

## Designing bird-friendly buildings

### Preventing collisions with bird protection glass solutions

Glass is an essential material in buildings. It benefits occupants by providing the natural daylight necessary for health and well-being, offers architectural freedom in design as well as visual connections with the outdoors and nature.

While all these benefits are made possible by the transparency and reflectivity of glass, in some cases these can pose a risk for birds.

**Bird fatalities from collisions with glass are unintentional**, they occur either because birds are unable to distinguish visually between transparent elements and air or because they mistake the reflection of trees or sky in glass. Bird collisions with glass can result in injury or death.

If this situation is known for years, it has recently gained attention even though the scale of the problem remains largely unknown due to limited data availability. With numerous bird populations in decline, the expansion of cities and buildings and the increased pressure on bird ecosystems due to climate change, there is now a greater desire to prevent bird-facade collisions.

To address this situation, the flat glass industry has been **proactively developing solutions to reduce collisions and preserve biodiversity**.

These so-called “*bird friendly products*”, developed over the last decade, **mark the glass so that it is more visible or reflective to birds**. In parallel, **these solutions maintain occupants’ comfort, thermal insulation and solar control properties**.

Glass for Europe publishes this paper to shed light on the risks of bird collisions with glass. It outlines the availability of a wide range of glass technologies that can prevent bird collisions while maintaining the energy efficiency, comfort and sustainable benefits of glazing in buildings.

*Glass for Europe is the trade association for Europe’s flat glass sector. Flat glass is the material that goes into a variety of end products, primarily in windows and facades for buildings, windscreens and windows for automotive and transport as well as solar energy equipment, furniture and appliances. Glass for Europe brings together multinational firms and thousands of SMEs across Europe, to represent the entire building glass value-chain. It is composed of flat glass manufacturers, AGC Glass Europe, Guardian, NSG-Group, Saint-Gobain Glass Industry, Şişecam and works in association with national partners gathering thousands of building glass processors and transformers all over Europe.*



## 1. Why do birds collide with glass?

Birds, like humans, orient themselves visually and therefore need to see where they are going. It means that while flying, birds can collide with vertical glazing surfaces, as well as advertising hoardings or bus shelters. The causes and correlations of when and why bird collisions occur are not fully understood. In the case of glass, the reasons are related to its main properties namely:

- **Transparency:** Without visible barriers or strong brightness differences between the areas on both sides of the glass, birds are unable to recognise glass as a solid object and do not distinguish it with air. The risk of collision due to transparency increases with corner glazing or if a second window on the rear wall suggests the possibility of flying through. It also increases with lighting behind the glass in the evening as birds are attracted to it.
- **Reflectivity:** In some cases, collisions happen because glass panes reflect the outside world (trees, bushes, other birds, etc.), a known environment for birds which will mislead them in flying towards it. Such collisions mostly occur when the area behind a pane of glass is darker than the area in front. This is particularly problematic during migration when birds are travelling often long distances and are therefore unfamiliar with their surroundings.

If the reasons are known, the **scale of the problem remains difficult to assess**. Though there is no exact number, experts in the field estimate that millions of birds die each year in Europe as a result of collisions with glass. Other regions of the world are obviously also concerned. The number in the United States is estimated between 365 million and 1 billion birds killed annually. However, collisions are not always fatal to birds and birds do not always die immediately on impact. It is therefore complicated to fully apprehend the scale and root causes of the issue.

## 2. How to address the issue?

Birds collision have received varying levels of attention in the EU Member States. The most ambitious ones have set requirements either at national or regional/city level.

For instance, in Germany, the Federal Nature Conservation Act<sup>1</sup> (Bundesnaturschutzgesetz) requires paying special attention to the safety of animals and the protection of biodiversity. However there is no official standard or legal threshold for when there is a *"significantly increased risk of killing"* in the case of bird strikes. It is therefore the responsibility of nature conservation authorities to assess the risk before new buildings are constructed. As part of their evaluation, the authorities will look at the size, transparency, reflectivity and arrangement of glass panes, lighting and exposure of the building.

Guidelines also exist at the regional or city-level to raise awareness and anticipate future legislations<sup>2</sup>. It is for example the case in Helsinki (Finland) where a new guideline was recently published. This presently non-binding document is meant to become part of the construction requirements in 2027.

