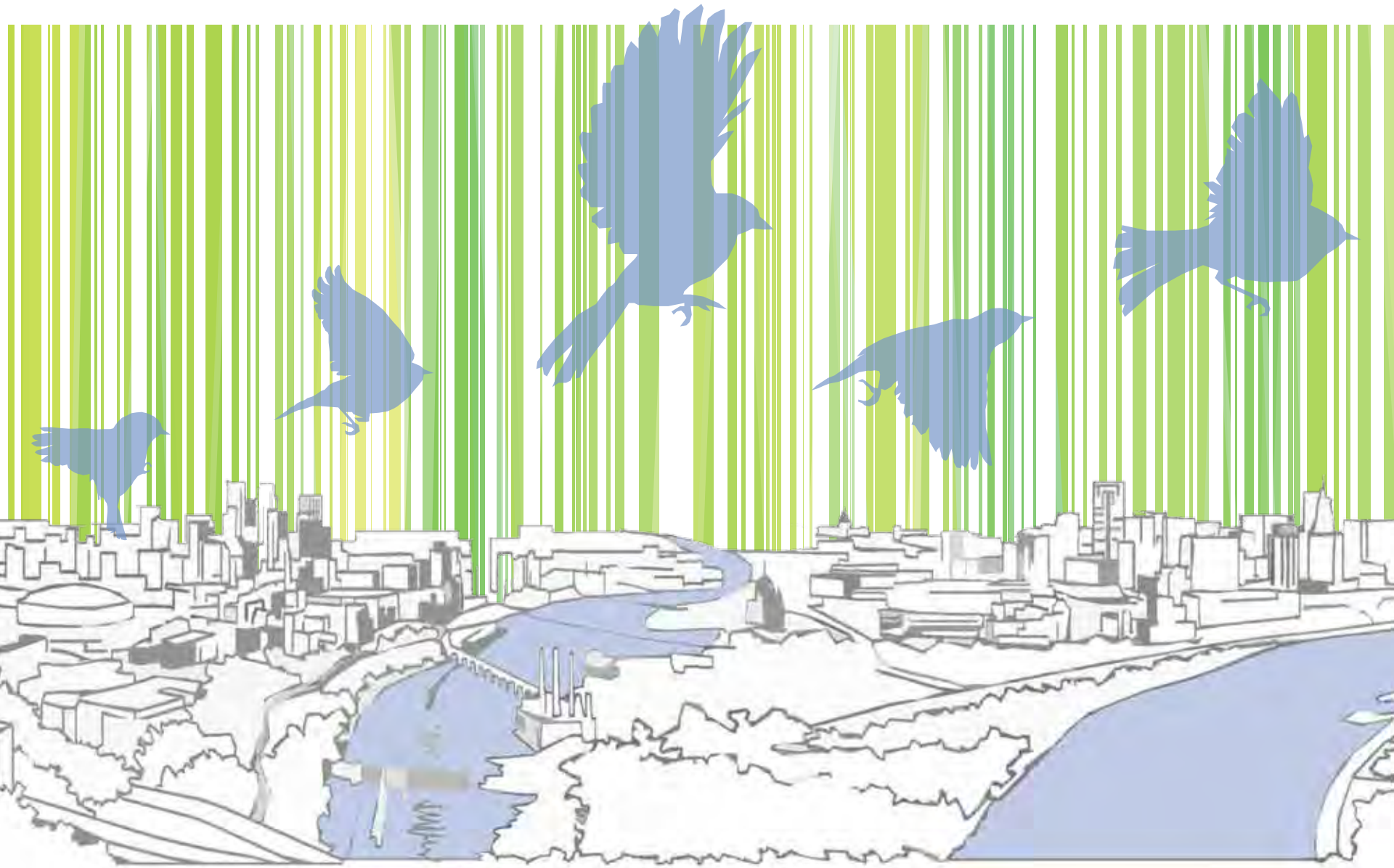
BIRD·SAFE BUILDING GUIDELINES

Audubon
MINNESOTA



Bird-Safe Building Guidelines


JIM WILLIAMS


MIKE LENTZ


MIKE LENTZ


MIKE LENTZ


JIM WILLIAMS

Over 100 bird species have been recovered from building collisions in Minnesota including Lincoln's Sparrow, Black-capped Chickadee, Indigo Bunting, Common Yellowthroat, and Nashville Warbler

