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## Birds cannot recognise transparent glass surfaces

Entirely transparent glass surfaces such as noise barriers, connecting walkways and conservatories are fatal for birds because they do not recognise these obstacles. It is suspected that glass panes are one of the most common anthropogenic causes of death in birds after habitat destruction.

**The Vienna Ombuds Office for Environmental Protection therefore urgently recommends that ornithologists be consulted as early as the planning stage of projects with large glass surfaces in order to avoid the subsequent retrofitting of bird traps.**

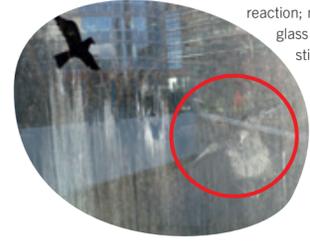
On behalf of the Vienna Ombuds Office for Environmental Protection, a wide variety of patterns have been tested over several years to determine their suitability for preventing bird collisions. We are happy to offer free consultations.

## Reflections can be deadly

When the sky or trees and bushes are reflected in glass, deadly bird traps are created. The fact that our roads are not 'littered' with birds is due to the fact that collision victims often do not die immediately upon impact and are instead able to flutter away to a nearby bush where they die of internal injuries. The disposal of carcasses is well organised by nature – the likes of rats, crows and martens are often far faster than street cleaning. Interior curtains and blinds can prevent transparency but not reflection and are therefore only an interim solution. To combat reflection, fritted glass surfaces or glass with films must be marked on the approach side.

## Bird of prey decals do not prevent bird collisions

Unfortunately, bird of prey silhouettes applied with good intentions are ineffective. Konrad Lorenz proved that a bird of prey has to move in its typical way so as to be recognised as an enemy by its prey. For this reason, bird decals do not trigger a flight reaction; many birds crash into the glass immediately next to these stickers.



## The entire glass surface has to be marked

Investigations carried out by the Vienna Ombuds Office for Environmental Protection impressively proved that only fully marked panes are recognisable as obstacles for birds. Strips as small as 3 mm wide at an interval of 50 mm can prevent bird impact; high-contrast dot patterns have also proven to be effective.

**Caution: birds will attempt to fly through unmarked areas larger than 5x10 cm (HxW).**



Creative designs on noise barriers increase the design value of a structure, but must be tested for their effectiveness according to ONR 191040 'Bird Protection Glass'.

# Birds collisions with glass surfaces

Tested samples



Highest standard for eco-effectiveness. Unique worldwide: Cradle-to-Cradle® print products innovated by Gugler®. All print components are optimised for the biological cycle. Binding not included.

External blinds as well as metal or wooden slats with a maximum interspace of 10–15 cm offer good bird protection only when extended.



Glass guardrails are death traps for birds if these are not adequately marked.



Translucent glass is not always necessary. Textured transparent materials are visible to birds.



Thin black lines are hardly perceptible to humans from a few metres away, but can save the lives of many birds.

Printed laminated glass can effectively prevent bird collisions if the interspace between the markings is less than 5x10 cm (HxW).



**Note:** Low-maintenance transparent guardrails can be made from wire mesh. Windbreaks can also be transparent and still be bird-proof. A summary of tested samples can be found at [www.wua-wien.at](http://www.wua-wien.at).

Fritted glass is more durable than film and can also be applied externally (layer 1).



## Do-it-yourself: Marking glass surfaces – protecting birds

Suppliers: [www.wua-wien.at](http://www.wua-wien.at)

### Strings

A simple and inexpensive way to make glass surfaces visible to birds is to stretch strings across them. For this purpose, strings measuring at least 3 mm thick are fastened vertically in front of the pane at intervals of 10 cm. Black, white or red strings are most visible to birds.

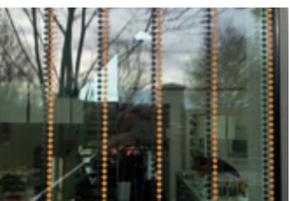


### Marking dots made from film

Commercially available adhesive dots in black, white, orange and red with a diameter of 1.2 to 2 cm can be stuck to the outside of the window at maximum intervals of 9 cm.

### Printed films

Transparent films printed with bird protection markings are applied to the entire surface of the glass. Mounting these on the approach side ensures that reflections are broken. Only fully opaque colours guarantee the necessary contrast for safe collision protection. The films have a durability of 5 to 15 years and are supplied, for example, by Adler Glastechnik.



