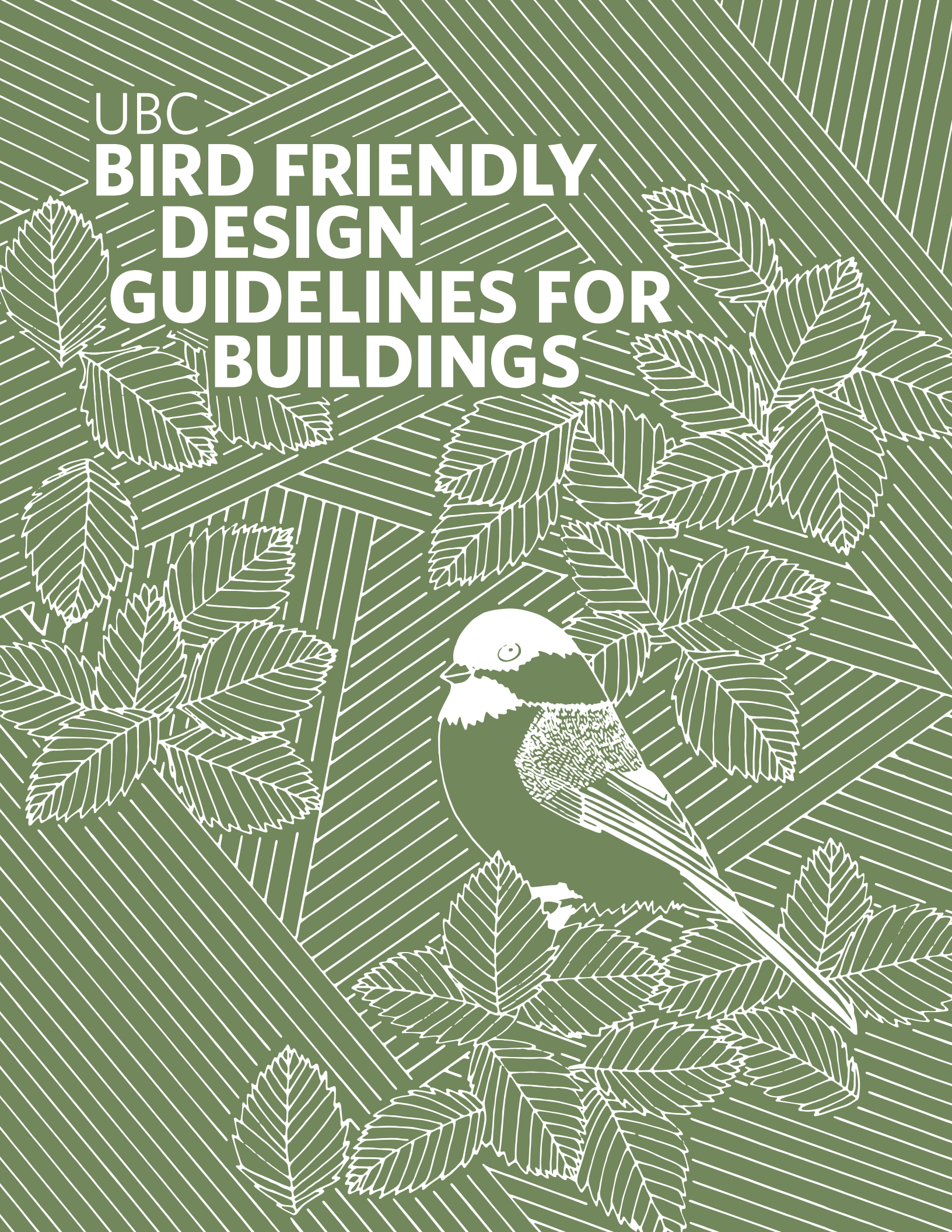
UBC

BIRD FRIENDLY DESIGN GUIDELINES FOR BUILDINGS



ACKNOWLEDGMENT

We acknowledge that the Vancouver campus is situated on the traditional, ancestral, and unceded territory of the xʷməθkʷəy̓əm (Musqueam) people.

sʔiːɬqəý qeqən (Double-Headed Serpent Post)"
Brent Sparrow Jr., Musqueam

PHOTOGRAPHER: UBC BRAND & MARKETING /HOVER COLLECTIVE

DATE: AUGUST 2019

CONTENTS

Introduction

The Goal of the Bird Friendly Design Guidelines For Buildings

Across Canada, research has estimated that 16 to 42 million birds die annually as a result of building window collisions.[1] Many major North American cities including Vancouver, Toronto, Calgary and San Francisco have introduced their bird-friendly guidelines to help tackle the problem. Similar to other jurisdictions, the University of British Columbia has developed the UBC Bird Friendly Design Guidelines for Buildings to provide cost-effective solutions that can be used by designers and builders to help reduce collisions on campus.

UBC Target to Reduce Bird Collisions

UBC's newly released Green Building Action Plan (GBAP) was approved by the Board of Governors in September 2018. The GBAP outlines goals, targets, and actions for academic and residential buildings at the UBC Vancouver campus across eight holistic component areas of building design: biodiversity, energy, water, materials and resources, health and wellbeing, quality, climate adaptation, and place and experience. The plan's vision is: by 2035, UBC's buildings will make net positive contributions to human and natural systems.

In the component area of biodiversity, the GBAP has set a bird friendly design target for new buildings:

100% compliance to the UBC Bird Friendly Design Guidelines for Buildings for new institutional buildings by 2020 and new residential buildings by 2025.

BIRD FRIENDLY GUIDELINES VERSION 2.0

The **UBC Bird Friendly Guidelines version 2.0** improves upon the first version of the guidelines by providing an expanded list of practical, cost effective solutions and examples. New glazing design strategies have been added to address retrofits and building occupant solutions have been added.

[1] Machtans, Craig S., Christopher H.R. Wedeles, & Erin M. Bayn. 2013. A first estimate for Canada of the number of birds killed by colliding with building windows. *Avian Conservation and Ecology, 8*(2), 6.

PHOTOGRAPHER:
DANIELA ORBEGOSO CAMPBELL

Background on Birds at UBC

Why are Birds Important?

Birds are important for biodiversity because they provide essential ecosystem services in the form of pest control, pollination, and seed dispersal. Many bird species can be seen and heard on campus and they create a valuable experiential link between people and local wildlife in urban settings and supporting our wellbeing by bringing people close to nature.

The Problem: Glass in Buildings

HOW ARE WE ENDANGERING BIRDS?

Glass on buildings is currently one of the largest sources of anthropogenic bird mortality in North America. Birds are unable to perceive glass as a solid object, and building collisions often occur when they attempt to fly through transparent glass or towards reflections of vegetation or open sky.[2] Bird vision differs from humans' and is mostly tuned to foraging and detecting movement and predators in their lateral field of view rather than perceiving static, human-made obstacles. Additionally, birds have a limited range of flight speeds and cannot slow down in time to avoid collisions with buildings. If glass is sensitively incorporated into the built environment with considerations of the threats they pose to birds, these pitfalls can be avoided and we can continue to enjoy the benefits this material offers.

HOW WIDESPREAD IS THE ISSUE?

At the University of British Columbia, there is an estimated number of 10,000 of bird collisions per year.[3] One study, monitored a stratified random sample of 8 buildings on the Point Grey campus in fall, winter, spring and summer for bird collisions.[4] From the survey, the researchers estimated that a total of 45 building collisions occur per day campus-wide in the winter and 72 in the fall. The number of building collisions in the fall is surmised to be higher than in the winter because migratory birds join resident birds on campus at this time, increasing the overall population.

When building collisions do occur, death is not always instantaneous and may occur as a result of internal hemorrhage days after impact, far away from the original collision site. This fact, paired with the rapidness of scavengers, makes accurately monitoring the problem difficult.

[2] Martin, Graham R. 2011. Understanding bird collisions with man-made objects: A sensory ecology approach. *Ibis, 153*(2), 239-254.
[3] De Groot, Krista (2018). Personal communication.
[4] De Groot, Krista L., Allison N. Porter, A.R. Norris, Andrew C. Huang. In prep. Year-round monitoring reveals a unique seasonal pattern and species affected by bird-window collisions along the West Coast of North America.

The Impact on Birds at UBC

WHICH BIRDS ARE THE MOST SUSCEPTIBLE?

Healthy, breeding adults are just as likely as weaker birds to collide with buildings, which means glass can have a serious impact on bird populations. While there is little distinction among the birds that fall victim to glass, migratory birds face a greater risk than resident birds because they are not as well-adapted to urban life.

A UBC study has shown that the following birds are some of the more common victims of collisions:[5]

Varied Thrush – A local species, mostly found on the ground or in dense thickets.

PHOTOGRAPHER: ROGER GOLUB

Fox Sparrow – A local species, mostly found in wooded areas, undergrowth, and brush.

PHOTOGRAPHER: BECKY MATSUBARA

American Robin – A local species that is abundant and widespread across Canada and common to city environments, often foraging on open lawns and nesting on house porches or windowsills.

PHOTOGRAPHER: DAKOTA LYNCH

Gold Crowned Kinglet – A small bird local to the Canadian west coast mostly found in conifers.

PHOTOGRAPHER: TIM MASON

As many of the common species impacted by window collisions at UBC are already in steep decline within BC, designing and retrofitting UBC buildings to be bird friendly can positively impact biodiversity.[6]

MIGRATION AND SEASONAL VULNERABILITY

Since UBC Vancouver is located adjacent to the Fraser River Estuary, a major stop along the Pacific Flyway, migratory birds are a primary concern. Every year, at least a billion migratory birds traverse this route during spring and fall on their way from northern breeding areas to southern wintering grounds. Southwestern BC also supports the highest densities of wintering birds in Canada. Research shows that migrant species as well as winter residents are vulnerable to building collisions. Bird-window collision rates are highest during fall migration, however collision rates are also very high during the winter season and during the spring migratory period.[7] Along with employing permanent bird friendly design strategies that are active year round, seasonal vulnerability can be addressed through events and campaigns during peak collision periods to increase awareness and occupant action.

