Tunnel Testing:

PROTOCOL FOR RATING BIRD COLLISION THREAT LEVELS OF MATERIALS

Introduction

Birds have intrinsic, cultural, and ecological value to humanity. Birdwatching alone contributes 32 billion to the U.S. economy each year (U.S. Department of the Interior, 2011). However, collisions with glass claim hundreds of millions bird lives each year, in the U.S. alone (Loss, 2013). Birds that have successfully flown thousands of miles on migration can then die in seconds on a pane of glass. Because glass is dangerous for strong, healthy, breeding adults, as well as sick or young birds, it can have a particularly serious impact on populations. Bird mortality from collisions with glass is a serious problem in virtually all habitats. To make identification and use of bird-friendly materials simpler, American Bird Conservancy (ABC) has developed a program to produce objective ratings of the relative threat to birds from different materials.

The ability to provide quantitative ratings for materials has proved essential in development of policies, ordinances and guidelines promoting 'bird-friendly design', especially LEED Pilot Credit #55: Reducing Bird Collisions. There is need to expand the capacity of the program as more companies identify bird-friendly new construction and retrofit of existing buildings as a market opportunity. Additional research is also needed, with the ultimate goal of developing less cumbersome ways of rating materials.

History:

In 2008, Christine Sheppard, then curator of birds at the Bronx Zoo, was awarded an Association of Zoos and Aquariums Conservation Endowment Fund grant to develop solutions to this problem, in conjunction with Carnegie's Powdermill Avian Research Center (PARC) and New York City Audubon. The project created a testing program using a binomial choice protocol with migrant passerines, based on a protocol developed in Austria at the Ringelsdorf Station in Hohenau (Rössler et al, 2007). That is now an official testing standard for free-standing glass in Austria: (http://collisions.abcbirds.org/pdf/ONR_191040_Bird_safe_glass_Testing_of_Efficiency_EN.pdf)

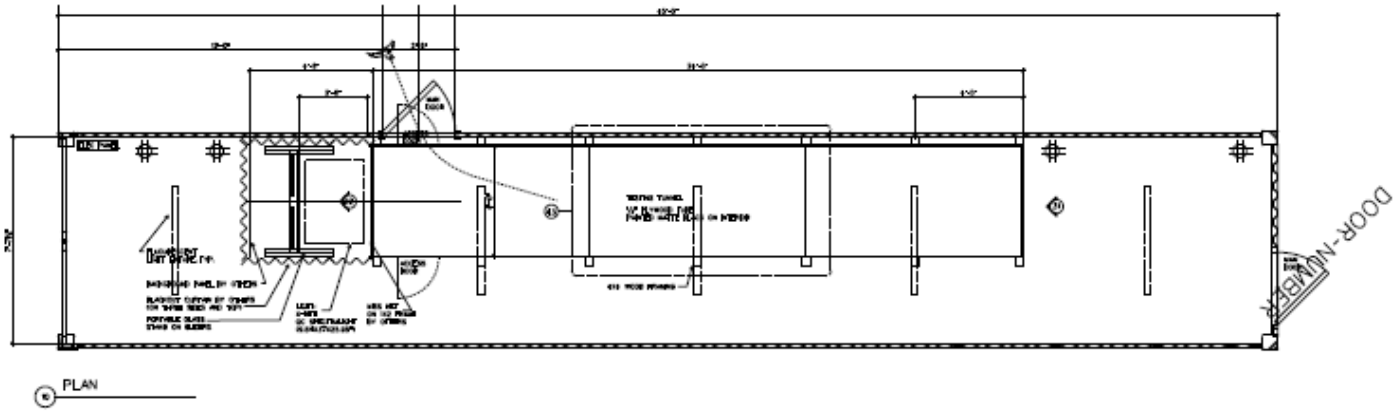
The on-going research at the Ringelsdorf station, started in 2004 by Martin Rössler, focused primarily on geometry of different patterns applied to glass, including dimensions, spacing, density, contrast and orientation of components, percent coverage, and in some cases, changes in effectiveness correlating with different intensities of ambient light (Rössler, 2007). In 2009, Dr. Sheppard moved to ABC as collisions campaign manager, and the program moved with her, still based at Powdermill. The testing protocol at Powdermill is similar to that used in Austria but with some modifications (see separate Powdermill testing protocol). Described below is a testing prototype based on Powdermill's but intended to reduce variation caused by changing light levels and to create a standard test that can be certified by ASTM.