Despite the lack of coherent legislations, there is **a commonly accepted testing method in Europe<sup>3</sup> for bird protection glass solutions**. To achieve consistent and measurable results in assessing the effectiveness of a marking specifically designed to be visible by birds, a methodology is needed that

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<sup>1</sup> [https://www.bmu.de/fileadmin/Daten\\_BMU/Download\\_PDF/Naturschutz/bnatschg\\_en\\_bf.pdf](https://www.bmu.de/fileadmin/Daten_BMU/Download_PDF/Naturschutz/bnatschg_en_bf.pdf)

<sup>2</sup> Available [here](#) in Finnish.

<sup>3</sup> It is worth noting that in other parts of the world, such as North America, the issue is much more considered and there are other test methods such as the [American Bird Conservancy/Powdermill test](#). However, this test differs from Hohenau-Ringelsdorf, which tests both visibility (glass walls, railings, approach from both sides) and reflection (façade, windows, approach from one side), whereas ABC/Powdermill only tests visibility.



concentrates collisions in specific, easily manageable zones while maintaining consistent control over key variables. The laboratory with the most knowledge about the effectiveness of such markings on glass is the Hohenau-Ringelsdorf Biological Station in Austria.

The test consists in sending birds through a tunnel which has two adjacent panes of glass, one with a test marking (the test pane), the other an unmarked glass pane (the reference pane)<sup>4</sup>. The test allows to assess how birds react under reflection-free transparent conditions and to the effects of reflections. Should the glass marking be effective, birds will recognise an obstacle and have an active avoidance response (such as stopping or changing direction).

The test results are categorized in 4 levels (presented below), with the following values applying to both the transparency test and the reflection test. **A result of below 10% is considered highly effective** (it means that at least 90% of the birds flew towards the unmarked reference pane, proving that the markings are readily perceived by birds) and a **result between 10 and 20% is effective** under certain conditions such as the location of the building or the light conditions.

		Bird flights toward the test panes (%)
Category A	Highly effective	0-10
Category B	Conditionally effective	>10-20
Category C	Barely effective	>20-42
Category D	Not effective	>42

### 3. Addressing the problem with bird-friendly solutions

Flat glass manufacturers have **developed top-performing markings through research and development** and extensive collaboration with professional ornithologists. These markings are visible to birds **but do not alter the thermal and solar control properties**.

To be effective, **markings** (whether it is stripes, dots or other shape) **must be of a certain minimum size and cover the entire glass surface**. It allows birds to perceive them at a distance and react in time which is not the case of bird stickers which have been proven ineffective.

The wide variety of bird friendly glass and glazing solutions can be easily adapted to project criteria based on cost, aesthetics and performance. However, every solution must be tested in combination with the coated glass and the final insulating glass unit composition (IGU). Markings can be made on different types of glass such as:

- **Patterned glass:** This type of glass has a certain pattern or texture, and it can be used in a variety of applications. As previously mentioned, the patterns must respect specific rules. New technologies such as laser engraved marking are being tested and developed.
- **Coated glass:** This type of glass has a patterned coating that disrupts the reflection on the glass, which birds can see as barriers (e.g. magnetron coated).
- **Laminated glass** with a PVB with a specific pattern.
- **Fritted glass** has a patterned layer of ceramic or enamel baked onto the surface of the glass,
- **Acid-etched glass** is treated with acid to create a full frosted or opaque surface, which reduces the reflectivity of the glass.

<sup>4</sup> Before a potential impact, birds are intercepted by a special net imperceptible to the avian eye and they are released immediately afterwards.



Below are some examples of the solutions which have successfully passed the Hohenau-Ringelsdorf test:



These products can be used in private homes or commercial buildings as **part of new construction or as a retrofit to existing buildings**. Furthermore, progress being made in special materials and coatings continue to expand the range of options available and to make these products more affordable.

In addition to protecting birdlife and biodiversity, **relying on bird-friendly glass is often linked with a commitment to sustainable building practices**. For instance, the Leadership in Energy and Environmental Design (LEED) certification – a widely recognized certification system – includes specific requirements for bird safe glass, and buildings can earn points for using bird protection glass products. Bird-friendly solutions are meant to becoming more and more mainstream to ensure that buildings are not just safe and functional, but also environmentally responsible.

**For further reading:**

- *Bird-Friendly Building Design* – American Bird Conservancy / New York City Audubon - [https://dariuszdziebk.wpenginepowered.com/wp-content/uploads/2015/05/Bird-friendly-Building-Guide\\_LINKS.pdf](https://dariuszdziebk.wpenginepowered.com/wp-content/uploads/2015/05/Bird-friendly-Building-Guide_LINKS.pdf)
- Bird-Friendly Best Practice Glass – City of Toronto - <https://www.toronto.ca/wp-content/uploads/2017/08/8d1c-Bird-Friendly-Best-Practices-Glass.pdf>