ensures that markers will be visible to birds in any kind of lighting condition. On the other hand, markers on inner surfaces can be hidden by reflections and glare. AviProtek® and Walker Textures® products are always etched on surface 1, making them a good choice to meet Green Standard requirements and deter birds in a multitude of settings.

Please see [first surface markers](#) on page 5 for more information on first-surface treatments.

## performance

Acid etching treats the first surface of the glass directly so there's nothing that can peel, wear off, or discolour over time. In fact, testing shows that AviProtek® and Walker Textures® match or surpass untreated glass in their overall strength and resistance to signs of wear. That's why these products are backed with a 10 year warranty against surface degradation.

Please see [table 3](#) and [table 4](#) for test results on acid-etched glass properties.

## visible light transmittance

There's a common misconception that acid-etched products reduce light transmittance. That's not the case. Full surface etched glass diffuses light flow without diminishing VLT.

See [table 2](#) for test results on visible light transmittance.

## suggested use

Toronto requires bird-friendly glass in the first five stories from grade. You can use AviProtek® E bird-friendly glass with low-e coating for this section, then continue with the same kind of low-e coated glass, minus the etched markers, for the remainder of the building. This ensures visual harmony throughout the structure while meeting requirements for bird safety and thermal performance.

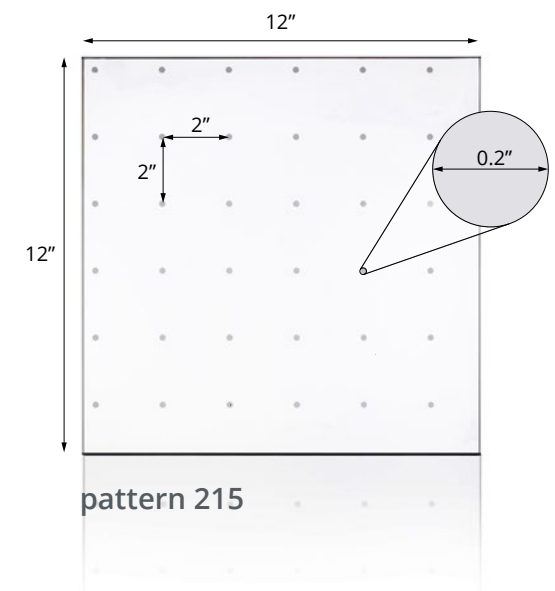
AviProtek® without low-e coating is a perfect choice for applications which don't need to be energy efficient, such as guardrails and spandrel. It's available in the same patterns and substrates as AviProtek® E. Walker Textures® glass with full surface etch on surface 1 can be another great choice for bird-friendly and energy efficient building.

Please see [page 17](#) for a list of product options.

## vision and aesthetic

Architects can meet bird-safe building requirements without compromising on a building's aesthetic. Several AviProtek® patterns cover as little as 1% of the surface of the glass, while conforming to the 2x4 rule.

For example, please refer to the diagram below illustrating a 12" x 12" sample of pattern 215. The acid-etched dots in this pattern cover only 1% of the surface of the glass, yet the pattern satisfies the 2x2 rule.



## product line descriptions

**AviProtek®:** non-coated bird-friendly glass with visual markers etched on the first surface.

**AviProtek® E:** bird-friendly glass with acid-etched visual markers on the first surface and Vitro's Solarban® high performance low-e coatings on the second surface.

**Walker Textures®:** full surface acid-etched glass, with etching on the first surface. Opaque and Satin finishes can be combined with Vitro's Solarban® high performance coatings on the second surface.

Please refer to the following sections to choose the right product for your project.

**2x2 rule and 2x4 rule:** see [table 1](#) for qualifying AviProtek® and Walker Textures® products.

**Building code:** see [table 5](#) for low-e coatings from Vitro that can meet the code. Don't forget – these coatings can be combined with AviProtek® and Walker Textures® products.



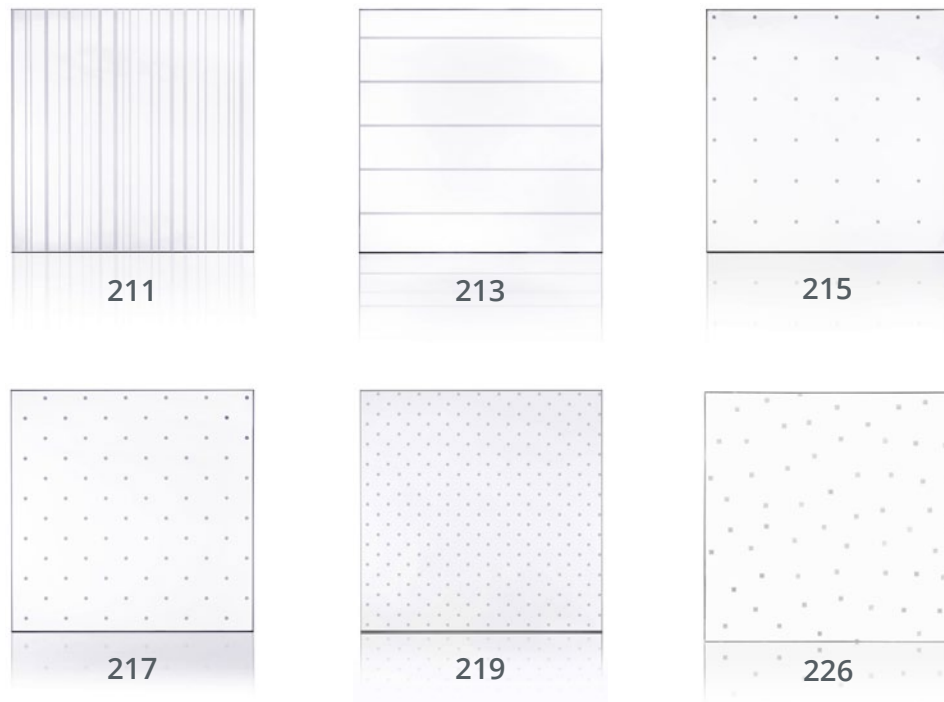


# qualifying products

Many AviProtek® bird-friendly patterns and Walker Textures® finishes meet the 2x2 rule, including the examples below.

