

The formulae $\frac{\partial \mu_i}{\partial x_j} + \frac{\partial}{\partial x_j}(\rho \mu_i) = -\frac{\partial}{\partial x_j} + \frac{\partial}{\partial x_j} \left(\mu \frac{\partial \mu_i}{\partial x_j} \right) + g_i(\rho - \rho_0)$ for building $\frac{\partial}{\partial x_j}(\rho \mu_i) = -\frac{\partial}{\partial x_j} + \frac{\partial}{\partial x_j} \left(\mu \frac{\partial \mu_i}{\partial x_j} - \rho \mu_i \right) + g_i(\rho - \rho_0)$ state of the art $\frac{\partial}{\partial x_j}(\rho \mu_i) = \frac{\partial}{\partial x_j} \left(\lambda \frac{\partial \mu_i}{\partial x_j} - \rho \mu_i \right)$ biomedical research facilities.

Guidance on Bird-Safe Glazing for New Construction

Large windows allow people to connect with the natural world, contributing to human wellness. An unintended consequence of using large windows in building design has been that, during the daytime, the reflectivity or the transparency of glass can mirror the adjacent landscape or provide a seemingly clear path to birds. In the U.S., it is estimated that nearly one billion birds per year die from collisions.¹ Between 1970 and 2014, collisions and other factors contributed to the net loss of 3 billion North American birds, or 29% of 1970's bird population.² Bird-strike reduction can be achieved through a variety of methods, including design choices such as utilizing glazing which deters birds.

Standards and Legislation

Government agencies and private organizations promote sustainable design policies and methods to preserve ecological stability by reducing bird strikes. The U.S. Fish and Wildlife Service Division of Migratory Bird Management provides a list of best practices.³ In Congress, H.R. 1986 – Federal Bird Safe Buildings Act of 2021 seeks “to incorporate practices and strategies to reduce bird fatality resulting from collisions with certain public buildings.”⁴ The Council for the Conservation of Migratory Birds was created in 2009 to oversee the implementation of Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, which requires “integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory bird resources when conducting agency actions.”⁵

The National Institutes of Health

The National Institutes of Health's (NIH) main campus is located in Bethesda, Maryland, with other regional field stations located in Baltimore, Frederick, and Poolesville. NIH participates in regional government initiatives. Within the mid-Atlantic region, New York,⁶ Maryland,⁷ and Washington, DC⁸ have passed legislation to require the use of bird-safe glazing

The *Design Requirements Manual (DRM)* (Section 1.1.2.3) advises that “local government mandates...and other unique geographic design criteria are not specifically mentioned in the *DRM* because the design shall comply with state and local regulations in addition to *DRM* requirements.”⁹

The upcoming Revision 2.1 of the *DRM* will address regional geographic design criteria in Section 4.1.4: Windows by requiring new construction of NIH building facades to be consistent with

federal direction as follows: “Incorporate appropriate bird strike mitigation as recommended by the most recent version on the *U.S. Fish and Wildlife Service: Reducing Bird Collisions with Buildings and Building Glass Best Practices* and as required by state and local laws and ordinances.” By incorporating these best practices, NIH can help reduce one of the leading causes of bird mortality while supporting the campus by reducing risks associated with animal remains.

Bird-safe glazing options continue to evolve. The American Bird Conservancy's *The Glass Collisions Products & Solutions Database*¹⁰ lists options by deterrent type, manufacturer, and efficacy. Glazing selections include transparent, ultraviolet coatings, screen printing, fritted (patterned ceramic paint), frosted, and acid etching on glass.

Conclusion

Determining how best to mitigate bird strikes is a multi-faceted problem which is best addressed with landscape strategies and architectural features. Utilizing bird-safe glazing at areas of high reflectivity and transparency, such as at glass corners, courtyards, skyways, walkways, and glass railings, reduces the likelihood of bird strikes. New exterior glazing projects for NIH owned buildings should include a review of the U.S. Fish and Wildlife Service: *Reducing Bird Collisions with Buildings and Building Glass Best Practices* for appropriately designed and detailed glazing.

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