Published by Audubon Minnesota, May 2010

Project Director: Joanna Eckles (Audubon Minnesota)

Contributor: Edward Heinen (Perkins + Will)

Reviewers: Mark Martell, Mark Peterson (Audubon Minnesota); Lori Naumann (Minnesota Department of Natural Resources); Chris Sheppard (American Bird Conservancy); Susan Elbin (NYC Audubon); Jonee Kulman Brigham (Center for Sustainable Building Research, UMN), Benjamin Sporer, Paul Neuhaus (Perkins + Will)

Design Manager: Bonita Jenné (Audubon Minnesota)

Cover Cityscape Artwork: Edward Heinen

Printing made possible by TogetherGreen

Citation: Audubon Minnesota. (2010). Bird-Safe Building Guidelines

The mission of Audubon Minnesota is to conserve and restore natural ecosystems, focusing on birds and their habitats, for the benefit of humanity and the earth's biological diversity.

AUDUBON MINNESOTA
2357 Ventura Drive, Suite 106 • Saint Paul MN 55125
mn.audubon.org

Thank you to New York City Audubon and their original working group for permission to revise their Bird-Safe Building Guidelines (May 2007).

NYC Project Director: Kate Orff, RLA, Columbia University GSAPP

NYC Authors: Hillary Brown, AIA, Steven Caputo, New Civic Works

NYC Audubon Project Staff: E.J. McAdams, Marcia Fowle, Glenn Phillips, Chelsea Dewitt, Yigal Gelb Graphics.

NYC Reviewers: Karen Cotton, Bird-Safe Working Group; Randi Doeker, Birds & Buildings Forum; Bruce Fowle, FAIA, Daniel Piselli, FXFOWLE; Marcia Fowle; Yigal Gelb, Program Director, NYC Audubon; Mary Jane Kaplan; Daniel Klem, Jr., PhD., Muhlenberg College; Albert M. Manville, PhD., US Department of the Interior, Fish and Wildlife Service; E. J. McAdams, Former Executive Director NYC, Audubon; Glenn Phillips, Executive Director, NYC Audubon.

Original publication of these guidelines was made possible with the support of US Department of the Interior, Fish and Wildlife Service through the Neotropical Migratory Bird Conservation Act, Joseph & Mary Fiore and the support of NYC Audubon members and patrons.

Table of Contents

MIKE LENTZ

Dark-eyed Junco

Bird-building collisions are an unfortunate side effect of our expanding built environment and a proven problem in Minnesota and throughout the world.

These are just a portion of the birds collected from Toronto window collisions in 2009.

KENNETH HERDY

GLAZED BUILDINGS THAT MAKE UP MODERN CITY skylines and suburban settings along with countless windows in our homes present serious hazards for birds. In the United States, hundreds of millions of birds perish each year from collisions with buildings.[1]

In Minnesota, bird-window collisions are a proven problem. Over 100 species of birds have been documented at just a small number of buildings being monitored throughout the state. Birds are killed or injured as a result of clear and reflective glass. Artificial lighting also confounds night-migrating species.

In addition, increased interest in "building green" often results in both desirable habitat for birds and large expanses of glass – a deadly combination.

Fortunately, awareness and preventative actions are emerging. Internationally, Lights Out programs are aiding night migrants in a growing number of cities. And by incorporating bird-safe building design strategies as part of an integrated sustainable design program, we can help save countless resident and migratory birds.

These Bird-Safe Building Guidelines expand upon ongoing Project BirdSafe initiatives in Minnesota to address bird-building collision issues at the building design level. Utilizing New York City Audubon's 2007 Bird-Safe Building Guidelines and other resources, established standards for bird-safe building enhancements have been updated and adapted to provide local examples and references.

NYC AUDUBON

Injured Golden Crowned Kinglet

These guidelines are intended for use by those involved in building design and operations. They promote measures to protect birds in the planning, design, and operation stages of all types of buildings, in all settings and have been updated to reflect implementation criteria in LEED® v3 (2009).