Please see the [AviProtek® product page](#) for additional bird-friendly solutions, including ones meeting the 2x4 rule. These additional options are applicable for projects developed under version 3 of the Toronto Green Standard, as well as earlier versions.

## AviProtek® patterns



For best practices in pattern selection, alignment and cutting optimization, please see our article, [Bird-Safe Glass – design rules to meet your budget and minimize bird collisions](#).

Pattern 226 is a scattered non-directional glazing solution, to make bird-friendly design simpler than ever.

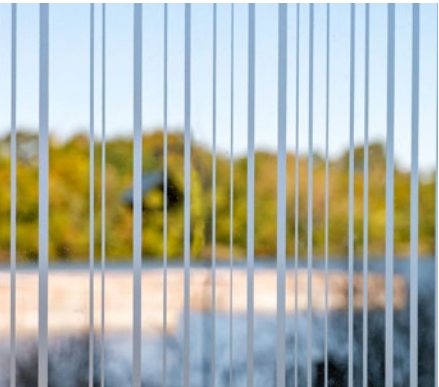
## Walker Textures® full surface finishes



table 1 | patterns and finishes meeting the 2x2 rule  
More pattern options are available on the [AviProtek® product page](#)

pattern / finish	pattern density	impact on VLT	impact on SHGC	maximum size <sup>1</sup>	available with a Solarban® low-e coating	compliant with TGS4 (2x2 rule)	ABC <sup>3</sup> threat factor
211	22.45%	No	No	96" x 130"	yes	yes	23
213	4.92%	No	No	96" x 130"	yes	yes	30
215	0.97%	No	No	96" x 130"	yes	yes	25
217	1.94%	No	No	96" x 130"	yes	yes	15
219	4.96%	No	No	96" x 130"	yes	yes	n/a
226	0.97%	No	No	96" x 130"	yes	yes	25
Opaque	N/A	No	+ 0.02	96" x 144"	yes	yes	25
Satin	N/A	No	+ 0.01	96" x 144"	yes	yes	25
Velour <sup>2</sup>	N/A	No	+ 0.03	100" x 144" 100" x 204"	no	yes	25

1. Please note: all products that combine acid-etch with low-e coatings are available in maximum size of 96" x 130".  
2. Please note: Velour is not available with low-e coating.  
3. ABC: American Bird Conservancy



**The Effectiveness of AviProtek® Glass**  
You may be wondering how well these products work in the real world. The reports we receive from staff and occupants of bird-friendly projects are unanimous: AviProtek® patterns drastically reduce bird strikes, or eliminate them altogether.

Want to see for yourself? You can find many success stories of various projects using our options in the [effectiveness of AviProtek® bird-friendly glass](#) document.

table 2 | acid-etched glass visible light transmittance (VLT)

surface finish	glass substrate	thickness	VLT
Opaque	clear	¼" (6mm)	91%
Velour	clear	¼" (6mm)	91%
Satin	clear	¼" (6mm)	89%
Opaque	Starphire®	¼" (6mm)	93%
Velour	Starphire®	¼" (6mm)	92%
Satin	Starphire®	¼" (6mm)	90%

1. Figures may vary due to manufacturing tolerances. All tabulated data is based on NFRC methodology using the LBNL's Window 5,2 software.  
2. Transmittance values based on spectrophotometric measurements and energy distribution of solar radiation.





acid-etched glass properties

The following charts outline essential properties of AviProtek® and Walker Textures® acid-etched glass, based on extensive testing. Since these patterns and finishes are acid-etched directly into the surface of the glass without adding any other substance, their appearance will not degrade or change over time. This, along with their formidable strength and resistance to wear, makes them particularly well suited to use on exterior surfaces.

AviProtek® visual markers and Walker Textures® full surface finishes are acid-etched directly onto the surface of the glass, so their appearance will not change or degrade over time.

table 3 | acid-etched glass strength properties

test / standard		Satin tempered: ¼" (6mm)		unetched tempered: ¼" (6mm)
modulus of rupture	ASTM-C158¹	etched surface in tension	unetched surface in tension	
max load (lbs)		357	351	338
flexural strength (psi)		1,070	1,050	1,000
modulus of rupture (psi)		28,720	28,370	26,720

table 4 | acid-etched glass resistance properties

test / standard		Opaque	Velour	Satin	float	unit of measure
resistance to wear	ASTM-C501²	213	210	198	183.29	abrasive wear index (Ix)
resistance to staining	ASTM-C1378³	A	A	A	A	classification
scratch hardness	Mohs⁴	5	5	6	5.5	out of 10

1. Modulus of rupture: ASTM-C158  
ASTM C158 is a common guideline for bend testing on glass and glass-ceramics. When executed properly, the modulus of rupture from this test method is considered a valid measure of tensile strength. Higher scores indicate greater tensile strength.