### Plotted films

Since the films used for this purpose are generally made of solid-coloured plastic material, the risk of fading is reduced compared with printed films. The patterns are cut to size on a plotter, tailored specifically to the customer's wishes. A disadvantage compared to films applied over the entire surface is a greater susceptibility to damage and weathering. The durability corresponds to that of printed films.



### Car decoration

Inexpensive, durable 5 mm wide black strips are available from car styling shops. These are effective when applied vertically at 10 cm intervals.

### SEEN Elements

'SEEN Elements' aluminium dots, applied by means of a backing film, are 9 mm in diameter and are highly effective as a 90 mm grid for both reflective and transparent applications



## Testing bird protection glass

### The test procedure

In the transparency test (ONR test), markings are tested in choice experiments in a flight tunnel in accordance with the Austrian Standard ONR 191040 'Bird protection glass'. When attempting to leave the tunnel, the birds have the choice between a marked pane (to be tested) and an unmarked pane. The birds are intercepted by a special net and do not suffer any harm. If at least 90% of the birds avoid the markings, the glass is classified as bird protection glass in accordance with ONR 191040.

The reflection test (WIN test) is carried out in a modified flight tunnel. The panes are positioned at an angle of 125° to the flight axis of the birds in front of a box with the lighting conditions of an interior space, and reflect the surroundings into the tunnel. In order to assess effectiveness, the same criteria apply as for the transparency tests in accordance with ONR 191040.

### Criteria for effectiveness

The effectiveness of a marking does not always depend on the proportion of surface area covered; its contrast with the glass surface and the minimum size of dots, lines or other elements are essential factors. So-called UV-based coatings, invisible decals and marking pens have failed ONR and WIN tests and are therefore not recommended.

## Transparency and reflection require different markings

Reflections are highly dependent on lighting conditions. They occur when it is darker in the background of a glass pane than in front of it. Since up to 100,000 lux are measured on a sunny day, but only 50 lux in an average interior space, significant reflections occur even with glass with a few percent reflectance. Anti-reflective glass can therefore at best reduce the risk of collision, but without appropriate markings it does not provide sufficient bird protection. However, the risk of collision increases with increasing reflectance, which is why we recommend using glass with the lowest possible degree of reflection. Markings must stand out clearly against bright and high-contrast reflections. Silk-screened frit patterns and films must be applied to the surface of the approach side (layer 1), otherwise they will be overlaid by the reflections and their effectiveness will be significantly reduced.

### Translucent bird protection strips

The Viennese company, Adler Glastechnik, supplies the translucent Oracal Dusted Glass Cal glass etching film in 2 cm and 4 cm wide strips via its online shop. 25% coverage offers highly effective bird protection when the strips are mounted vertically on the approach side.

### Bird tape

CollidEscape sells tapes that are particularly effective when applied as double strips, 10 cm apart.



## What should you do with a collision victim?

If you find a dazed bird, place it in a closed box with air holes (not in a cage!) and wait for one to two hours. Do not try to put water or food in its beak as this could cause the bird to choke. If the bird recovers on its own, it can be released in a safe place. If it does not, then a vet should decide whether and how to help.



Based on many years of experience, four categories have been defined in consultation with international experts:

Category	Effectiveness	Approaches in the testing facility in %
A	Highly effective – 'Bird protection glass' in terms of ONR 191040	≤10
B	May be suitable depending on conditions	>10 – 20
C	barely effective	>20 – 42
D	Ineffective	> 42

### Hohenau flight tunnel



### Aluminium dots

Metallic shiny products are particularly suitable for windows and façades due to their high degree of reflection. Some products, such as Safflex FlySafe 3D SEEN, do not have to be installed at layer 1, unlike silk-screened frit patterns and films; they can also make obstacles visible to birds when placed between the panes of laminated safety glass.



## Compilation of markings tested in the flight tunnel

The selection of the most important test results of the Hohenau flight tunnel (presented overleaf), distinguishes for the first time between markings for transparent settings against a bright background, such as noise barriers (ONR test), and markings for applications against a low-light background, such as windows and façades (WIN test for reflections). The coloured area with the test number refers to the four categories determined by the Hohenau rating scheme. The percentage indicates the approaches to the test pane in the choice test – the smaller this number, the better a pattern is recognised by the birds and the further ahead it is in the ranking.

Even small modifications to a pattern in terms of design, scale, colour or material may influence its effectiveness. Particularly with the WIN test, reflection also must be taken into account; the test result here only applies up to the specified reflectance of the test pane.