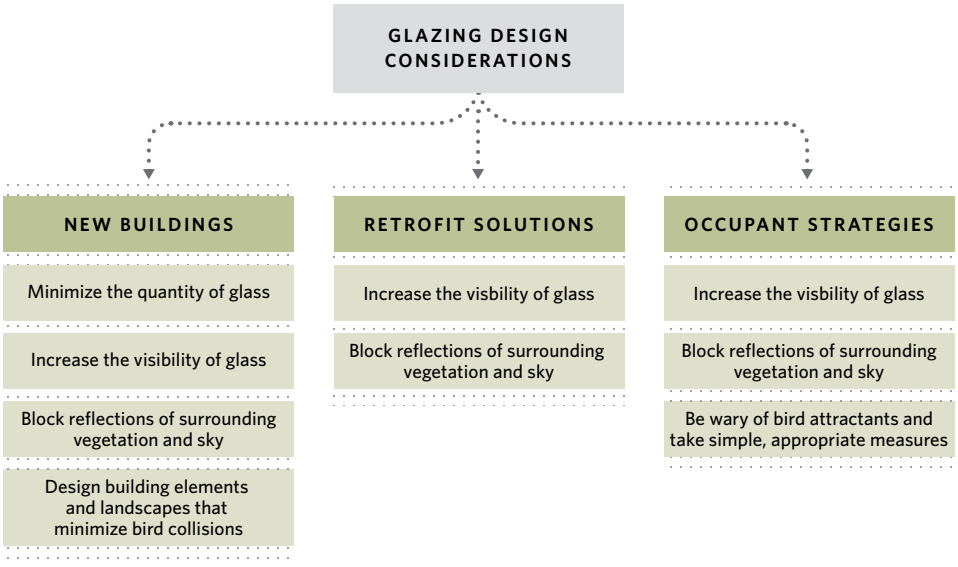
[5] Huang, Andrew C. & Allison N. Porter. 2015. Bird Collisions with Glass: UBC Pilot Project to Assess Bird Collision Rates in Western North America. UBC SEEDS.
De Groot et al. In prep.
[6] Ibid.
[7] De Groot et al. In prep.

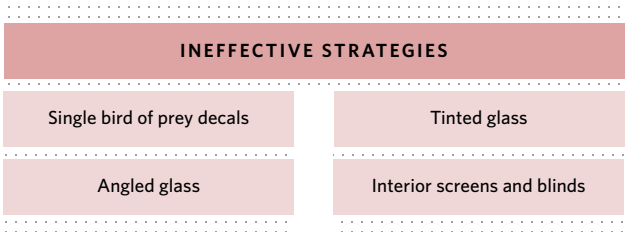
Earth Sciences Building
PHOTOGRAPHER: PHILIP BERTOGG

Strategies:

1. Glazing Design Considerations

Building collisions occur because birds are unable to perceive glass as a solid object. The following strategies for new institutional and residential building design, retrofits, and occupant measures can help reduce collisions by increasing the visibility of glass to birds and reducing reflections of bird attractions such as vegetation and open sky.





STRATEGIES – 1. GLAZING DESIGN CONSIDERATIONS

New Buildings

For architects and designers who want to crate bird friendly buildings:

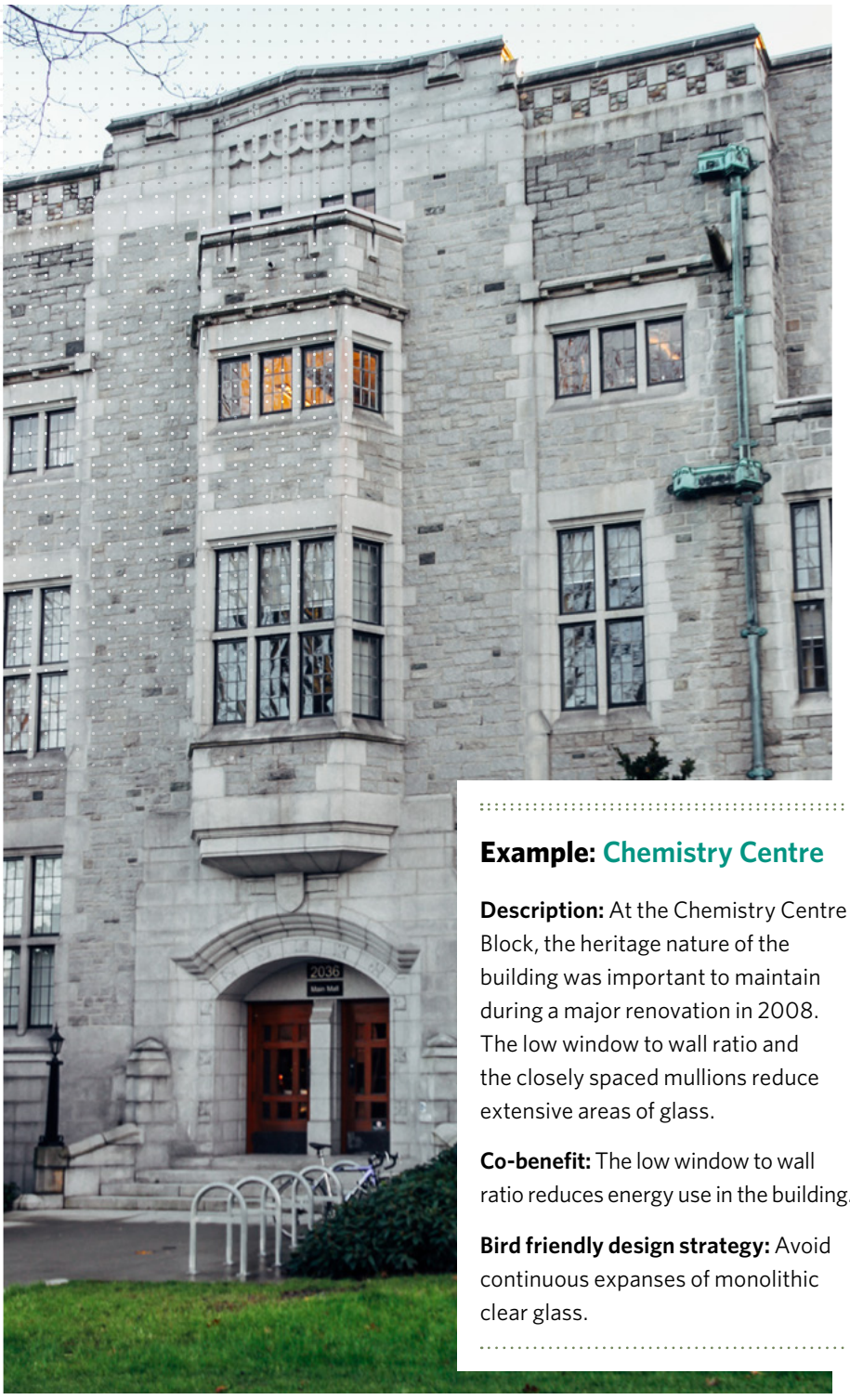
GLAZING DESIGN CONSIDERATIONS

NEW BUILDINGS

- **Minimize the quantity of glass**
- Increase the visibility of glass
- Block reflections of surrounding vegetation and sky
- Design building elements and landscapes that minimize bird collisions

Minimize the quantity of glass

- Avoid continuous expanses of monolithic, clear glass especially near grade where vegetation may be reflected.



Chemistry Centre
PHOTOGRAPHER: PENNY MARTIN

Example: Chemistry Centre

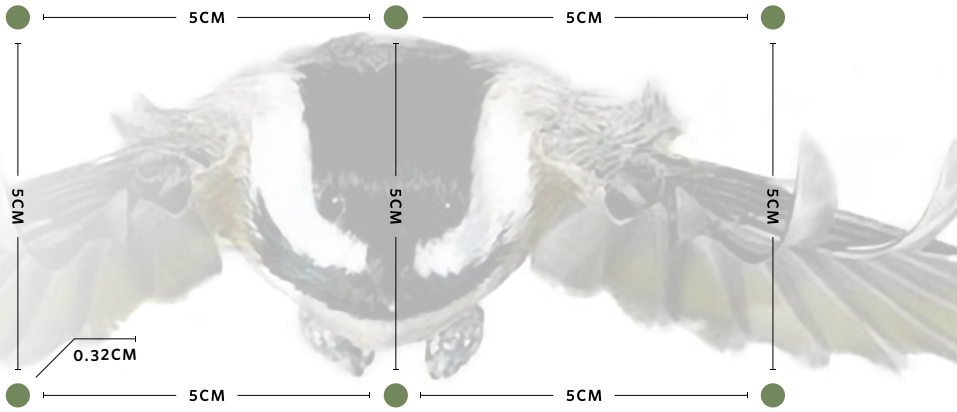
Description: At the Chemistry Centre Block, the heritage nature of the building was important to maintain during a major renovation in 2008. The low window to wall ratio and the closely spaced mullions reduce extensive areas of glass.

Co-benefit: The low window to wall ratio reduces energy use in the building.