2. Resistance to wear: ASTM-C501  
This test method covers the establishment of an abrasive wear index by determining the loss of weight resulting from abrasion of unglazed ceramic tile by Taber Abraser. Higher scores indicate greater resistance to wear.

3. Resistance to stain: ASTM-C1378  
This test method details the standard procedures for determining the resistance to staining of ceramic tile surfaces. After exposure, the surface is cleaned in a defined manner, and the test specimens are inspected visually for change. Higher scores indicate greater resistance to stains.

4. Scratch Hardness: Mohs scale  
This test compares the resistance of a mineral to being scratched to ten reference minerals, known as the Mohs Hardness Scale. Higher scores indicate greater resistance to scratches.

AviProtek® bird-friendly glass

AviProtek®

- **Thicknesses:** 1/8" to 1/2" (3mm to 12mm).
- **Dimensions:** standard 96" x 130". On demand 72" x 130" or 84" x 130".
- **Substrates:** Clear and Starphire Ultra-Clear™ glass by Vitro. Tints are available on demand.

AviProtek® E

- **Thickness:** 1/4", 5/16", 3/8" (6mm, 8mm, 10mm).
- **Dimensions:** standard 96" x 130". On demand 72" x 130" or 84" x 130".
- **Substrates:** Clear and Starphire Ultra-Clear™ glass by Vitro Glass. Tints are available on demand.
- **Energy:** to meet energy requirements, choose the appropriate Vitro Glass high performance coating on surface 2.

Walker Textures® full surface acid-etched glass

Opaque

- **Thicknesses:** 1/8" to 3/4" (3mm to 19mm).
- **Dimensions:** Standard 96" x 130". Other dimensions are available on request.
- **Substrates:** Clear, low-iron, bronze, grey, blue and black.
- **Surface:** Available on both sides from 3mm to 19mm – subject to minimum quantity.
- **Energy:** When combined with Vitro's Solarban® coatings on surface 2, the glass is available in 6mm in standard size of 96" x 130".

Velour

- **Thicknesses:** 1/8" to 3/4" (3mm to 19mm).
- **Dimensions:** Standard 96" x 130". Also available in 100" x 144".
- **Oversize:** The Velour finish is available in oversize dimensions of 100" x 168" and 100" x 204". These sizes are available in clear and low-iron glass, with the etching on one side only.
- **Substrates:** Clear, low-iron, bronze, grey, blue and black.
- **Surface:** Available on both sides from 3mm to 19mm – subject to minimum quantity.
- **Energy:** The Velour finish is not available with low-e coatings on surface 2.

Satin

- **Thicknesses:** 1/8" to 3/4" (3mm to 19mm).
- **Dimensions:** Standard 96" x 130". Other dimensions are available on request.
- **Substrates:** Clear, low-iron, bronze, grey, blue and black.
- **Surface:** Available on both sides from 3mm to 8mm – subject to minimum quantity.
- **Energy:** When combined with Vitro's Solarban® coatings on surface 2, the glass is available in 6mm in standard size of 96" x 130".



# AviProtek® E

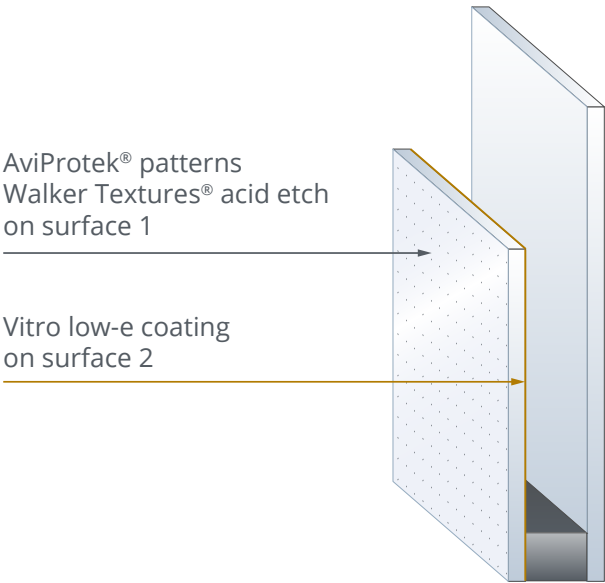
with Vitro Glass solar control coatings

## AviProtek® + Solarban® = AviProtek® E

Walker Glass and Vitro Architectural Glass worked closely to develop award-winning AviProtek® E, a uniquely energy-efficient line of bird-friendly architectural glass.

AviProtek® E combines the Solarban® family of solar control glass with acid-etched visual markers on surface 1. Uniting the AviProtek® acid-etched bird friendly patterns with the industry's most trusted brand of low-e coatings, AviProtek® E glass offers architects and building owners an unsurpassed combination of avian protection and code compliance for daylighting, solar control and insulating performance.

This combination is especially helpful in meeting Toronto's demanding energy standards, along with the city's bird deterrence glazing requirements.



### about Vitro

Vitro Architectural Glass (formerly PPG Glass) is part of Vitro, North America's largest glass producer. It is exclusively dedicated to glass innovation and fuelled by the same people, plants and products that have made PPG Glass one of the industry's most respected and reliable commercial glass manufacturers.



According to a recent study conducted by Dodge Data Analytics, Vitro products are the most commonly specified brand of commercial glass in the industry. Operating under a global company exclusively committed to glass, architects and customers can expect accelerated research and development.

Learn more at [vitroglazings.com](http://vitroglazings.com)

### Vitro thermal performance

Solarban® glass is a spectrally selective glass option which reduces long and short wave (infrared) heat energy, while at the same time transmitting visible light through the glass. Solarban® glass products by Vitro Architectural Glass let you specify large spans of glass that maximize natural daylighting without sacrificing thermal efficiency.