## Abbreviations

**CV:** Coverage, proportion of area covered by the markings  
**RF:** Reflectance of the entire test pane construction  
**DM:** Diameter  
**CS:** Centre spacing  
**ES:** Edge spacing  
**GPI:** Glass pane interspace  
**FC:** Functional coating  
**LSG:** Laminated safety glass

The '**position**' designates the application layer of a coating in order of the pane surfaces, starting with position 1 – 'approach side' (outside) of the pane, position 2 – rear side of a single pane or first pane of laminated safety glass, position 3 – front side of the second pane of laminated safety glass etc.

**Test reports** can be found on the website of the Vienna Ombuds Office for Environmental Protection, [www.wua-wien.at](http://www.wua-wien.at)

## More information

in relation to preventing bird strikes and tested samples:

[www.wua-wien.at](http://www.wua-wien.at)  
[www.vogelglas.info](http://www.vogelglas.info)  
[www.auring.at](http://www.auring.at)

# Tested samples

## Markings for windows and façades (reflections)

Illustration approx. 60x120 cm

No	Description	Approaches to the test pane	Viewed from the outside	Viewed from the inside
1S	<b>ZooLex/Gasperlmair Astmuster</b> Branch pattern Digital printing, RAL 6014 yellow-olive CV: 20–25% Position: 1 Installation: Monolith float glass (6 mm) FC: none RF: 8% Test year: 2020  The marking was developed for use in zoos.	4 %		

2S	<b>AGC Interpane</b> Fritted glass similar to etching tone Dimensions: Rectangles 8x30 mm CV: 11% Position: 1 Installation: LSG 66.2 FC: none RF: 8% Test year: 2019  This silk-screened marking was tested in two variants (compare no. 13S), here the clearly more effective etching tone variant.	6 %		
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3S	<b>Saflex® FlySafe™ 3D SEEN shiny 9/90 ISO.</b> Aluminium coating Dimensions: 9 mm DM, CS 90 mm CV: 0.8% Position: 2 Installation: insulating LSG 44.2 / GPI 16 mm/4 mm float FC: Low-E (Clima Guard Premium Position 4) RF: 12% Test year: 2020  Saflex® markings were tested multiple times, here with a low-E coating in laminated safety glass. (Compare no 6S and 7S).	6 %		
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4S	<b>Ornilux® design lines 5/95 - 8% Decochrome</b> metallic gloss coating Dimensions: 5 mm wide, ES 95 mm CV: 5% Position: 1 Installation: LSG 66.2 FC: none RF: unknown Test year: 2020 Test report: WUA  Ornilux® design designates visible markings with metallic surfaces. Not to be confused with UV variants under the brand name Ornilux®.	8 %		
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5S	<b>AviSafe™ AS/h (hard-eDGe) 9 % laminated 70/40</b> Semi-reflective coating (transparent from inside), metallic reflective Dimensions: 40 mm wide strips, ES approx. 60 mm, blurred border CV: unknown Position: 1 Installation: insulating LSG 64.2/4 mm float FC: Solar control 70/40 Position 4 RF: unknown Test year: 2021  AviSafe™ markings are reflective from the outside, transparent from the inside and only faintly visible.	9 %		
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6S	<b>SEEN shiny 9/90 (später Saflex®)</b> aluminium coating Dimensions: 9 mm DM, CS 90 mm CV: 0.8%, Position: 2 Installation: LSG 44.2 FC: none RF: 8% Test year: 2019 Test report: WUA  SEEN Elements Shiny has glossy concave surfaces with very strong light reflection and is also highly effective at position 2. At position 1, suitable for retrofitting.	9 %		
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7S	<b>SEEN matt 9/90</b> aluminium coating Dimensions: 9 mm DM, CS 90 mm CV: 0.8%, Position: 2 Installation: LSG 44.2 FC: none RF: 8% Test year: 2019 Test report: WUA  SEEN Elements Shiny has matt flat surfaces that reflect light evenly. At position 1, suitable for retrofitting.	9 %		
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## Markings for noise barriers and glass parapets (transparent) Illustration approx. 40x40 cm