Bird-safe building criteria are scheduled to be incorporated into B3 State of Minnesota Sustainable Building Guidelines (B3-MSBG) in 2010. B3-MSBG is required for all new construction and major renovations that receive state bond money. B3-MSBG covers the planning, design, construction, and operation of buildings.[2]

"ARCHITECTS AND THEIR CLIENTS CAN USE ALL THE RECYCLED MATERIAL THEY WANT. THEY CAN SAVE ALL THE ENERGY THEY WANT, BUT IF THEIR BUILDING IS STILL KILLING BIRDS, IT'S NOT GREEN TO ME."

Dr. Daniel Klem, Muhlenberg College, *Audubon,* Nov-Dec 2008

DID YOU KNOW?

Birds are an important asset to the travel and recreational sectors of the economy. According to the United States Fish and Wildlife Service, bird-watching is the second fastest growing leisure activity in North America. An estimated 63 million Americans participate in wildlife watching and eco-tourism each year. In the process, they spend close to $30 billion annually, with a major portion related to birds.[3] With fully one-third of Minnesotans self-identifying as bird-watchers,[4] the health of our birds and their habitats is economically as well as ecologically imperative.

Birds and the Built Environment

Bird populations, already in decline from loss of habitat, are further threatened by the incursion of man-made structures into avian air space.

Low-density development generally results in habitat loss

Architectural trends favor use of glass

Stunned Brown Creeper

JOEL DUNNETTE

IN RECENT DECADES, sprawling land-use patterns and intensified urbanization have degraded the quantity and quality of bird habitat throughout the globe. Cities and towns cling to waterfronts and shorelines, and increasingly infringe upon the wetlands and woodlands that birds depend upon for food and shelter. Loss of habitat makes city parks, streetscape vegetation, waterfront business districts, and other urban green patches important resources for resident and migratory birds. There birds encounter the nighttime dangers of illuminated structures and the daytime hazards of dense and highly glazed buildings.

The increased use of glass poses a distinct threat to birdlife. From urban high-rises to suburban office parks to single-story structures, large expanses of glass are now routinely used as building enclosure. Energy performance improvements in transparent exterior wall systems have enabled deep daylighting of building interiors, often by means of floor-to-ceiling glass expanses. The aesthetic and functional pursuit of still greater visual transparency has spurred the production of ultra-clear glass.

The combined effects of these factors have led scientists to determine that bird mortality caused by building collisions is a biologically significant[5] issue. In other words, it is a threat of sufficient magnitude to affect the viability of bird populations, leading to local, regional, and national declines.

Songbirds – already imperiled by habitat loss and other environmental stressors – are especially vulnerable during migration to daytime and nighttime collisions as they seek food and shelter among urban buildings. Researchers have documented hundreds of thousands of building collision-related bird deaths nationally during migration seasons. Included in this toll are specimens representing over 225 species, a quarter of the species found in the United States.

DID YOU KNOW?

Buildings contribute substantially to greenhouse gas emissions, which in turn adversely impact native and migratory birds. Building operations consume over 75% of the electricity in the U.S. In 2007, the commercial building sector alone produced more than 1 billion metric tons of carbon dioxide, an increase of 4.4% from 2006 levels, and an increase of over 38% from 1990 levels.[6] Research provides clear evidence of the negative effects of climate change on the migration, breeding, numbers, and behavior of many North American bird species.[7]

Birds and Building Green

SUSTAINABLE, HIGH-PERFORMANCE BUILDINGS are designed to conserve energy and reduce carbon emissions, conserve water resources, harvest daylight and provide healthy indoor environments. These buildings conserve and recycle materials and display unprecedented levels of environmental responsibility and functionality. They are integrated with their natural surroundings and often enhanced with native landscaping.

The green building movement is an exciting advancement for architects, designers, building users and conservationists alike. But it is not without pitfalls. Unless carefully considered, greening efforts may actually contribute to the loss of the very creatures we seek to protect. Ironically, in our desire to bring the outside in, we may increase risks to birds. By attracting birds in and around glazed buildings we inadvertently increase the risk of bird-window collisions. Better sustainable design practices therefore demand that buildings also be designed to integrate specific bird-safe strategies.