With a range of options, the Solarban® family of glass products features a clear aesthetic with some of the highest light-to-solar gain (LSG) ratios in the industry.

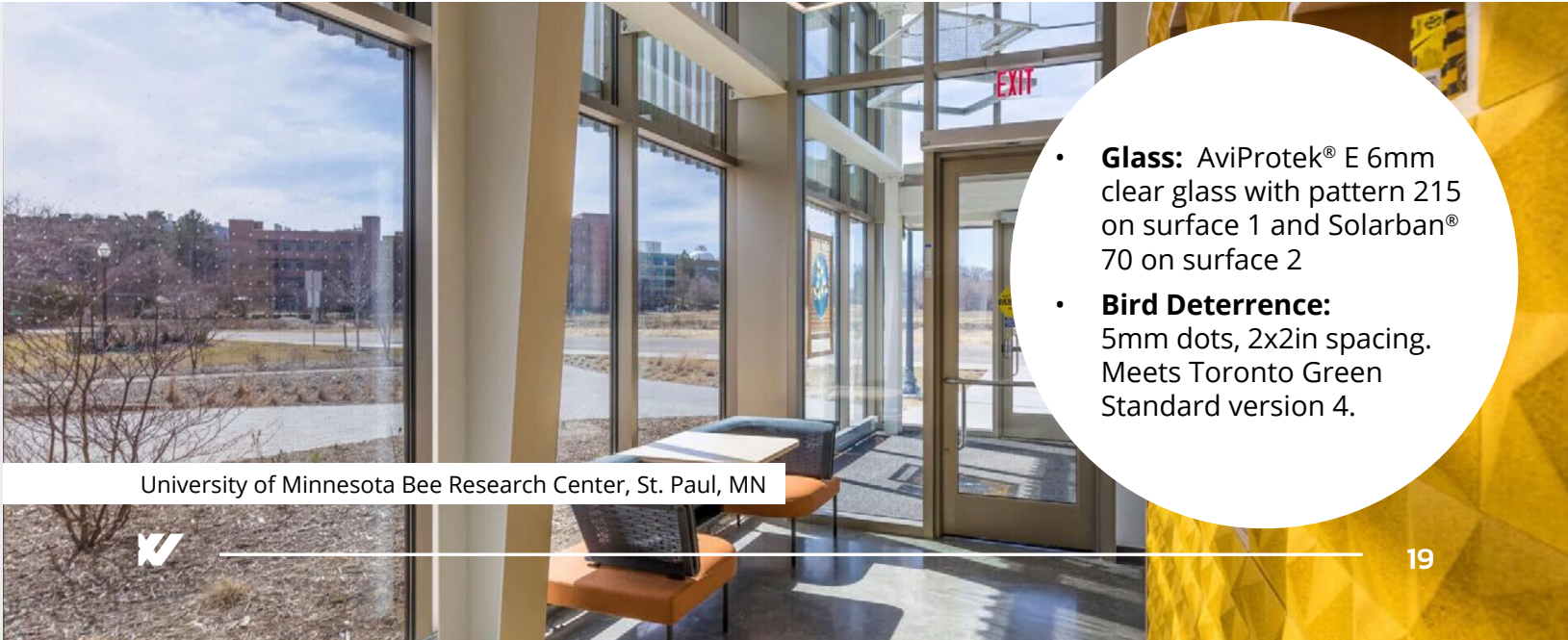


table 5 | Vitro solar control coatings

basic configurations <sup>1</sup>	VLT	U-Value Winter Nighttime	SHGC
clear glass with Solarban® 60 (2) + clear glass	70	0.29	0.39
clear glass with Solarban® R67 (2) + clear glass	54	0.29	0.29
clear glass with Solarban® 70 (2) + clear glass	64	0.28	0.27
Acuity™ glass with Solarban® 72 (2) + clear glass	67	0.28	0.28
clear glass with Solarban® 90 (2) + clear glass	51	0.28	0.23

Due to the low density of AviProtek® patterns, they have no significant impact on the above values.

1. Please note that due to their highly reflective surfaces, we do not recommend combining the following coatings with AviProtek® visual markers for bird deterrence purposes: **Solarban® R77** and **Solarban® R100**.



University of Minnesota Bee Research Center, St. Paul, MN

- **Glass:** AviProtek® E 6mm clear glass with pattern 215 on surface 1 and Solarban® 70 on surface 2
- **Bird Deterrence:** 5mm dots, 2x2in spacing. Meets Toronto Green Standard version 4.



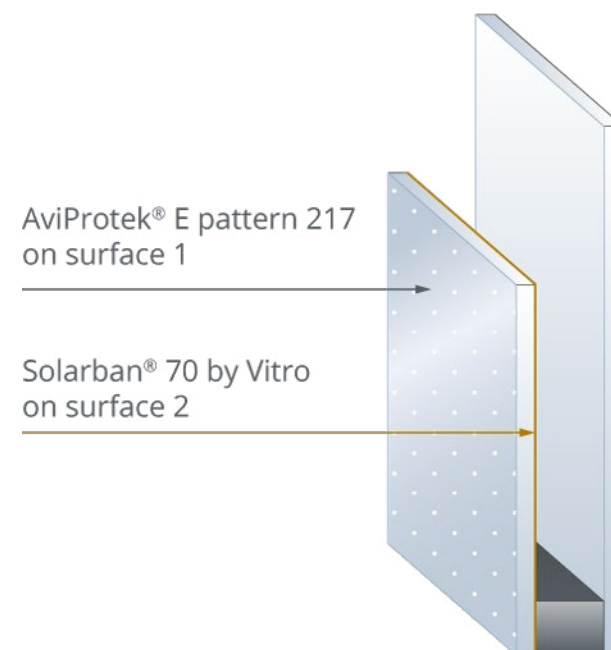
# case study: University of Saskatchewan