Goals

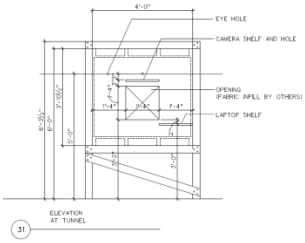
ABC has created a testing program to expand knowledge of what visual signals deter bird collisions with glass, to provide comparative ratings of deterrence for existing commercial products and to provide support and feedback for companies developing new bird-friendly products.

Tunnel apparatus

The tunnel is currently located at the Bronx Zoo, Bronx, New York, inside a 30’ shipping container modified to add a man-door at the operator end and a release door parallel to the tunnel release door. The tunnel apparatus itself is a hollow rectangular prism, 4x4x24’, mounted on legs to raise it 18” above floor level. It is constructed of ½” plywood and the inside is completely lined with black felt.

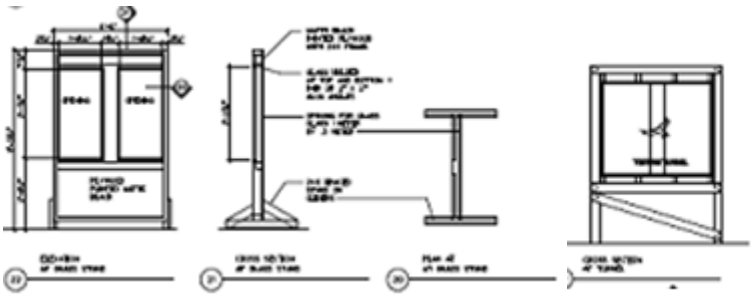


The operator end is solid wood with a viewport for a video camera and an opening where the release sleeve is installed. Mounted at that end is a shelf holding a Panasonic LUMIX DMC-FZ70 16.1 MP digital camera, used to video each trial through a viewing port. A second shelf holds data sheets or a notebook computer. A sleeve is inserted in lightproof fabric covering a central opening, 18”x18”, permitting birds to be released into the tunnel in darkness.



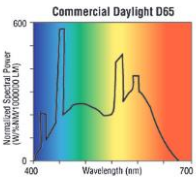
At the test end, the tunnel is open. A frame mounted in the opening is covered with a stretched piece of mist net with trammels removed, to prevent birds being tested from actually hitting the glass. A vibration detector (specs pending) is mounted at the edge of the net and produces a ‘flash’ when the bird contacts the net.

Glass holder



Currently 0.5 meters (not yet set) beyond the net, the glass holder can hold two panels of glass (or other material) side by side. Plywood covered with a patterned fabric (the 'background') is mounted 36" behind the glass to disguise the net. The fabric extends across the back and the sides, between the background and the glass holder.

Light source



The light source is an Xrite Spectralite QC (http://www.xrite.com/spectralight-qc), suspended from four eyebolts welded to the roof of the container, above the space between the tunnel and the glass holder. The lamp is suspended at a 45 degree angle, with light shining on the glass. Tests use the 'daylight' setting, with or without a UV component.

[We need to create a protocol for documenting the output of the light source]

Tunnel Operation

Controls

Trials using two clear panes or no glass are run as a control for potential bias in the apparatus itself. Equal numbers of flights to left and right indicate that the tunnel itself is not influencing the choice made by the birds and they are flying randomly.

Samples

The glass holder usually holds a plain glass control on the right side and the test sample on the left. The majority of samples are 0.5x1.0 meters but vary in thickness. Insulated glass units (IGU) are tested as well as laminated and single-paned glass.

of trials

We target at least 80 trials per material to account for environmental variation and species mix.

Test subjects

Birds are mist-netted during spring and fall migration in the vicinity of the tunnel. The majority are migratory individuals, especially warblers, thrushes and sparrows. This provides large sample sizes of

species that are frequent victims of collisions, during relatively short periods of time. Species larger than 20 cm in length (such as American Robins and Blue Jays) or smaller than 10 cm in length (such as hummingbirds) are not tested, because birds too heavy or too small could go through the net and the risk injury. In addition, species like Nuthatches and Chickadees are not tested because instead of flying in the tunnel they tend to cling to the walls.

Bird Handling

All bird handling conforms with guidelines established by the Ornithological Council (

http://oacu.od.nih.gov/WildBirdGuide.pdf) Nets generally open at dawn and close late morning to early afternoon, according to ambient conditions. Nets are closed in inclement weather. All personnel handling birds for this project are experienced bird handlers, working under a master bander. Birds are released from mist nets by the tunnel technician, placed in cloth bags and taken to the station for banding and measuring.