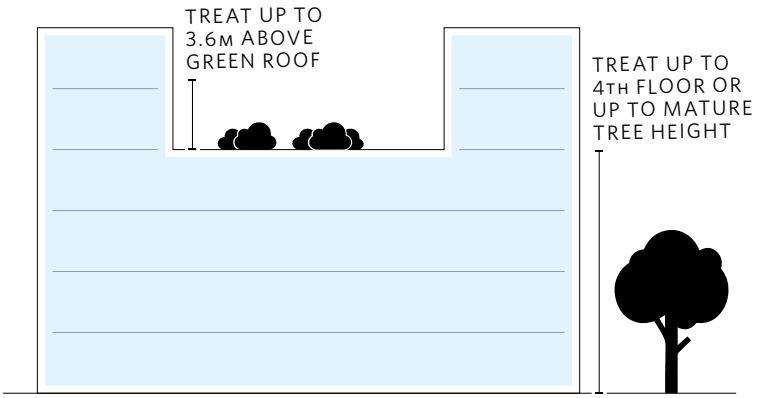
Bird friendly design strategy: Avoid continuous expanses of monolithic clear glass.

Increase the visibility of glass

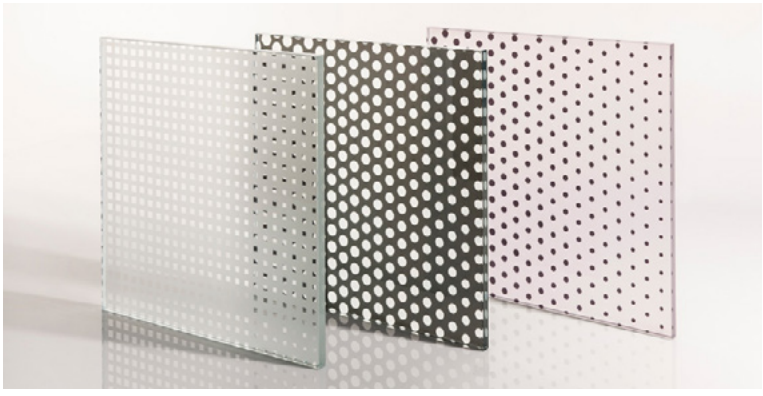
- Utilize adhesive film, acid-etch, or frit patterns to create visual noise which breaks up the transparency of glass and prevents bird from perceiving it as clear to fly through.
- To ensure that such pattern designs are bird friendly, use high contrast and dense: spacing at a maximum 5cm x 5cm apart with markers no more than 0.32cm in size to provide an effective visual cue that alerts birds of glass *(see figure 1)*.
- Apply patterns onto the exterior surface of the glass (surface 1). Applications to surface 2 or surface 3 may be obscured by reflections and rendered less effective.
- Pay special attention to applying glazing strategies in the critical zone for collisions – up to the fourth floor of a building or mature tree height, whichever is greater, and up to 3.6m (12 feet) above a green roof *(see figure 2)*.
- Consider creative pattern designs that integrate bird friendly glazing practices with aesthetic expression to communicate the unique identity of the building and its connection to the surrounding landscape.
- Consider the placement and design of patterns to accomplish co-benefits in shading, views, and the privacy of building occupants.
- In circumstances where clear glass is desirable, consider UV patterned glass which makes glazing visible to birds, but not to humans. While birds have evolved to perceive the ultraviolet (UV) spectrum of light, glass products that reflect or absorb UV light appear clear to the human eye and preserve views.



[FIG 1] *Diagram of bird friendly glazing pattern with visual markers at maximum 5cm x 5cm spacing* **IMAGE SOURCE:** FLAP CANADA



[FIG 2]
PRACTICES FOR BIRD FRIENDLY GLASS



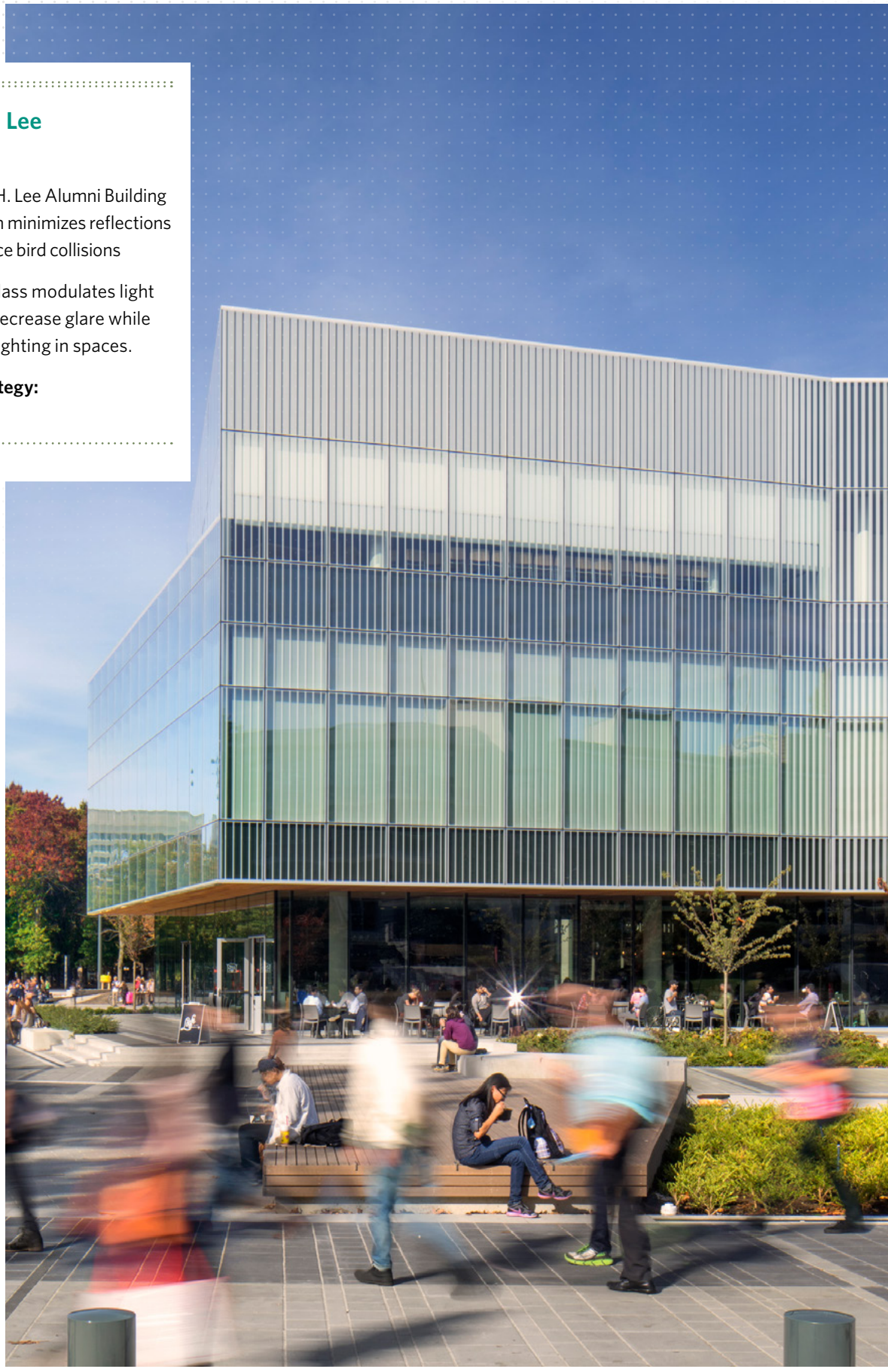
Examples of glass patterns which create visual noise and break up the transparency of glass

Example: Robert H. Lee Alumni Centre

Description: The Robert H. Lee Alumni Building utilizes fritted glass, which minimizes reflections and transparency to reduce bird collisions

Co-benefit: The fritted glass modulates light to increase privacy and decrease glare while allowing for natural day lighting in spaces.