Collaborative Science Research Building (CSRB)

2 Green Globes certified

When [Flad Architects](#) took on the [University of Saskatchewan's Collaborative Science Research Building](#) in 2018, they knew it would be a challenge. The building would need to serve state-of-the-art research labs with enhanced energy needs, include greenhouses for crop research, give sightlines onto campus activities, and merge seamlessly into the university's traditional Gothic aesthetic. It would have to be bird friendly as well. Furthermore, the project was to meet the institution's strict Sustainability Strategy and aim for [Green Globes](#) certification. As if that wasn't enough, all this was to take place at the heart of the Canadian prairies, in frigid ASHRAE zone 7.

Flad Architects managed to balance these criteria and design a building that was functional, beautiful, and bird-deterrent.



## the university's position

The University of Saskatchewan's Sustainability Strategy commits the institution to being "The University the World Needs"<sup>1</sup>. Strategies to meet this commitment include a robust framework based on the United Nations' [Sustainable Development Goals](#).

In order to achieve these goals, the university is directing its development toward long-term solutions such as energy-efficient architecture and programs geared toward sustainable development. As a research centre dedicated to eco-friendly agriculture, the CSRB project was a golden opportunity to act on these principles.

Chitani Ndisale, project manager at Flad Architects, was enthusiastic about the opportunity. He described the experience to us, saying, "It was a wonderful thing to be able to work on a project where everybody, from the funding stream perspective, to the actual campus goals, was all aligned in wanting a building that was ecologically responsible."

1. University of Saskatchewan Office of Sustainability, *Critical Patch to Sustainability: University of Saskatchewan Sustainability Strategy, 2021-2030*. <https://sustainability.usask.ca/documents/usask-sustainability-strategy-2021-2030.pdf>

## why use bird-friendly glass?

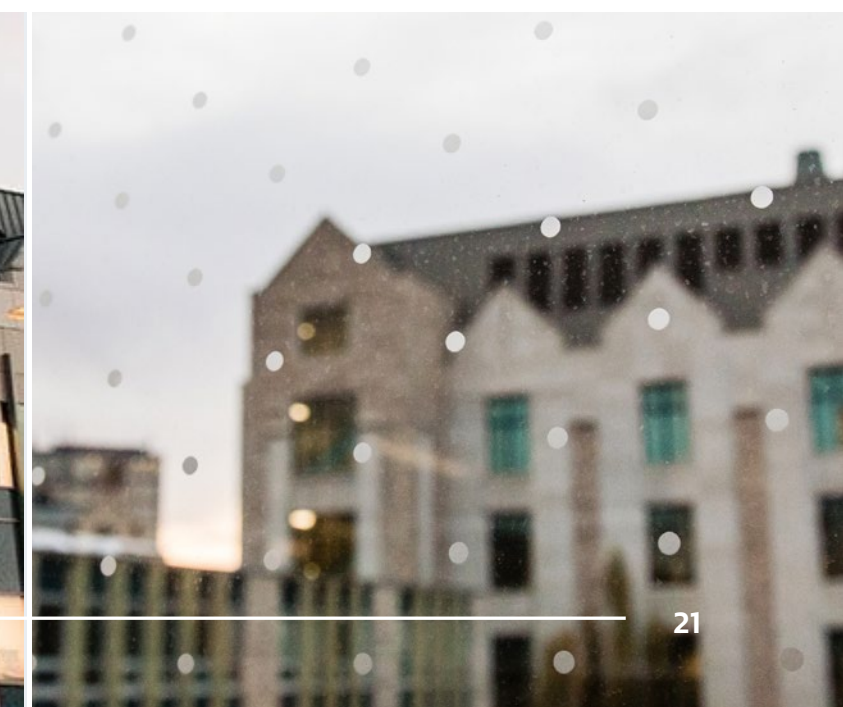
**Even though the city of Saskatoon and the province of Saskatchewan have no bird-friendly building legislation**, bird deterrent glazing was non-negotiable for the University of Saskatchewan. Faculty and staff had had enough of seeing birds collide against campus windows. Furthermore, ecological health was at the heart of the new building's mission. It only made sense to take measures to protect wild species.

"As the building we were constructing was to focus primarily on research aimed to life and natural sciences, we wanted to provide a facility that would not only support the work they do, but the principles that their research is dedicated to which involves the **conservation, preservation and prevention of harm to the natural environment and those living in it.**"

- Dr. Christy Morrissey, Professor at the University of Saskatchewan, specializing in the study of wild bird population health.



- **Glass:** AviProtek® E 6mm clear glass with pattern 217 on surface 1 and Solarban® 70 on surface 2.
- **Bird Deterrence:** 5mm dots, 2x2in spacing. Meets Toronto Green Standard version 4.
- **VLT:** 64%
- **SHGC:** 0.27





collision risks and results

Since the CSRB's construction, graduate students have studied bird-to-glass collisions in Saskatoon and the University of Saskatchewan campus.