1D	<b>ZooLex/Gasperlmair branch patterned film</b> RAL 6014, yellow-olive 25% transparency Position: 1 Test year: 2020 CV: 20–25%	2 %	
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2D	<b>Eckelt 4Bird V3066</b> Vertical rows of dots, black-orange fritted glass Dimensions: DM 8 mm, ES between rows of dots 100 mm Position: 1 Test year: 2010 CV: 9%	2 %	
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3D	<b>Eckelt Litex 540</b> Diagonal black dot pattern, fritted glass Dimensions: DM 7.5 mm, CS diagonal 12.7 mm Position: 1 CV: 27% Test year: 2010	3 %	
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4D	<b>Vertical black strips</b> black print on polycarbonate Dimensions: 5 mm wide, ES 95 mm Position: 1 CV: 5%	3 %	
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5D	<b>Eckelt 4Bird V3067</b> Vertical rows of dots, black fritted glass Dimensions: DM 8 mm, ES between rows of dots 100 mm Position: 1 CV: 9% Test year: 2010	5 %	
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6D	<b>Horizontal black strips</b> black print on polycarbonate Dimensions: 3 mm wide, ES 47 mm Position: 1 CV: 6%	5 %	
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7D	<b>Vertical orange strips</b> Paint spray, Dupicolor Platinum, RAL 2009 Dimensions: 5 mm wide, ES 100 mm Position: 1 CV: 4.8%	6 %	
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8D	<b>Glasdecor 25</b> adhesive film, ORACAL Etches Glass Cal 8510, matt, translucent Dimensions: irregular wide strips 15–40 mm, horizontal spacing < 100 mm Position: 1 CV: 25%	6 %	
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9D	<b>Saflex® FlySafe™ 3D SEEN shiny 9/90</b> aluminium dot pattern 9/90 Dimensions: 9 mm DM, CS 90 mm Position: 2, LSG 44.2 CV: 0.8% Test year: 2020	6 %	
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11S	<b>Saflex® FlySafe™ SEEN shiny 6/90</b> aluminium coating Dimensions: 6 mm DM, CS 90 mm CV: 0.4% Position: 2 Installation: LSG 44.2 FC: none RF: 12% Test year: 2020  Metallic dots with 6 mm DM are less effective than dots with 9 mm DM (compare nos. 3S, 6S and 7S).	13 %		
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12S	<b>Ornilux® design dart 9/90 - 16% Decochrome</b> metallic gloss coating Dimensions: dots in bullseye pattern, outer ring 2 mm, inner circle 3 mm DM, CS: 90 mm CV: 0.4% Position: 1 Installation: LSG 66.2 FC: none RF: unknown Test year: 2020 Test report: WUA  Perforated metallic dots are less effective than the metallic strip pattern no 4S.	16 %		
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13S	<b>AGC Interpane Ipasol grey/Ipasol bright</b> fritted glass Dimensions: Rectangles, 8x30 mm CV: 11% Position: 1 Installation: LSG 66.2 FC: none RF: 8% Test year: 2020  Transparent version of etching tone pattern no 2S.	16 %		
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10D	<b>ABC double-strip bird tape,</b> ABC translucent bird tape Dimensions: 20 mm wide vertical strips, intervals between strips alternately 5 mm and 100 mm Position: 1 CV: 22.8%	10 %	
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11D	<b>White dot fritted glass</b> Dimensions: DM 18 mm, CS 82 mm Position: 1 CV: 3.8%	15 %	
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12D	<b>Plexiglas Soundstop® Smoky Brown</b> tinted acrylic glass Dimensions: 15 mm thick	35 %	
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14S	<b>Vertical rows of dots 3 mm black fritted glass</b> Dimensions: 3 mm DM, CS in the row 6 mm, between rows 38 mm. CV: 3.1% Position: 2 Installation: insulation glass 6 mm float / GPI: 16 mm / 6 mm float FC: Low-E at position 3 RF: unknown Test year: 2021  Rows with dots of 3 mm DM at position 2 offer too little contrast and are therefore not effective.	45 %		
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15S	<b>Kolbe birdsticker® silhouettes</b> 15 pcs. Bird silhouettes transparent, UV reflective Dimensions: 94 cm²/decal CV: 21.7% Position: 1 Installation: Monolith float glass (4 mm) FC: none RF: 8% Test year: 2017 Test report: WUA  Ineffective UV marking	47 %		
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16S	<b>Anthracite dot pattern 3/14, 48 %</b> plotted adhesive film, RAL 7016, black Dimensions: Dots 3 mm DM, CS 14 mm CV: 3.6% Position: 1 Installation: Monolith float glass (4 mm) FC: none RF: 8% Test year: 2018 Test report: WUA  The dot pattern with dot DM of 3 mm at position 1 offers too little contrast and therefore is not effective.	48 %		
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