Bird friendly design strategy:
Fritted glass



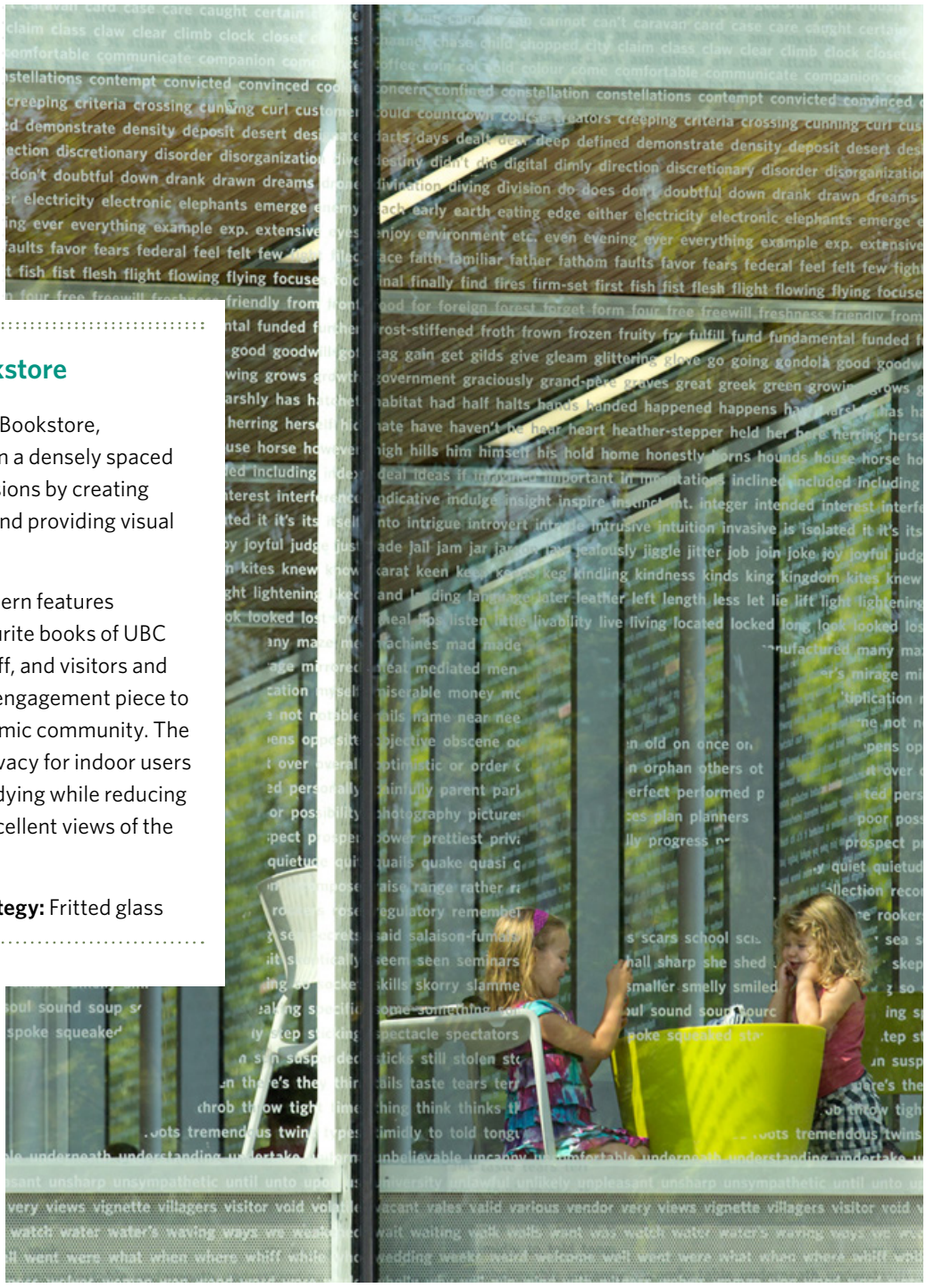
Robert H. Lee Alumni Centre
PHOTO CREDIT: HCMA ARCHITECTURE + DESIGN

Example: UBC Bookstore

Description: At the UBC Bookstore, extensively fritted glass in a densely spaced design reduces bird collisions by creating large-scale visual noise and providing visual cues of the glass to birds.

Co-benefit: The text pattern features sentences from the favourite books of UBC professors, students, staff, and visitors and acts as a creative public engagement piece to express a sense of academic community. The design also enhances privacy for indoor users who are relaxing and studying while reducing glare and maintaining excellent views of the Lee Square.

Bird friendly design strategy: Fritted glass



UBC Bookstore

PHOTO CREDIT:
OFFICE OF MCFARLANE BIGGAR ARCHITECTS + DESIGNERS INC.

GLAZING DESIGN CONSIDERATIONS

NEW BUILDINGS

Minimize the quantity of glass

Increase the visibility of glass

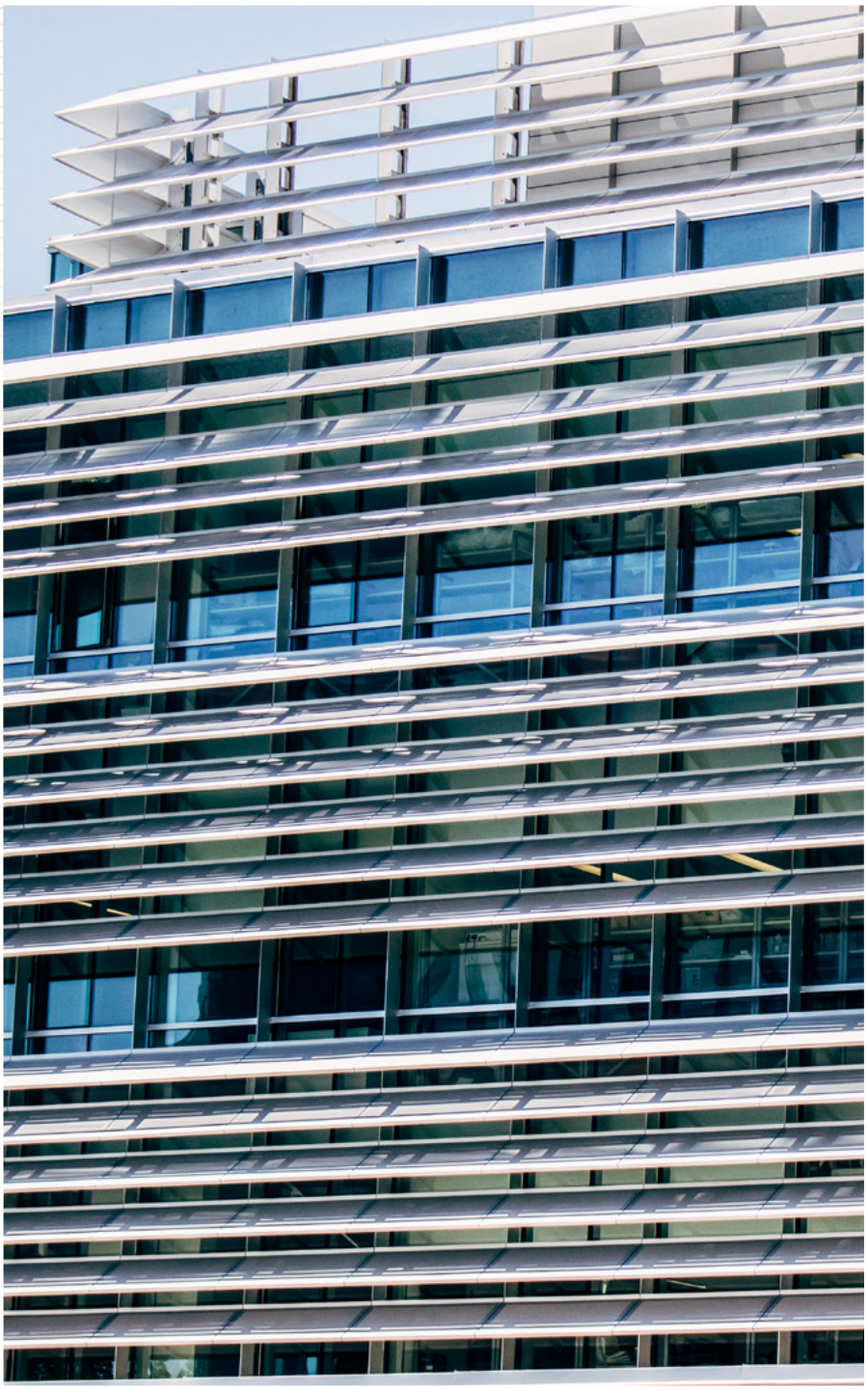
Block reflections of surrounding vegetation and sky

Design building elements and landscapes that minimize bird collisions

NEW BUILDINGS

Block reflections of surrounding vegetation and sky

- Utilize exterior screens, architectural mesh, and grilles to block reflections of vegetation and sky, and break up transparency.
- Consider combining bird friendly objectives alongside co-benefit features such as solar shading, energy saving, increased thermal comfort, and additional wind and rain screening.



Earth Sciences Building

PHOTOGRAPHER:
PHILIP BERTOGG

Example: Earth Sciences Building

Description: Shading devices at the Earth Sciences Building block reflections of vegetation and sky by creating a physical barrier and areas of deep shade to prevent bird collisions.

Co-benefit: The shading devices reduce solar heat gain in the building and prevent glare for occupants.

Bird friendly design strategy:
Exterior solar shading devices

Campus Energy Centre
PHOTO CREDIT: UBC MEDIA RELATIONS

Example: Campus Energy Centre

Description: Metal screens surround the upper floors of the Campus Energy Centre to create a large-scale barrier at the upper levels which prevents birds from flying through.

Co-benefit: The perforated zinc panels hide the extensive vents and louvers required to expel heat from the energy production within the building and facilitate air exchange and ventilation. Through a mixture of opaque, 30% perforated and 50% perforated panels, natural daylight can still enter the building. The screen additionally functions as weather protection at the building entrance.