After banding, the tunnel testing technician again evaluates the bird and. any bird that appears stressed is simply released. Otherwise, the band number is read aloud, to label the video; the band number is also recorded on the data sheet and the bird is released into the tunnel, through the sleeve set into the end panel. Any bird that does not fly after 30 seconds is withdrawn from the tunnel released and scored as 'no fly'. Birds that fly to the net are recorded as flights to control or test side; birds that fly to the tunnel floor, ceiling or wall are marked accordingly.

Most birds fly out of the tunnel when the release door is opened. Those that don't are hand caught and released.

Data

We record destination for each flight -- to the control side or test side of the net, or side, floor or ceiling of the tunnel. Data is recorded on a notebook computer, or on paper. (See appendix I, data sheet.) All trials are video recorded as well as observed and all videos are reviewed to confirm data before scores are final

Avoidance Index

All flight videos are reviewed, using frame by frame analysis when necessary, and initial flight scores are corrected when necessary. After careful review of videos, the data is consolidated and an avoidance index (AI) is calculated. ABC defines AI as the percentage of birds that flew toward the control, out of all flights. Trials where the bird did not fly are eliminated from the count. The AI ranges from 50 (birds fly randomly to the left or right, indicating no effect from the material being tested) to 100. The 'effectiveness' of a material at reducing collisions ranges from 0 (no effect) to 99

and must be measured by monitoring collisions at an installation site before and after a material is installed. The AI therefore correlates with effectiveness but is not equivalent to effectiveness. A given material might vary in effectiveness from site to site, depending on site specific variables. The threat factor for a material is the inverse of its AI

In addition to the Avoidance Index, reports give the number of usable flights, and the confidence interval and p value.

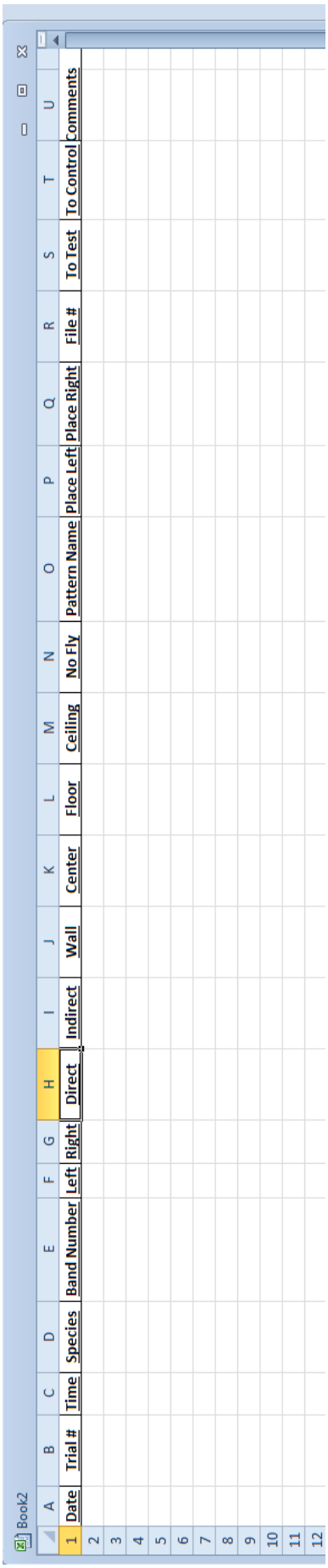
References

U.S. Department of the Interior, U.S. Fish and Wildlife Service, and U.S. Department of Commerce, U.S. Census Bureau. 2011 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.

Loss, Scott R., Tom Will, Sara S. Loss and Peter P. Marra, 2014.
Bird–building collisions in the United States: Estimates of annual mortality and species vulnerability. Condor 116:8-23. DOI: 10.1650/CONDOR-13-090.1

Rössler, M., W. Laube, and P. Weihs. 2007. Vermeidung von Vogelanprall an lasflächen. Experimentelle Untersuchungen zur Wirksamkeit von lasmarkierungen unter natürlichen Lichtbedingungen im Flugtunnel II. Bilogische Station Hohenau-Ringelsdorf [available for download from www.windowcollisions.info].

Appendix I: data sheet



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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	Date	Trial #	Time	Species	Band Number	Left	Right	Direct	Indirect	Wall	Center	Floor	Ceiling	No Fly	Pattern Name	Place Left	Place Right	File #	To Test	To Control	Comments
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