A national standard for bird-friendly building design

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By Daniel Klem, Jr., PhD

 [1]*Photos courtesy P. G. Saenger, Acopian Center for Ornithology, Muhlenberg College, Allentown, Pa.*

More than four decades of comprehensive scientific research have documented and experimentally validated the very lethal consequences sheet glass pose to birds. Free-flying wild birds behave as if clear and reflective windows are invisible to them. Billions of avians are killed striking sheet glass installed as windows of all sizes, walls covering entire structural façades, atria, outdoor railings, and noise barriers lining roads and railways. The annual avian toll is estimated at 16 to 42 million in Canada and 365 to 988 million in the United States. To address this unintended and unwanted killing of birds, the federal government commissioned the National Standard of Canada group to prepare the Canadian Standards Association (CSA) A460:19, *Bird-friendly building design*, in order to help building industry professionals, including architects, developers, and owners, to make structures safe for birds. Guided by the science and several existing municipal and private bird-safe regulations in North America, the application, utility, and reach of CSA A460:19 is global even though it was created specifically for Canada.

Not only is it a moral and ethical obligation and responsibility to make the human-built environment safe for birds, but also a growing number of federal, provincial, and local governments are requiring and implementing bird-safe bills, codes, ordinances, zoning regulations, and other legislation. Thanks to the collaborative efforts of the Fatal Light Awareness Program (FLAP) and the environmental legal firm Ecojustice, the City of Toronto was the first municipality to enact mandatory bird-safe building practices for new construction. This legislative milestone has stimulated similar measures throughout North America and Europe.

 [2]Acid-etched line patterning used on the outside window surface in order to prevent bird-window collisions at the Berks County Nature Center in Reading, Pa.

Legislations

The most prominent international bird protection legal agreements relevant to avian mortality at windows for Canada are the *Migratory Birds Convention Act* (*MBCA*) and *Species at Risk Act* (*SARA*). Their equivalents are the *Migratory Bird Treaty Act* (*MBTA*) and *Endangered Species Act* (*ESA*) in the United States and the *Birds Directive of the European Commission* in the European Union. For North America regionally, protecting birds from windows is authorized under the *Environmental Protection Act* (*EPA*) in Ontario, and the B3 Program (Building, Benchmark, and Beyond) in Minnesota.

Although regional legislation is almost exclusively directed at retrofits, remodels, and new construction of government buildings, the hope is mandatory bird-safe practices will serve as a model and example to emulate in private commercial structures.

Specific mandatory ordinances and zoning regulations to prevent bird-window collisions at government and commercial buildings have been adopted by the municipalities of Markham and Toronto in Ontario.

Voluntary recommendations have been formalized in Calgary, Alta., and Vancouver, B.C. The drafting of each of these legislative policies have been inspired by bird-safe building design guidelines published by the American Bird Conservancy (ABC), and the planning authorities and their avian conservation co-operators in the cities of Calgary, Markham, Toronto, and Vancouver.

An obvious prediction is as awareness of the problem and growing solutions continue to emerge, legislation to protect birds from sheet glass will grow accordingly until it is required everywhere.

CSA A460:19

According to CSA A460:19, design strategies to minimize the risk of bird-building collisions are:

- treatment of glazing materials;
- building integrated permanent structures;
- overall building and site design; and
- lighting.

 [3]Yellow-throated Vireo killed striking a patio door.

Treatment of glazing

Regarding glazing, a minimum of 90 per cent of sheet glass in a building must be treated where a fly-through or reflective habitats create illusions and risks of a bird strike. The full glazing surface must be treated for non-vision (spandrel glass, shadow boxes, privacy) sheet glass. Birds have fatal collisions attempting to reach their habitat and sky on the other side of clear windows, or when trying to reach the illusion of habitat and sky reflected off of windows covering dark interior spaces. To make sheet glass safe, visual markers are used to transform glazed surfaces into barriers birds can see and avoid. To be effective, the application of visible-to-birds markers must uniformly cover the glass surface, and form contrasting patterns consisting of absorbing and reflecting elements. Among other options yet to be discovered, markers can be created using acid etching, ceramic frit, printing on film, non-film adhesives, and ultraviolet (UV) patterning applied to inorganic sheet glass and organic films. For most applications, organic films are used to retrofit existing structures, and novel bird-safe sheet glass is for remodelling and new construction.

These marker elements can be of any shape, minimally 4 mm ($^{5}/_{32}$ in.) in diameter or 2 mm ($^{5}/_{64}$ in.) wide x 9 mm ($^{19}/_{64}$ in.) long, if linear. They should be separated no more than 50 mm (2 in.), have high contrast with the background, and applied to the outside exterior glass surface. No matter the marker shape (dots, lines, diamonds, etc.), they

will effectively deter bird strikes if applied using the 2 x 2 Rule, meaning if separated by 50 mm either in horizontal rows or in vertical columns. Multi-paned glass is an effective visual marker that birds avoid if horizontal and vertical mullions create at most 100 x 100-mm (4 x 4-in.) subdivisions.

 [4]Visual markers can be applied to make sheet glass safe for avians.

The height of marker treatment on any façade is critical. It must be 16 to 25 m (52.5 to 82 ft) above grade. The limits of treatment are associated with the prospective height of mature trees seen through or reflected off the glazing that provides an attractive illusion to birds. Exceptions to these limits occur when buildings are placed within ravines or at varying heights relative to different grades near bird-attracting vegetation seen through or reflected in higher heights or in the entire glazing. At these sites all or the glass above the reflected mature vegetation must be treated with protective markers.