Bird friendly design strategy: Exterior screens

Beaty Biodiversity Research Centre

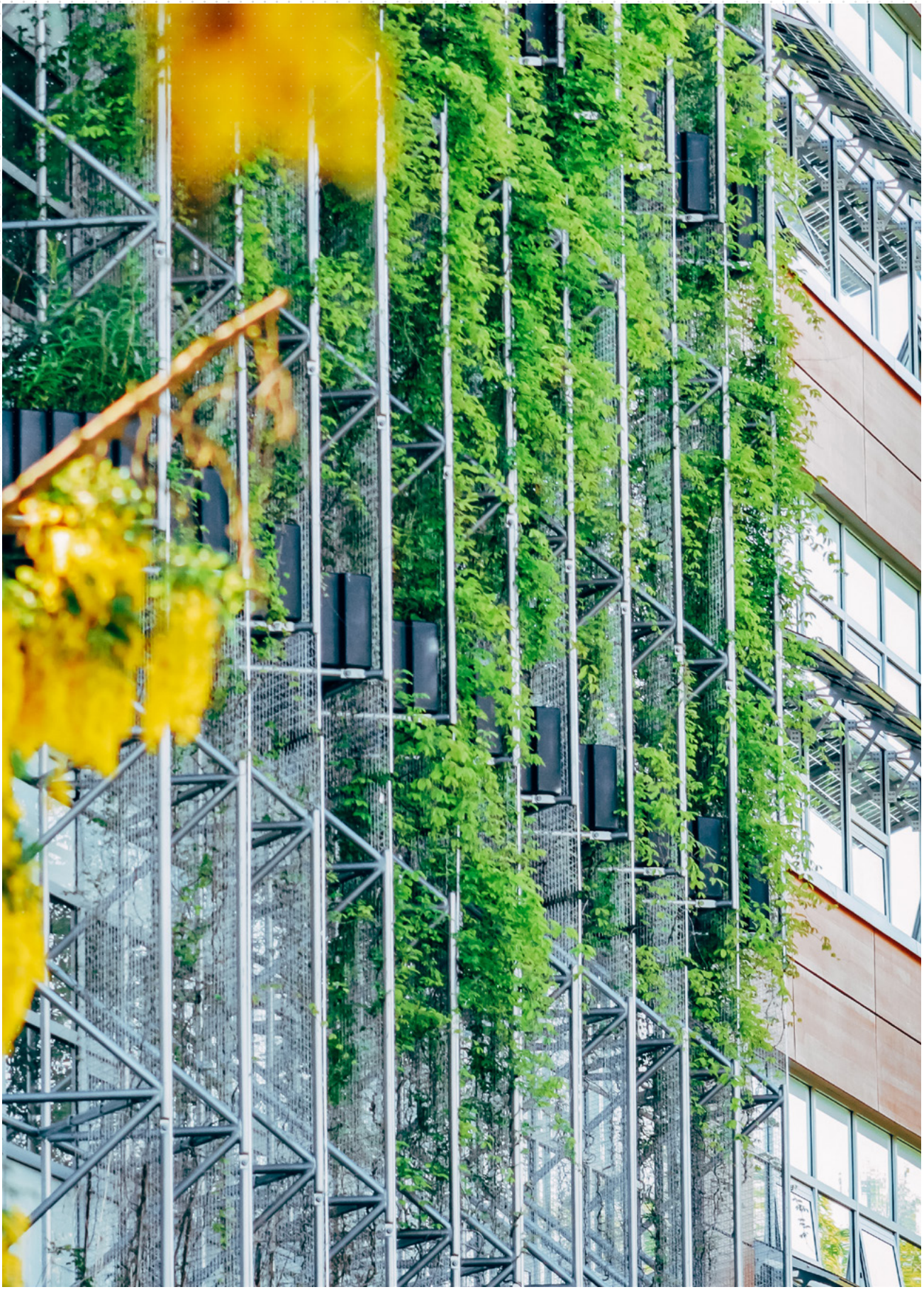
PHOTO CREDIT: PATKAU ARCHITECTS

Example: Beaty Biodiversity Research Centre

Description: At the Beaty Biodiversity Research Centre, the surrounding landscape is an important site for local biodiversity, and exterior screens on all sides of the building create a large-scale barrier which impedes birds from flying through.

Co-benefit: The screens are part of the building aesthetic also provide some shading and contribute to reducing the building's heat gain.

Bird friendly design strategy: Exterior screens

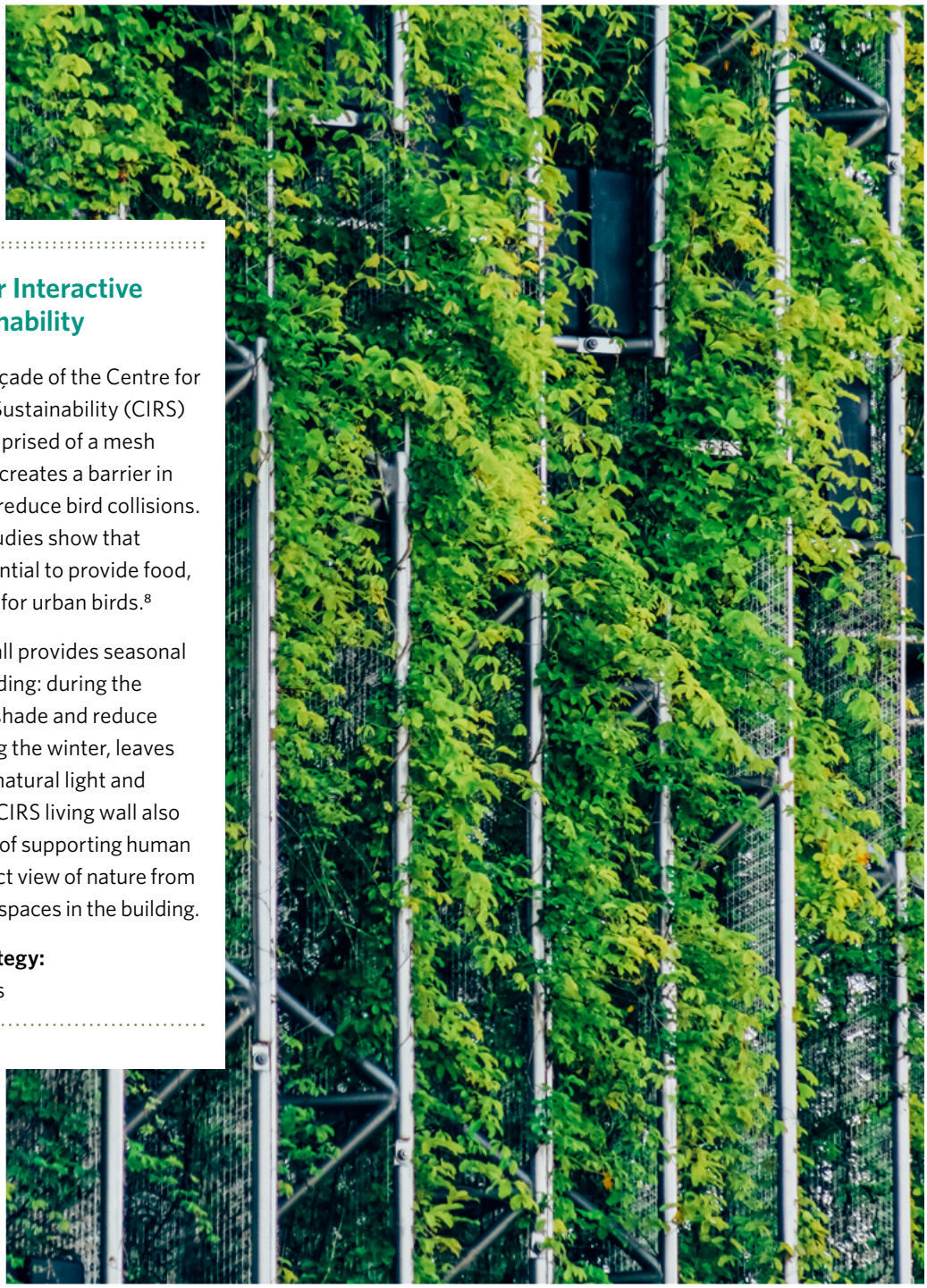


Example: Centre for Interactive Research on Sustainability

Description: The west façade of the Centre for Interactive Research on Sustainability (CIRS) features a living wall comprised of a mesh screen with vines, which creates a barrier in front of windows to help reduce bird collisions. Additionally, research studies show that living walls have the potential to provide food, shelter, and nesting sites for urban birds.[8]

Co-benefit: The living wall provides seasonal solar shading for the building: during the summer, leaves provide shade and reduce solar heat gain and during the winter, leaves drop and allow for more natural light and heat in the building. The CIRS living wall also expresses UBC's mission of supporting human health by providing a direct view of nature from circulation and gathering spaces in the building.

Bird friendly design strategy:
Living wall, metal screens



Centre for Interactive Research on Sustainability
PHOTOGRAPHER: PHILIP BERTOGGR

[8] Chiquet, Caroline, Dover, John W., & Mitchell, Paul. 2013. Birds and the urban environment: The value of green walls. *Urban Ecosystems, 16*(3), 453-462.