Advocating bird-safety in buildings should be integral to the green building movement. Many of the strategies for reducing bird collisions complement other sustainable site and building objectives. In concert, efforts to reduce collision hazards, enhance and restore habitat and conserve energy help native and migratory birds.

While development poses a myriad of risks to birds, the movement towards sustainability and collaboration offers hope. Those leading the shift to building green are well suited to stimulate the development of new glazing technologies and to create a market for all bird-safe building products. If builders and developers demand it, much-needed advancements will follow.

Bird populations are remarkably resilient and can respond well to conservation efforts. By incorporating bird-safe building design strategies as part of an integrated sustainable design program, we can help birds thrive in our built environment.

"THERE IS NOTHING IN WHICH THE BIRDS DIFFER MORE FROM MAN THAN THE WAY IN WHICH THEY CAN BUILD AND YET LEAVE A LANDSCAPE AS IT WAS BEFORE."

Robert Lynd, *The Blue Lion and other essays*

A green roof is one way we "build green"

MIKE LENTZ

American Redstarts weigh less than 1/2 ounce but their migration route may cover more than 2500 miles

Causes of Collisions

Birds have two key issues with buildings – one relates to glass, the other to lighting.

DAYTIME COLLISIONS occur because most birds do not perceive glass as an obstacle. Migratory birds in particular have not evolved to live in built environments and don't see the context cues that indicate that glass is solid.[8] Instead they see the things they know and need, such as habitat and open sky, reflected in the glazed surface or on the other side of one or more panes of glass.

Collisions occur at glass facades of all sizes, in all seasons and weather conditions, and in every type of environment from residential and rural settings to dense urban cores. Collisions and mortality occur at any place where birds and glass coexist.[1] As a result, daytime collisions are likely the most prevalent of all building collision hazards.

PROBLEM GLASS REFLECTIVITY: MIRROR EFFECT

Problem: Reflection

From outside most buildings, glass often appears highly reflective. Under the right conditions almost every type of architectural glass reflects the sky, clouds, or nearby trees and vegetation, reproducing a perceived habitat familiar and attractive to birds. Birds fly from the real habitat to the reflected habitat or sky and hit the glass in between.

PROBLEM GLASS TRANSPARENCY: FLY THROUGH

Problem: Transparency

The trick of transparency is exacerbated when windows are installed directly across from one another or at a corner because birds perceive an unobstructed passageway and attempt to fly through the glass. In Minnesota, glass linkways and skyways are commonly used to protect people from the elements and often cause bird collisions.

NIGHTTIME COLLISIONS occur because the illumination of buildings creates a beacon effect for night-migrating birds. When weather conditions are favorable, these birds tend to fly high (over 500 feet) and depend heavily on visual references to maintain their orientation. However, during inclement weather, they often descend to lower altitudes, possibly in search of clear sky celestial clues or magnetic references and are liable to be attracted to illuminated buildings or other tall lighted structures.

Night lighting also affects daytime collisions by temporarily increasing the number of migratory birds in urban areas. When the sun rises and those "trapped" birds begin to move about, forage or seek an escape, they often encounter the deadly effects of reflective and transparent glass.

"Even the darkness moves with the passage of birds. On soft spring midnights, the air is alive with the flight notes of unseen birds filtering down through the moonlight like the voices of stars."

Scott Weidensaul, *Living on the Wind*

PROBLEM BEACON EFFECT

NYC AUDUBON

Heavy moisture (humidity, fog or mist) in the air greatly increases the illuminated space or "skyglow" around buildings, regardless of whether the light is generated by an interior or exterior source. Birds become disoriented and entrapped while circling in the illuminated zone and are likely to succumb to exhaustion, predation, or lethal collision.

Problem: Beacon effect, illumination

PROBLEM ILLUMINATED ATRIA

When night-migrating birds become trapped in a dense urban area they often fly towards illuminated lobbies and atria on lower levels. Potted plants inside the glass can be a deadly lure as birds seek safety and do not perceive the glass in their way.

DID YOU KNOW?