A 2021 Master of Environment and Sustainability (MES) thesis analyzed collision rates in Saskatoon based on data gathered from FLAP's Global Bird Collision Mapper (GBCM) website.<sup>1</sup> MES Candidate Abbey Duinker found that the downtown core represented fully one-fifth of recorded bird strikes. Within that neighbourhood, the University of Saskatchewan campus saw some of the highest collision rates.

An earlier thesis from MES candidate Anang Grace Yashim recorded bird strikes against four different campus buildings, including the CSRB.<sup>2</sup> The study was conducted over three months during the spring/summer migration and breeding seasons, when wild bird activity was at its peak.

1. Duinker, Abbey. "Bird-Building Collision Assessment and Mitigation Strategies in the City of Saskatoon". MES. diss. University of Saskatchewan, 2021.  
2. Grace Yashim, Anang. "Risk and Mitigation Strategies for Bird-building Collisions on the University of Saskatchewan Campus". MES. diss. University of Saskatchewan, 2019.

Like Ms. Duinker, Anang Grace Yashim found that the campus windows posed a serious threat to local bird life. The Agriculture and Bioresources Building alone accounted for nine bird collisions over the three months of observation. Interestingly, none of these collisions occurred on the acid-etched portions of the façade, nor around the acid-etched glass adjacent to the building's rooftop garden.

There were zero collisions reported against the CSRB.

What should we conclude from these studies? Even in a proven high-risk area such as the University of Saskatchewan campus, bird strikes are preventable. Effective bird-deterrent glazing like AviProtek® glass can mean the difference between life and death for bird populations.

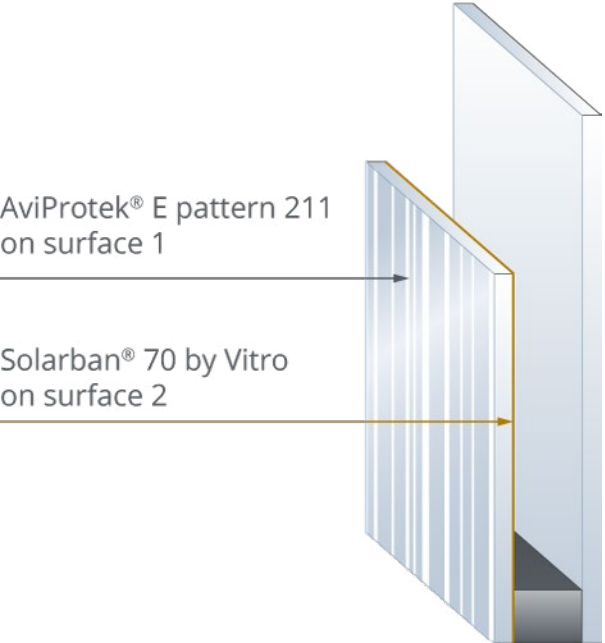
case study: Oregon Zoo

Education Center

LEED® Platinum, Net Zero

New structures must meet rigorous criteria for bird deterrence and energy conservation, while maintaining good VLT levels. AviProtek® E glass can meet these demands, as it did in the Oregon Zoo's new Education Center. Though built on the US Pacific Coast, the structure satisfies Toronto Green Standard criteria. Toronto-based architects would do well to study this project.

Built in 2016, the Education Center punches above its weight in sustainability, performance and use of daylighting. Throughout the Center, Opsis Architecture used AviProtek® E bird-friendly glass in pattern 211, which conforms to the 2x4 rule. A low-e coating on the second surface of the glass minimizes energy waste and helps the project meet its ambitious sustainability goals.



Collaborative Science Research Building, University of Saskatchewan, SK



- **Glass:** AviProtek® E 6mm clear glass with pattern 211 on surface 1 and Solarban® 70 on surface 2.
- **Bird Deterrence:** Varied vertical stripes. Meets Toronto Green Standard version 4.
- **VLT:** 64%
- **SHGC:** 0.27



performance

Despite a limited budget, the Oregon Zoo Education Center was designed to aim high. The building needed LEED® Silver status to meet its green building code requirements, but the Zoo aspired to achieve LEED® Gold.

In the end, they made Platinum.

So how did they do it? Through a series of workshop sessions and consultations with zoo staff, the architectural team came up with all sorts of creative ways to optimize the building's effectiveness. Solutions include low-e coated glazing to minimize SHGC on hot days and heat loss in the winter. In fine weather, classrooms open up with full-height sectional sliding doors,

also glazed with AviProtek® E. This energy efficient and bird-friendly touch goes above and beyond standard requirements, but it fits perfectly with the project's concept.

As Heather DeGrella, Opsis Architecture's Sustainability Director explained, "It's about the small things."

Small things like this have a big impact on the space's performance, helping it to stand out and earn its impressive credentials.

Here are some of the ways that AviProtek® E contributed to LEED® Platinum status for the Oregon Zoo Education Center under BD+C: New Construction (v2009).

LEED® credits awarded to the Oregon Zoo Education Center

relating to its use of AviProtek® E bird friendly, low-e coated glass

credit	description	points earned
EAc1, Optimize Energy Performance	received all 19 points through a variety of strategies, including building envelope, of which the glazing is part	19
EQc8.1	Daylight, for 75% of spaces	1
EQc8.2	Views, for 90% of spaces	1
Innovation Credit	Bird Collision Deterrence	1
	Building Education.	
Innovation Credit	The visible pattern on the glazing in conjunction with signage contributes to this credit, which requires a public education component related to the sustainable attributes of the building.	1

bird-friendly glazing

The Oregon Zoo and Opsis Architecture overcame several challenges when designing the Center to be safe for birds. The structures are a pair of single story buildings, so the glass surfaces are entirely within the danger zone for avian strikes. Located in a forested zoo setting, the site is surrounded by trees full of local birds. As we know, this creates a risk for collisions because trees cast reflections onto nearby windows and can create inviting yet deadly illusions for birds nearby.