GLAZING DESIGN CONSIDERATIONS

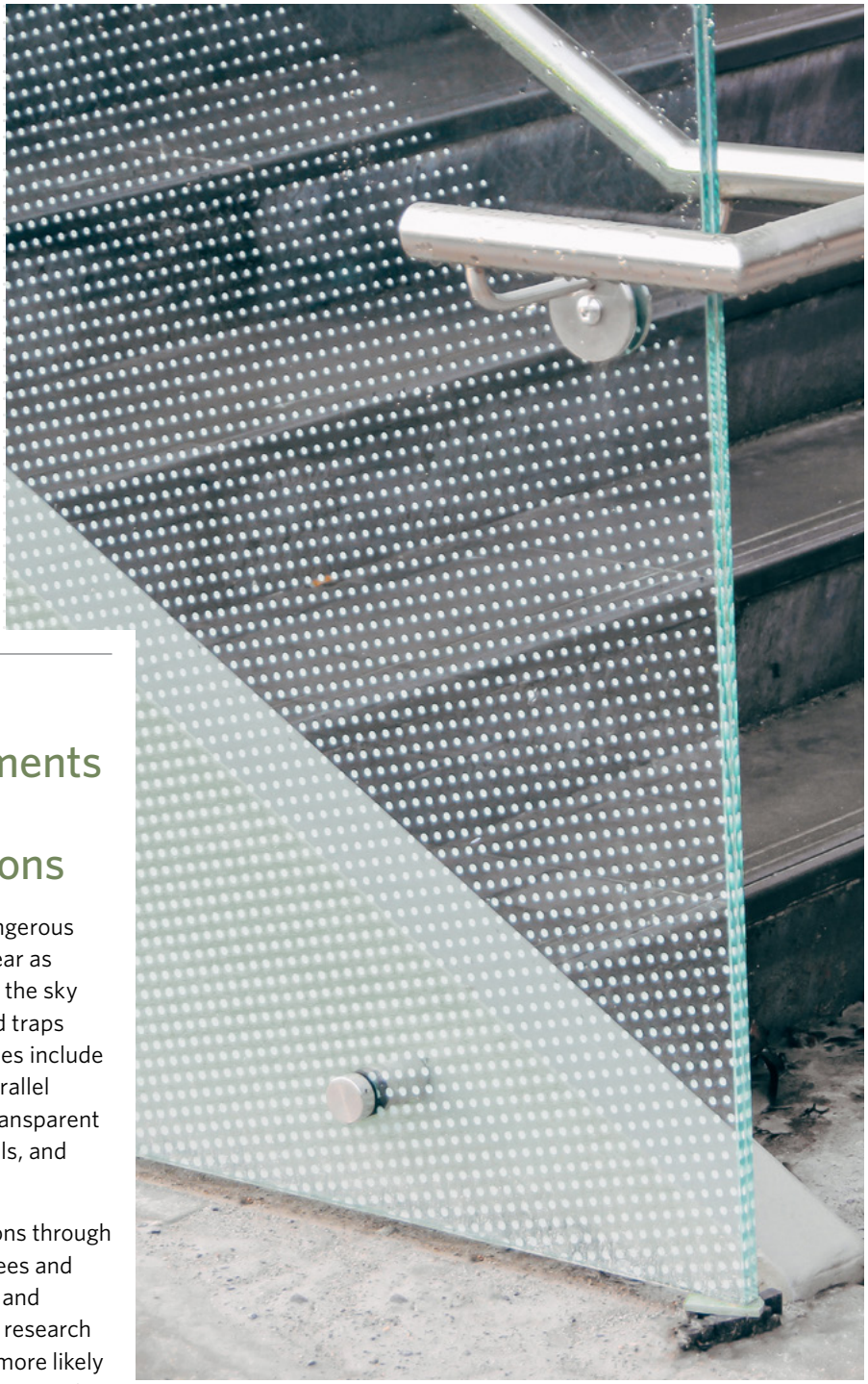
NEW BUILDINGS

Minimize the quantity of glass

Increase the visibility of glass

Block reflections of surrounding vegetation and sky

Design building elements and landscapes that minimize bird collisions



AMS Nest stairs
PHOTOGRAPHER: PENNY MARTYN

NEW BUILDINGS

Design building elements and landscapes to minimize bird collisions

- Prevent constructing the most dangerous fly through conditions, which appear as clear paths for birds to fly towards the sky or habitat on the other side, or bird traps where glass corners meet. Examples include glass corners without mullions, parallel glass (spaced 5m apart or less), transparent skywalks, glass guards or guardrails, and glass parapets.
- Reduce bird attractants in reflections through careful landscape design. While trees and shrubs provide necessary habitats and foraging sites for birds on campus, research studies have shown that birds are more likely to collide with glazed surfaces that are within 2 to 20 meters from vegetation.[9]
- Avoid interior plants near windows.

[9] Cusa, Marine, Donald A. Jackson, & Michael Mesure. 2015. Window collisions by migratory bird species: urban geographical patterns and habitat associations. *Urban Ecosystems, 18*(4), 1427-1446.

The UBC Campus Energy Centre's metal screens surrounding the upper floors create a large-scale barrier at the upper levels which prevents birds from flying through.

PHOTOGRAPHER: DANIELA ORBEGOSO CAMPBELL

STRATEGIES – 1. GLAZING DESIGN CONSIDERATIONS

Retrofit solutions

For existing buildings and glazing to achieve bird friendly design:

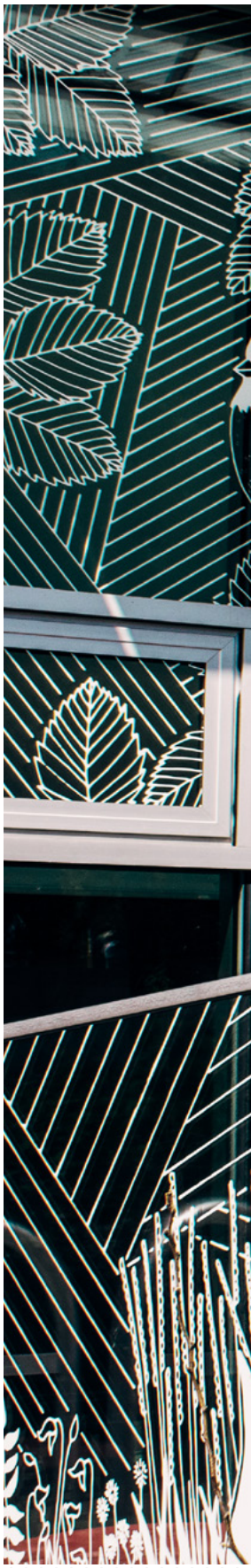
GLAZING DESIGN CONSIDERATIONS

RETROFIT SOLUTIONS

- Increase the visibility of glass
- Block reflections of surrounding vegetation and sky

Increase the visibility of glass

- **To existing glazed surfaces:** Utilize adhesive film patterns to create visual noise which breaks up the transparency of glass and prevents birds from perceiving it as clear to fly through.
- **To replaced windows and glazed surfaces:** Utilize adhesive film, acid-etch, frit patterns, or market-ready bird friendly glass to create visual noise and deter birds from flying through.
- To ensure such patterns are bird friendly, use high-contract and dense: spacing at a maximum 5cm x 5cm apart with markers no more than 0.32cm in size to provide an effective visual cue that alerts birds of glass *(see figure 1)*.
- Apply patterns onto the exterior surface of the glass (surface 1). Applications to surface 2 or surface 3 are less effective and may be obscured by reflections and rendered less effective.
- Pay special attention to target windows that have experienced many collisions in the past or are located near attractive sites for birds such as trees, shrubs, and ponds.
- Pay special attention to applying glazing strategies in the critical zone for collisions – up to the fourth floor of a building or mature tree height, whichever is greater, and up to 3.6m (12 feet) above a green roof *(see figure 2)*.
- Consider creative pattern designs that integrate bird friendly glazing practices with aesthetic expression to communicate the unique identity of the building and its connection to the surrounding landscape.
- Consider the placement and design of patterns to accomplish co-benefits in shading, views, and the privacy of building occupants.



Block reflections of surrounding vegetation and sky

- Utilize exterior screens, architectural mesh, and grilles to block reflections of vegetation and sky, and break up transparency.
- Consider combining bird friendly objectives alongside co-benefit features such as solar shading, energy saving, natural ventilation, and rain protection.

Example: Centre for Interactive Research on Sustainability

Description: "Albireo's Aviary" at the Center for Interactive Research on Sustainability is a bird-friendly film artwork displayed on the main floor of the building and was launched through a SEEDS Sustainability Program student art contest in 2017. The art piece utilizes creative designs of common campus birds and plants in an intricate, appropriately spaced pattern,[10] to reduce bird collisions in a highly vegetated corner of the building.

Co-benefit: "Albireo's Aviary" transforms traditional bird friendly glazing strategies into an educational artwork that raises awareness of the issue of bird collisions.

Bird friendly design strategy:
Adhesive film, occupant engagement

"Albireo's Aviary" at the Centre for Interactive Research on Sustainability
DESIGNED BY:
LORA ZOSIA MOON
PHOTOGRAPHER:
DANIELA ORBEGOSO CAMPBELL

[10] Note that this project followed a 5cm x 10cm spacing rule in alignment with the previous version of the Bird Friendly Design Guidelines For Buildings. The current guideline advises that gaps in designs are no more than 5cm x 5xm apart to lower the chance of collisions for smaller species, such as hummingbirds.

Beaty Biodiversity Museum south stairwell
PHOTOGRAPHER: DANIELA ORBEGOSO CAMPBELL

Niche Café
PHOTOGRAPHER: DANIELA ORBEGOSO CAMPBELL

Example: Niche Café + Beaty Biodiversity Museum

Description: At the Niche Café and south stairwell of the Beaty Biodiversity Museum, a contrasted 5cm x 5cm dot pattern film has been applied to the exterior surface of windows as a pilot for student research on bird collisions. Bird friendly film is a cost-effective, easily to install, off the shelf solution that can be applied as a retrofit strategy. Dot patterns minimally obscure views and have been tested through research as an effective solution.[11]

Bird friendly design strategy: Adhesive film, research

[11] Klem Jr., Daniel. 2009. Preventing Bird-Window collisions. *The Wilson Journal of Ornithology, 121*(2), 314-321.

Example: Library Gardens

Description: The guardrail at the Library Gardens uses laminated glass with a bird friendly dot pattern to provide visual cues of the glass and help reduce the chance of bird collisions.

Bird friendly design strategy: Bird friendly laminated glass prevents fly through conditions at glass guardrails.

Library Gardens guardrail
PHOTOGRAPHER: CHRISTA YEUNG

Example: Kenny Building Atrium

Description: At the Kenny building atrium, glazing close to vegetation was replaced using fritted glass using the 5cm x 5cm rule.

Bird friendly design strategy: Fritted glass

Douglas T. Kenny atrium
PHOTOGRAPHER: JAMES CORNELIA

STRATEGIES – 1. GLAZING DESIGN CONSIDERATIONS

Occupant strategies

For residents, building managers, staff, students, and visitors who want to improve bird safety:

GLAZING DESIGN CONSIDERATIONS

OCCUPANT STRATEGIES

- Increase the visibility of glass
- Block reflections of surrounding vegetation and sky
- Be wary of bird attractants and take simple, appropriate measures

Locate bird feeders within 0.5m from windows to help prevent collisions and to improve bird viewing.