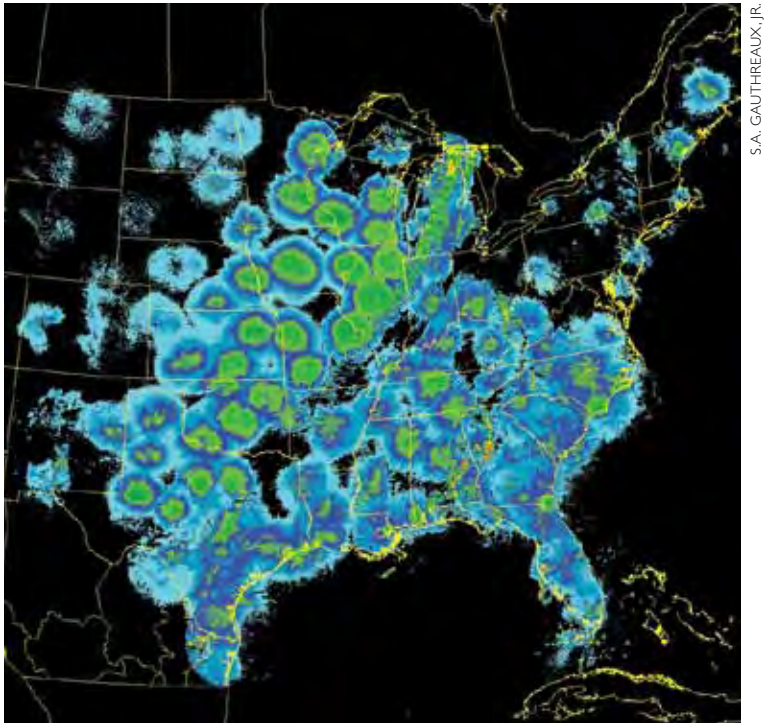
In addition to the adverse impacts on migrating birds, significant economic and health incentives exist for curbing light pollution. Overly lit buildings waste tremendous amounts of electrical energy, increasing greenhouse gas emissions and air pollution levels, and of course, wasting money. Researchers estimate that the United States alone wastes over one billion dollars on electricity annually because poorly designed or improperly installed outdoor fixtures allow much of the lighting to go up to the sky.[9] In addition to the threat this poses to birds and other animals, "light pollution" has significant aesthetic and cultural impact as well. Studies estimate that over two thirds of the world's population can no longer see the Milky Way, which humans have gazed at with a sense of mystery and imagination for millennia. Together the ecological, financial and aesthetic/cultural impacts of excessive lighting serve as compelling motivation to reduce and refine light usage.

Factors Affecting Bird Collisions

MIGRATION IN MINNESOTA

Minnesota is on the Mississippi Flyway. About 40% of all North American waterfowl and 326 species of birds (1/3 of all species in North America) use the Mississippi Flyway on their spring and fall migrations. Our peak migration months are May, September and October.

PLANNING BIRD-SAFE ENVIRONMENTS for both new and existing buildings requires an assessment of existing conditions. Conditions affecting bird collisions include migration, proximity to stopover locations, proximity to feeding grounds, glass coverage and glazing characteristics, building orientation and massing features, lighting, weather conditions, and building height.



Radar captures masses of migrating birds as seen from each station

MIGRATION. Collisions tend to increase each spring and fall when local bird populations are boosted by a huge influx of migrants traveling between breeding and wintering grounds. Songbirds travel primarily at night in a "broad-front" migration following several major flyways. These historic routes follow major rivers, coastlines, mountain ranges, and lakes. Along the way densely built urban areas have become migration danger zones.

S.A. GAUTHREAUX, JR.

Glass hi-rise near key habitat

PROXIMITY TO STOPOVER LOCATIONS. Birds make stopovers in waterfront, wetland, grassland, and wooded environments that are now America's most densely populated urban areas. Migrating birds have a significant chance of encountering at least one major metropolitan area during migration between breeding and wintering grounds. Birds need stopover sites to refuel. Building sites located near bird feeding areas, waterfront habitat, or patches of urban vegetation experience increased risk of bird collisions.

Birds use urban green spaces

PROXIMITY TO FEEDING AND HABITAT AREAS. Sites bordering parkland, pocket parks, habitat patches, green roofs, and street-tree corridors threaten birds since they forage in these areas for food. Building sites near water bodies and wetlands – no matter how small – put both resident and migrant species at risk. Suburban building sites with proximity to natural landscapes also present a range of hazards and can be even more dangerous to birds than urban settings.