Furthermore, it was important that the buildings' design connect visitors with nature as much as possible. With this in mind, Opsis needed a glazing solution that would deter bird strikes without impeding the view from inside.

connecting with nature

Opsis Architecture and the Oregon Zoo considered several glazing options when they were planning the Education Center. Initial concepts used a combination of patterns and some unetched glass, but input from zoo employees brought AviProtek® E pattern 211 into every part of the project. Heather DeGrella described the conversation for us.

According to Oregon Zoo staff in charge of overseeing this building, **there have been no bird strikes since its completion.**

"The zoo came back and said, 'Why don't we use [pattern 211] everywhere? The staff in the admin offices feel like they've been left out because they don't have it in their area.' "

Heather also related staff and visitor feedback about the patterned glass gathered during a post-occupancy follow up. The vertical lines made some people think of gentle rain, evocative of Oregon's natural environment. Others imagined they were looking out through tall grass, which helped them to identify with the zoo's animals and the surrounding ecosystem. Instead of cutting people off from the environment, the patterned glass actually enabled connection.

Although patterned glass was chosen initially to meet bird deterrent requirements, it quickly emerged as a key component of the building's aesthetic.

Many thanks to Heather DeGrella of [Opsis Architecture](#) for her help in writing this case study.

selected awards

Here are a few of the many honours awarded to the Oregon Zoo's Education Center.

- **2019:** AIA, COTE Top Ten Green Building Award
  - **2018:** AIA Portland, 2030 Award
  - **2017:** DJC Top Projects, Energy Trust of Oregon High Performance Building Award, New Construction
- see the full list at [opsisarch.com](#)





# projects

- **Glass:** AviProtek® 6mm Optiblue® with pattern 215 on surface 1
- **Bird Deterrence:** 5mm dots, 2x2in spacing. Meets Toronto Green Standard version 4.
- **VLT:** 51%
- **SHGC:** 0.38

OVO Athletic Centre (NBA Raptors training facility), Toronto, ON



# Boulevard Club

## West Wing Replacement

Toronto, ON

The Boulevard Club is located on the edge of Lake Ontario, at the confluence of two major bird migration routes. As a result, birds are prolific in this area. To mitigate the risk of bird strikes, the Boulevard Club is glazed with AviProtek® visual markers on surface 1. A Solarban® low-e coating on surface 2 helps the project meet Toronto's energy efficiency requirements.



- **architectural firm:** Teeple | [see the project](#)
- **glass:** AviProtek® E 6mm clear glass with pattern 216 on surface 1 and Solarban® 60 on surface 2.
- **Bird Deterrence:** 6mm dots, 4x4in spacing.
- **VLT:** 70% | **SHGC:** 0.39



# H&M

## Flagship Store

Toronto, ON

Over the last decade, the retail mega-brand H&M has revamped its presence in Canada. The flagship store in downtown Toronto layers Starphire low-iron panes with a double-sided acid-etched Opaque treatment to create a milky white base, characteristic of the brand's clean aesthetic. As an added bonus, the etched finish also deters bird strikes.



- **architectural firm:** Petroff | [see the project](#)
- **glass:** 6mm Starphire Ultra-Clear® glass with Opaque etch on surfaces 1, 2, 3, 4.
- **Bird Deterrence:** Opaque full-surface etch. Meets Toronto Green Standard version 4.





# Humber College

## Centre for Entrepreneurship

Toronto, ON

This glass-and-zinc extension re-purposes a 19<sup>th</sup> century psychiatric hospital building into a welcoming space for personal and professional development. The glass addition was designed to enlarge the heritage building with minimal impact, while meeting the needs of a 21<sup>st</sup> century institution. First surface bird-deterrent patterning supports this mandate.



- **architectural firm:** [Moriyama & Teshima](#)  
[see the project](#)
- **glass:** AviProtek® E 6mm clear glass with pattern 211 on surface 1 & 4, Solarban® 70 on surface 2.
- **Bird Deterrence:** Vertical stripes. Meets Toronto Green Standard version 4.
- **VLT:** 64% | **SHGC:** 0.27



# noteworthy mentions

Here are additional examples of bird-friendly buildings made with AviProtek® solutions.

Click through to find all the project details on our site.



University of Minnesota Bee and Pollinator Research Lab, St Paul, MN



Pikes Peak Summit Visitor Center, Pikes Peak, CO



Swarthmore College Maxine Singer Hall, Swarthmore, PA





# sustainable materials

To see real progress in the building industry, companies need to adopt responsible practices throughout the supply chain. Over the last few years experts have become increasingly aware of the effects of a structure’s materials on its builders and occupants. Green building benchmarks like WELL, Green Globes, BREEAM and LEED® v4.1, in particular, reward the use of sustainably produced materials.



## EPD and HPD®

Building sustainably is a multifaceted endeavour which goes beyond bird deterrence. Eco-friendly products with third-party verification such as HPD® and EPD give building professionals at every level a reliable, standardized tool to select the ideal product for their projects. They also contribute to green building certifications such as WELL, Green Globes, BREEAM and LEED® v4.

- **EPD (Environmental Product Declaration):** a report describing a product’s potential environmental impact according to the life cycle assessment (LCA) criteria and in conformity with ISO protocol 14025.
- **HPD® (Health Product Declaration®):** a declaration that discloses a product’s chemical ingredients and their associated effects on health.