PHOTOGRAPHER: DANIELA ORBEGOSO CAMPBELL

Increase the visibility of glass

- Utilize patterned window film or tape on glass to create visual noise which breaks up the transparency of glass and prevents bird from perceiving it as clear to fly through.
- Apply your own creative designs with oil-based makers, soap bars, shaving cream, or tempera paint in high contrast, dense patterns on the exterior surface of the glass.
- Place wind curtains or strings spaced at no more than 10cm apart outside windows. Wind curtains transform glass surfaces into an obstacle for birds to fly through and create effective visual noise.
- Whenever possible, close curtains or blinds, especially at glazed building corners, to create visual cues of the glass for birds. Please note that Interior curtains and blinds do not reduce reflections and this strategy should be paired with others to be effective.

Block reflections of surrounding vegetation and sky

- Apply exterior window screens and nets to block reflections of vegetation and sky and make glass more opaque and visible to birds.

Be wary of bird attractants and take simple, appropriate measures

- Move interior plants away from windows.
- Locate bird feeders within 0.5m from windows. From this distance, birds cannot build up the momentum to injure themselves if they collide with the window.

Ground level windows at the Beaty Biodiversity Research Centre

DESIGN BY:
DEREK TAN AND BEATY BIODIVERSITY RESEARCH CENTRE VOLUNTEERS

PHOTOGRAPHER:
DEREK TAN

Example: Beaty Biodiversity Research Centre

Description: The Beaty Biodiversity Research Centre (BBRC) features a series of ground-floor full-height windows facing an open vegetated courtyard, which attracts many birds during migration months. BBRC staff had identified these courtyard windows as a hotspot for collisions and decided to take action. Using a design from Derek Tan, Digital Media Specialist at the Beaty Biodiversity Museum, a team of volunteers got together to draw and trace their own bird friendly design using oil-based markers.

Co-benefits: This occupant strategy is both a quick and low-cost bird collision prevention method that can be applied on any ground-level windows. Design patterns can enhance the aesthetic qualities of a building while showcasing and connecting occupants with the research that happens inside. Organizing bird-friendly art activities is a fun, cost-effective method to engage occupants with sustainability projects on campus and to foster a sense of ownership and community.

Bird friendly design strategy: Oil-based marker pattern, occupant engagement

STRATEGIES – 1. GLAZING DESIGN CONSIDERATIONS

Ineffective strategies

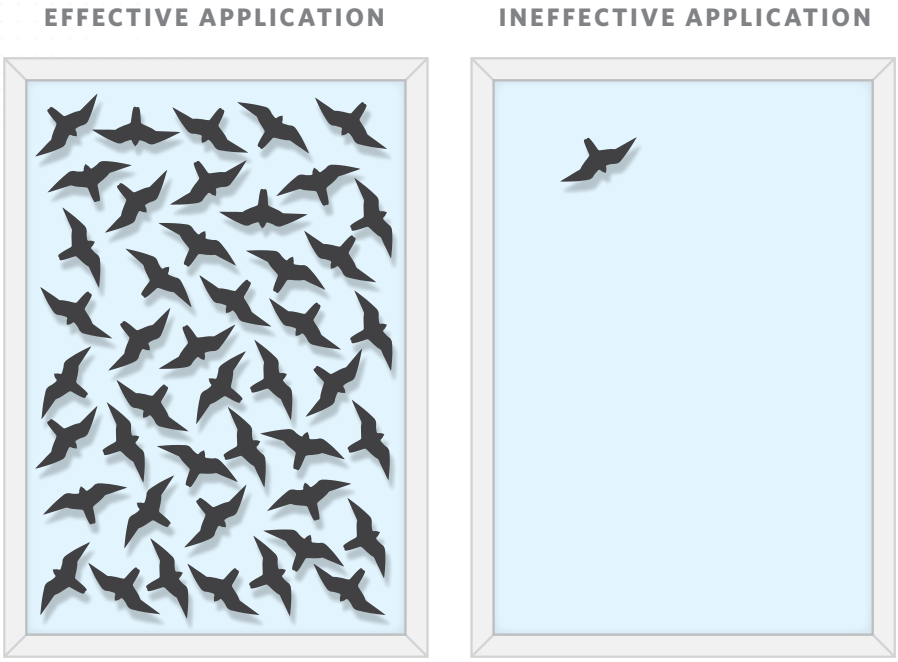
The following strategies, although popular, have been proven to be ineffective by research:

INEFFECTIVE STRATEGIES

- Single bird of prey decals
- Angled glass
- Tinted glass
- Interior screens and blinds

Single Bird of Prey Decals

- Contrary to popular belief, decals and printed images of silhouettes of hawks, eagles, and other birds of prey do not frighten birds away from windows.[12] To be effective, all decals must follow the 5cm x 5cm rule *(see figure 1)* and be applied to the exterior of glazed surfaces.



[FIG 3] *Diagram of ineffective vs. effective window decalling on windows.*
SOURCE: FLAP CANADA

[12] Brisque, Thaís, Lucas Andrei Campos-Silva, & Augusto João Piratelli. 2017. Relationship between bird-of-prey decals and bird-window collisions on a Brazilian university campus. *Zoologia, 34,* 1-8.

A Gold Crowned Kinglet at UBC killed by a collision with a window

Angled Glass

- While angling glass panes downward has been suggested as a strategy in the past, due to the lack of scientific evidence supporting its effectiveness, angled glass is not a bird friendly design strategy.

Tinted Glass

- There is not definitive research that tinted glass reduces bird collisions.

Interior Screens and Blinds

- Although interior screens and closed blinds provide some visual cues of glass, they do not prevent reflections. However, they can be effective strategies on glass walkways and other areas where transparency is the primary issue in creating bird window collision risk.

2. Bird Trap Reduction

Birds can become trapped in enclosed spaces while exploring potential nesting sites. To prevent this, use screens to secure enclosed spaces such as mechanical ducts, pipes, and intake and exhaust vents.

PHOTOGRAPHER:
PENNY MARTYN

Description: Screens to secure exhaust vents with large openings helps prevent bird entrapment.

STRATEGIES – 3. LIGHT POLLUTION REDUCTION

3. Light Pollution Reduction

Light pollution attracts and disorients migratory birds at night and subsequently leads to an increased number of building collisions during the day.

In addition to contributing to increased bird mortality rates, overly-lit buildings waste electricity and energy costs. At UBC energy use reduction is a major goal, and incorporating more effective lighting strategies presents the opportunity to reduce light pollution while creating a safer environment for migratory birds.

The following strategies are for campus operational staff, architects, designers, and building occupants to help reduce light pollution and bird collisions:

Reduce light trespass from interior sources

- Use minimum wattage fixtures appropriate for the use.
- Switch off lights or draw blinds after hours to reduce light pollution.
- Install motion-sensitive lighting, particularly in lobbies, walkways, and corridors.
- Implement a program to turn off all unnecessary lights after hours or install an operational system to automatically turn lights off. If the building is used frequently after hours, use the same measure to ensure lighting levels are appropriately adjusted during all nighttime hours.
- Turn off unnecessary lights after hours. While this should be done year round, it is particularly important to switch off indoor lights during migration months in spring and fall.

Reduce light trespass from exterior sources

- Use minimum wattage fixtures appropriate for the use.
- Reduce spill light through targeted lighting and shielding. Down lighting is required on campus while up lighting and vanity lighting should be avoided in most circumstances.
- Use green or blue light before white and red light. Research suggests that nocturnally migrating birds are disoriented from their flight path and attracted to the long-wavelength radiation in red and white light.[13]

Description: Standard freestanding light fixture for pedestrian areas – Selux Saturn 2 Cutoff.

PHOTOGRAPHER:
PENNY MARTYN

[13] Poot, Hanneke, Bruno J. Ens, Han de Vries, Maurice A. H. Donners, Marcel R. Wernand, & Joop M. Marquenie. 2008. Green light for nocturnally migrating birds. Ecology and Society, 13(2), 47.