How a building is situated on a property affects collision rates

NYC AUDUBON

BUILDING ORIENTATION AND MASSING FEATURES. Since migratory routes are broad and flight patterns vary, one cannot simply address building facades that face an assumed direction of migration. The impacts of all facades, with special emphasis on those adjacent to landscapes or other features attractive to birds, must be considered. For example, landscaped courtyards and glass vestibules can be very confusing and difficult for birds to negotiate.

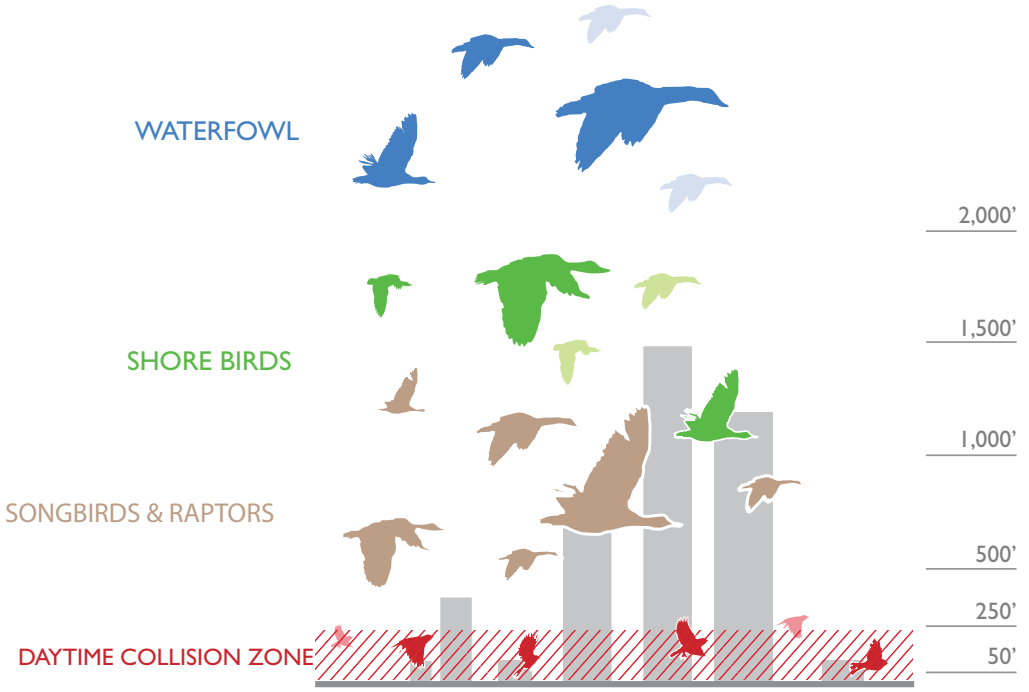
Glass confuses birds by reflecting sky or habitat

GLASS COVERAGE AND GLAZING CHARACTERISTICS. A major determinant of potential strikes is the sheer percentage of glass used on the building facade. In general, collisions will occur wherever glass and birds coexist. Ground level and low stories are the major collision zones. At these levels large expanses of monolithic glazing should be minimized, glazing reflectivity (especially when adjacent to landscapes) reduced, and "fly-through" situations eliminated.

Bright lighting oriented skyward draws birds in

NYC AUDUBON

LIGHTING AND WEATHER. Regions that are prone to haze, fog, mist, and/or low-lying clouds may see more frequent bird-kills, especially if the area contains tall buildings that are highly illuminated. Generally, there are fewer birds aloft during precipitation; however, inclement weather can develop, reducing their navigational awareness and forcing them to fly at lower altitudes in search of visual clues. Heavily illuminated buildings in their path can serve as deadly lures.



Fox & Fowle Architects - Bruce Fowle, E.J. McAdams, March 11, 2005

BUILDING HEIGHT

TALLEST:
While birds' migratory paths vary, radar tracking has determined that approximately 98% of flying vertebrates (birds and bats) migrate at heights below 1640 feet during the spring, with 75% flying below that level in the fall.[10] Today, many of the tallest buildings in the world reach or come close to the upper limits of bird migration.[11] Storms or fog, which cause migrants to fly lower and can cause disorientation, can put countless birds at risk during a single evening. Any building over 500 feet tall is an obstacle in the path of avian nighttime migration and must be thoughtfully designed and operated to minimize its impact.