AviProtek® glass and Walker Textures® glass come with HPD® and EPD transparency reports prepared by Vertima, accredited experts in green building and LEED® certification. The EPDs have Type III verification and are registered in accordance with certification requirements for ISO standard 14025:2006.

## About Vertima

Vertima is recognized for its leading edge expertise in materials and green building certifications. Founders Josée Lupien and Jean DesRosiers lead a team of experts in green building practices. Together, they support manufacturers and stakeholders in their green building projects, especially when aiming for LEED® certification.

Learn more at [vertima.ca](https://vertima.ca)



# LEED® credits contribution with AviProtek® and Walker Textures® glass

Walker glazing products can contribute toward many different credits under LEED® v.4.1, maybe more than you realize. Table 6 lists credits which can be attained with the help of Walker Textures® and AviProtek® glass under LEED® BD+C: New Construction.

For details on LEED® v4.1 certification using Walker Glass, please see our article: [Designing for LEED® Credits with Walker Glass Products.](#)

table 6 | LEED® v4.1 credits with Walker products

LEED® BD+C: New Construction v4.1

category	credit name	option	credits available
Energy and Atmosphere	Optimize Energy Performance¹	Option 1. Energy Performance Compliance	18
	Environmental Product Declarations	Option 1. Environmental Product Declaration (EPD)	1
Materials and Resources	Material Ingredients	Option 1. Material Ingredient Reporting	1
	Low-Emitting Materials	n/a	3
	Thermal Comfort¹	n/a	1
	Daylight	Option 1. Simulation: Spatial Daylight Autonomy and Annual Sunlight Exposure Option 2. Simulation: Illuminance Calculations Option 3. Measurement	3 (2 for Healthcare)
Indoor Environmental Quality	Quality Views	n/a	1
	Innovation	Option 1. Innovation	1
		Option 2. Bird Collision Deterrence credit	1
		Option 3. Additional Strategies	3

1. Available for AviProtek® E and Walker Textures® glass with a Solarban® low-e coating from Vitro on surface 2.

## Innovation: Bird Collision Deterrence

This credit aims to reduce bird injury and mortality due to collisions with buildings.

Projects can earn the credit by using bird deterrent façade materials such as AviProtek® bird-friendly glass and Walker Textures® acid-etched glass with full surface treatment. Qualifying products can be determined with calculations using Threat Factor ratings, or through compliance with CSA A460-19 guidelines.



# samples, specifications and education

## samples program

**AviProtek® samples box**  
You are probably looking at different bird-friendly options and want to see what they're like in person. The AviProtek® sample box, dedicated solely to bird-friendly glass solutions, is a perfect way to start.

The AviProtek® sample box contains the most comprehensive bird-friendly sample selection on the market and will meet your every need. Please feel free to order your box and see all the possibilities that are at your fingertips.

[Order your samples](#)

Walker offers a comprehensive sample program to support our bird-friendly product lines.

- AviProtek® sample kit
- 12" x 12" monolithic samples
- 12" x 12" IGUs (insulated glass units) with Solarban® high performance coatings on surface 2 or 3
- Full size mock-ups



## product specifications

These three part specifications are a tool for architects, designers and specification writers to communicate exactly which finishes, translucencies and substrates they want in their projects. Walker Glass carries ISO 9001:2015 certification, and strives to provide the highest possible quality assurance. When architects and designers specify Walker glass, they can be sure that they are choosing high performance acid-etched glass and mirror products that will look great for years to come.

The Walker Architectural Glazing Guide Specs include all pertinent information on our full surface and bird-friendly glass, as pertains to Master Format Section 08 81 00.

It is recommended that architects clearly state their product performance expectations in the specifications for every project, including etched patterns on surface 1. It is also best to indicate your expectations regarding glass strength, resistance to scratch and stain, visible light transmittance, and any other relevant performance indicators.

[Download the specification documents](#)



## e-books of bird-friendly glass

For more information about bird-safe building in Canada and the United States, please see [our other titles in this series](#).

- the AviProtek® **Canada** e-book of bird-friendly glass
- the AviProtek® **United States** e-book of bird-friendly glass
- the AviProtek® **New York City** e-book of bird-friendly glass
- the AviProtek® **Pacific Coast** e-book of bird-friendly glass





# education



**AIA accredited courses**  
Walker offers three accredited courses, including one titled “Bird-Friendly Glazing Challenges and Solutions” to architects, designers and specifiers. Book your training session to discover creative, yet eminently practical ways that you can use bird-friendly and acid-etched glass products.

[Learn more](#)



**bird-safe glass explained**  
World renowned ornithologist Dr. Daniel Klem introduces and explains the multifaceted issue of bird deterrence. Each episode focuses on specific aspects of the phenomenon, from the causes to potential solutions and what has already been done to reduce bird strikes.

[Watch the videos](#)



**technical papers**  
White papers by Dr. Daniel Klem, professor of ornithology and conservation biology at Muhlenberg College.

- the building industry and bird conservation
- legislative measures promoting bird-friendly buildings
- technical design of bird-friendly glass

[Read the white papers](#)



**blog posts**  
Educational articles and case studies highlighting best practices for working with bird-friendly glass, energy efficient glass, sustainable materials and more. These articles are readily available to you on the Walker Glass website.

[Read the blog](#)

# contact us

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Don’t miss a beat! Subscribe to our monthly [newsletter](#).

**Thank you** for helping the glass industry work toward a safer, more sustainable built environment.







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