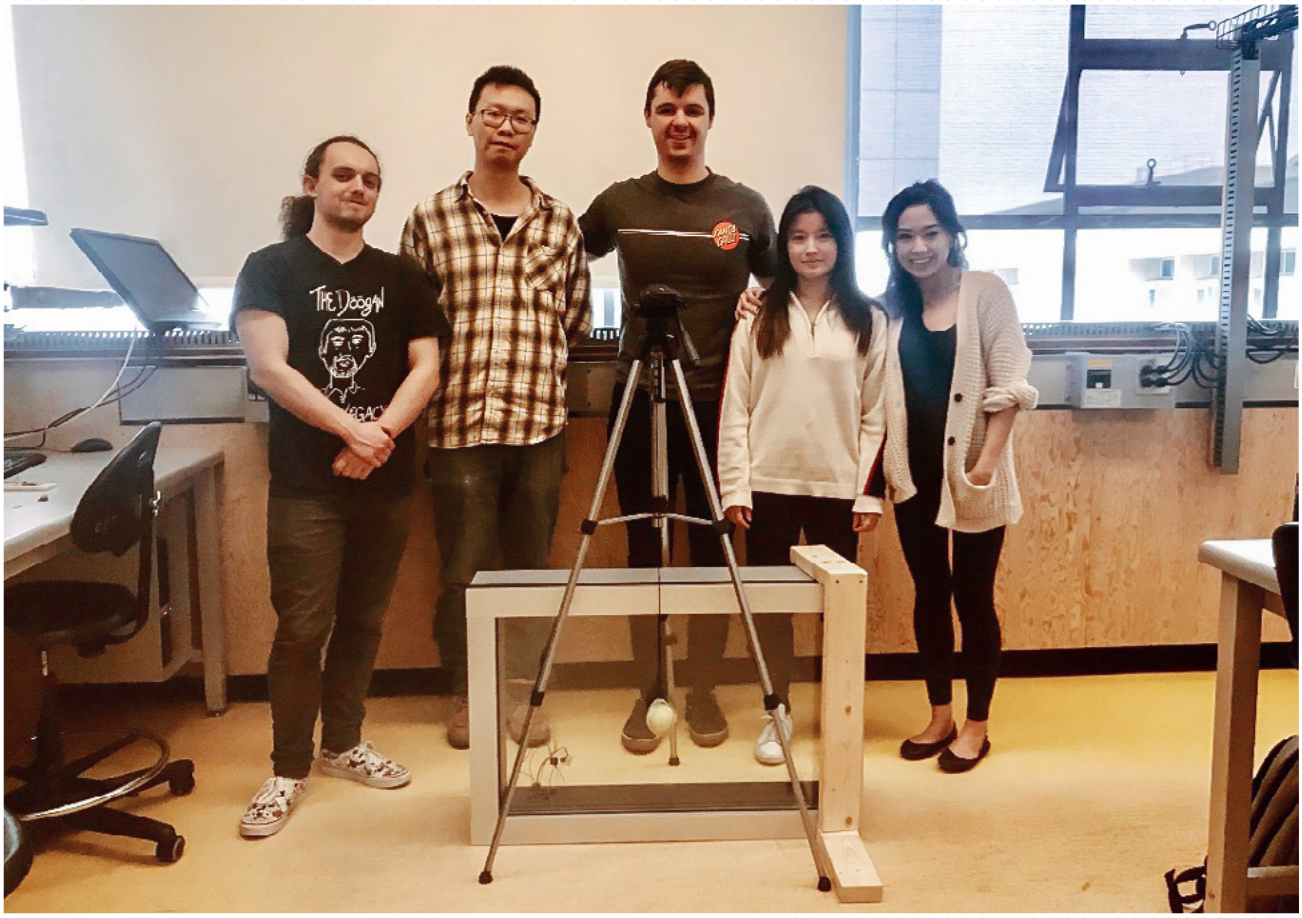
4. Connections to Research

UBC is a living laboratory[14] and a place where faculty, staff, and students collaborate to explore, study, test, and apply lessons learned for the advancement of sustainability on campus.

Research on bird collisions is growing and many more studies are needed to understand the complexity of the issue and raise awareness of its impact on campus biodiversity. UBC encourages building projects and campus operations to connect to research through the following methods:

- Partner with student research to monitor bird collisions and pilot solutions. Since 2015, UBC staff have collaborated with students, faculty, and external partners like Environment and Climate Change Canada through the SEEDS[15] Sustainability Program to investigate bird collision rates, risk factors, and even install art that raises awareness of the issue. Further research to test the effectiveness of bird friendly design strategies at UBC as they are adopted over time could be explored.
- Report bird collisions through Global Bird Collision Mapper and contribute to a growing body of knowledge to understand and raise awareness for bird collisions. FLAP (Fatal Light Awareness Program) is a non-profit organization which records and shares global data on the locations and frequency of bird collisions. For birds found around the Beaty Biodiversity Research Center, visit their bird collision reporting database.
- Conduct a BirdSafe audit with a trained FLAP Canada consultant. Bird friendly strategies are highly contextual and specific to each building. A building-specific audit can ensure that bird collision risks are recognized and design strategies are tailored to the site.

[14] See UBC's Campus as a Living Laboratory commitment at: *https://sustain.ubc.ca/campus-living-laboratory*
[15] See "bird collisions" in the *SEEDS Sustainability Library* to read all published research reports.



Example: Bird Impact Detection Monitor SEED's Research Project

Project team: Emily Xiong, Susanna Chen, Kieran Morton, Stevan Vicentijevic, David He

Strategy: Student research

The Bird Impact Detection Monitor project was conducted in collaboration with Electrical Engineering students and Dr. Paul Lusina through the SEEDS program with the aim to design and build an automated system that accurately detects and records bird collisions with minimal maintenance. This prototype takes the first step in being able to provide better monitoring of bird collisions at UBC and beyond. By automating the bird collision study process, the monitor could provide necessary data for future studies and potentially replace the current manual data collection methods used in the field.

Cost Effective Measures

Bird-friendly design does not need to add significantly to construction costs in new buildings and retrofits. Additionally, innovative bird friendly design solutions can have many additional co-benefits.

Creative glass pattern designs can be both bird friendly and provide other co-benefits including: artistic expression of building function, light modulation, provision of privacy and reduction of glare. Thoughtful incorporation of grilles, mesh, or exterior screens can be intrinsic to building design, reduce bird collisions, and save energy as well as improve thermal comfort through reductions in solar heat gain. Sunscreens are often installed to reduce heat gain and prevent glare for occupants, but also create a physical barrier which prevent reflections and mitigate collisions.

Bird friendly design strategies can be strategically applied to the most hazardous parts of a building rather than the entire building. This includes the first 4 storeys or up to the highest mature tree height, and up to 3.6m above a green roof. Building audits can be performed that identify the most hazardous glazing in an existing building helping to target the appropriate windows for retrofit solutions.

Avoiding certain design features altogether also helps prevent bird collisions without any additional cost. For example, fly through conditions (e.g. Transparent skywalks), which appear as clear paths for birds to fly towards the sky or habitat on the other side, can often be specifically avoided or treated appropriately if considered early in the design process.

Appendix: Guide to Bird Friendly Design Strategies

DESIGN STRATEGY	BIRD FRIENDLY EFFECT	POTENTIAL CO-BENEFITS	BIRD FRIENDLY EFFECTIVENESS	COST
BIRD FRIENDLY GLASS STRATEGIES				
Frit or acid etched patterns on glass	Increased visibility of glass reduces fly through conditions and reflections	Privacy, light modulation	High	$$
Frit or acid etched patterns on glass: custom design	Increased visibility of glass reduces fly through conditions and reflections	Building identity, messaging, privacy, light modulation	High	$$ - $$$
UV patterns on glass	Increased visibility of glass reduces fly through conditions and reflections	Looks like clear glass and preserves occupant views	High	$$$
Adhesive film: off the shelf patterns	Increased visibility of glass reduces fly through conditions and reflections	Privacy, light modulation, easy to retrofit	High (limited service life)	$
Adhesive film: custom design patterns	Increased visibility of glass reduces fly through conditions and reflections	Building identity, messaging, privacy, light modulation, easy to retrofit	High (limited service life)	$$
Exterior screens or mesh	Increased visibility of glass reduces fly through conditions and reflections	Reduced solar heat gain	High	$$
Exterior sunshades	Increased visibility of glass reduces fly through conditions and reflections	Reduced solar heat gain in summer, reduced glare for occupants	Partial	$$
BUILDING DESIGN STRATEGIES				
Reduce window to wall ratio	Reduced expanse of transparent glass	Energy efficiency	Partial	zero
Avoid glass corners	Reduced expanse of transparent glass	—	Partial	zero
Avoid parallel glass	Reduced expanse of transparent glass	—	Partial	zero
Avoid clear glass guards + parapets	Prevent fly through conditions	Increases safety for humans	Partial	$
Living wall	Creates barrier to prevent fly through conditions	Connection to nature, shading, creates bird habitat	Varies	$$$
OCCUPANT STRATEGIES				
Draw designs on outside of window glass	Increased visibility of glass reduces fly through conditions and reflections	Engages occupants, building identity, messaging	High (limited service life)	zero
Draw blinds	Partial visual noise reduces fly through conditions and reflections	Saves energy, engages occupants	Partial	zero
Occupants or building management systems turn lights off at night	Prevent attraction of migrating birds	Saves energy	Partial	zero
Correct placement of bird feeders close to windows	Prevents birds from fatal collisions	Engages occupants	Partial	zero
Placement of interior plants	Prevent bird attraction behind glass	Engages occupants	Partial	zero
OCCUPANT STRATEGIES				
Dark sky compliant light fixtures	Avoids attracting migrating birds	Decreases light pollution, meets other requirements (e.g. LEED, REAP)	Partial	zero
Mesh over ventilation grates	Avoids trapping birds	Meets other requirements (Technical Guidelines)	High	zero

References

- De Groot, Krista L., Allison N. Porter, A.R. Norris, Andrew C. Huang. In prep. Year-round monitoring reveals a unique seasonal pattern and species affected by bird-window collisions along the West Coast of North America.
- FLAP Canada. Bird Safe. https://birdsafe.ca
- Audubon. Guide to North American Birds. https://www.audubon.org/bird-guide
- City of Calgary. 2011. Bird-Friendly Urban Design Guidelines: Integrating Natural Systems with Human Activities 2011. http://www.calgary.ca/PDA/pd/Documents/Centre-City/Centre-City-Policies/bird-friendly-design-guidelines.pdf
- City of Toronto. 2016. Best Practices for Bird Friendly Glass. https://www.toronto.ca/city-government/planning-development/official-plan-guidelines/design-guidelines/bird-friendly-guidelines/
- CSA Group. 2018. CSA A460, Bird-friendly building design (Draft Review).
- Hager, Stephen B., Bradley J. Cosentino, Kelly J. McKay, Cathleen Monson, Walt Zuurdeeg & Brian Blevins. 2013. Window area and development drive spatial variation in bird-window collisions in an urban landscape. *PLoS ONE. 8*(1):e460.
- New York City Audubon. 2007. Bird-Safe Building Guidelines. http://www.nycaudubon.org/our-publications/bird-friendly-building-design
- University of British Columbia. 2018. Pathway to a Net Positive Campus: UBC Green Building Action Plan. https://planning.ubc.ca/vancouver/sustainability-operations/green-buildings

American Robin
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