Integrated building structures

Integrated and permanently installed building structures, such as recessed windows, awnings, sunshades, screens, grilles, mesh, shutters, louvers, decorative façades wrapping entire structures, and balconies or overhangs providing shading below their projections qualify as preventive bird collision applications. Each of these options reduce the amount of visual glass, mute reflections during certain times of day, and provide visual cues for birds to avoid the area. They can be used in retrofitting an existing structure, or as design features of new buildings. An example is the grille placed in front of the windows of the *New York Times* building in New York City.

Traditional insect screening placed over windows eliminate bird strikes by preventing a flying bird from hitting the unyielding glass surface while absorbing the force of the impact. Widely spaced net openings covering the outside of glazing can do the same, but caution is advised when selecting materials and mesh size and during installation to prevent birds from entering and becoming trapped between the netting and glass surface. These external net coverings also trap unwanted leaves and other debris, thus requiring continuous maintenance. With the exception of insect screening and similar netting, the collection of optional integrated structures reduces but does not eliminate the risk of bird strike casualties as long as some areas of sheet glass, no matter how small, are exposed in a façade.

Design

Additional considerations of where a building is proposed to be constructed must be examined to reduce the risk of bird mortality. Site locations increasing the risk of fatal bird strikes exist near natural avian habitat and along known migratory flightpaths. Research studies have repeatedly revealed the two principal features that best explain the number of birds dying from striking windows at any one location are the amount of sheet glass covering a building and the associated vegetation attracting birds to within the immediate vicinity of the window surface, within 10 m (33 ft).

[5]The visual markers on a glass façade must be at least 16 to 25 m (52 to 82 ft) above grade to ensure reflections of nearby trees do not create an attractive illusion to birds.

A building designed with 25 to 40 per cent glass surface, a relatively low window to wall ratio, reduces lethal bird strikes. It is recommended to reduce see-through effects on buildings, such as glass-lined bridges, corridors (linkways), the walls around atria, outdoor railings, glass panels as noise barriers, and where sheet glass walls meet in corners, or treat these respective clear panes with markers following the 2 x 4 Rule. It is advisable to not design and construct buildings with glass-lined courtyards or open-topped atria unless bird-safe glass is used. Even then, in the case of open-topped atria, netting or another roof barrier must be installed to prohibit bird access.

Ventilation grates below or near windows must have openings no greater than 20 x 20 mm ($^{25}/_{32}$ x $^{25}/_{32}$ in.) or 40 x 10 mm (1 $^{19}/_{32}$ x $^{13}/_{32}$ in.) to prevent injured and dead strike victims from passing into wells they cannot escape or be retrieved from, respectively. Interior plants should not be placed near untreated windows such that they are visible as birds may attempt to fly to them. Bird feeders must be placed not more than 0.5 m (2 ft) from the surface of a window. Birds the size of a sparrow perched just a bit over 1 m (3 ft) from the glass surface can fly into a window and kill itself outright. Attractants such as bird feeders and vegetation placed within 0.5 m of the window surface protect birds by limiting their ability to build up enough momentum to injure or kill themselves.

Lighting

Exterior lighting should be installed to project downward with no upward leakage, to be dark sky compliant. For commercial buildings, it is recommended to prevent interior lighting from entering the outdoors where it can attract birds to the window hazard after business hours, and from sunset to sunrise in all buildings. During nighttime, wherever possible, it is recommended to use task lighting instead of section building luminaires.

Bird strikes and consequent fatalities at night are rare events, occurring almost exclusively over urban areas in North America, during inclement weather with low cloud cover, forcing nocturnal migrants to fly lower on passage and to be attracted to projecting city lights from high-rise buildings. Both birds and moths are attracted to lights, and the brighter the light, the greater the attraction. The deceptive feature of sheet glass is not an issue under these conditions. However, light-attracted birds swirl in and out of the light. They are as likely to injure or kill themselves hitting one another as the birds are, in this situation, the high-rise buildings. As the birds move around the light they become exhausted, flutter to the ground, and are then in the canyons of concrete and glass where they become vulnerable to clear and reflective windows. Keeping lights from attracting birds to the vicinity of building windows at all levels of elevation will reduce the risk of a fatal strike.

The lethal hazard glass poses for birds will not go away unless the measures described in CSA A460:19 are enacted. Unlike the intractable complexity of solving the problems created by climate change, building professionals can solve the fatal hazard glass poses for birds. This can be an environmental challenge with a happy ending, but it will not be so unless architects, developers, and building owners collaborate with those interested in protecting birds, and act to make designs and actual structures safe for birds.

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Endnotes:

1. [Image]: https://www.constructioncanada.net/wp-content/uploads/2019/11/UBC-1-High-Rise-Rec-11-IX-2019-by-P-G-Saenger.jpg
2. [Image]: https://www.constructioncanada.net/wp-content/uploads/2019/11/Berks-Cnty-Nat-Cntr-Inside-View-3-21-VIII-2019-P-G-Saenger-DSC_0041.jpg
3. [Image]: https://www.constructioncanada.net/wp-content/uploads/2019/11/YT-Vireo-door-by-P-G-Saenger-Rec-20-VIII-2019.jpg
4. [Image]: https://www.constructioncanada.net/wp-content/uploads/2019/11/UBC-2-High-Rise-Rec-11-IX-2019-by-P-G-Saenger.jpg
5. [Image]: https://www.constructioncanada.net/wp-content/uploads/2019/11/UBC-3-High-Rise-Rec-11-IX-2019-by-P-G-Saenger.jpg
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