MODERATE HEIGHT:
Buildings between 50 and 500 feet tall pose hazards since migrating birds descend from migration heights in the early morning to rest and forage for food. Migrants also frequently fly short distances at lower elevations in the early morning to correct the path of their migration, making moderate-height buildings, especially if reflective or transparent, a serious hazard.

LOWER LEVELS:
The most hazardous areas of all buildings, especially during the day and regardless of overall height, are the ground level and bottom few stories. Here, birds are most likely to fly into glazed facades that reflect surrounding vegetation, sky and other attractive features.

Many urban areas, like Saint Paul (above) have developed along key migration corridors like the Mississippi River

Project BirdSafe

PROJECT BIRDSAFE WAS ESTABLISHED IN MINNESOTA in 2007 as a result of growing international concern over the impact of bird collisions. Minnesota joins a growing network of individuals and organizations working to reduce hazards to birds from building collisions. Key Project BirdSafe initiatives include Lights Out, research, building monitoring, and bird safe buildings.

Minneapolis before and after "Lights Out" on the same April night

PER BREIEHAGEN

TAMI VOGEL / CLAUDIA EGELHOFF

Ovenbirds (left) and Nashville Warblers (right) are common Minnesota collision victims

LIGHTS OUT. Bright lights make beautiful skylines but they can also disorient migrating birds and lead to deadly collisions with buildings. In 2007 an ongoing Lights Out program was established as a core Project BirdSafe program. Lights Out was embraced early by both the Minneapolis and St. Paul Building Owner's and Manager's Associations (BOMA) and had an immediate effect on the Twin Cities skylines.

Lights Out buildings extinguish all possible interior and exterior lighting after midnight during both spring and fall migration. See page 26.

In 2009 the State of Minnesota passed a "Lights Out" law requiring all of the over 5,000 state owned and leased buildings to adhere to our Lights Out criterion in order to save birds and energy.

RESEARCH AND MONITORING. To answer key questions about the numbers and types of birds affected by collisions in Minnesota, Project BirdSafe volunteers monitor specific research routes in downtown Minneapolis, St. Paul and at Rochester's Mayo Clinic for dead and injured birds. These routes, while representing only a tiny subset of Minnesota structures, are designed to sample a variety of dense urban buildings. Findings help researchers to better understand some of the local conditions that contribute to bird collisions.

BIRDSAFE BUILDINGS. Ultimately the work done here and throughout the world to understand and quantify the problem of bird-building collisions must lead to action. Those who design and operate buildings are perfectly positioned to make design decisions that not only save birds day to day but also create markets for bird-safe products.

To increase awareness of bird safety in the architecture and planning community, Audubon Minnesota worked with New York City Audubon to revise these Bird-Safe Building Guidelines for distribution in Minnesota. This publication serves as an important first step towards increasing awareness and adoption of strategies locally to reduce hazards to native and migratory birds using this key migration corridor.

PARTNERS

Audubon Minnesota

Audubon Chapter of Minneapolis

Bell Museum of Natural History

BOMA Greater Minneapolis

BOMA Saint Paul

DNR Non-game Wildlife Program

National Parks Service

Perkins + Will Minneapolis

St. Paul Audubon Society

Wildlife Rehabilitation Center

Zumbro Valley Audubon Society

Comprehensive Planning for Bird Conservation

OBJECTIVE:
Incorporate bird-friendly policies and activities in design and development of urban spaces. Raise awareness of bird collision issues.

THE INCREASED INTEREST IN BUILDING GREEN creates genuine opportunities to address broader conservation issues in the design and planning of our urban and suburban spaces. A building's effect on the local, regional, national and international environment over its lifetime is reflected in energy and resource use, waste management, daily operations and direct environmental impact. Bird safety is one clear and direct impact that can be creatively addressed through collaborative comprehensive planning.

Birds are an ideal focus of community wide conservation efforts because they are a sentinel of overall environmental health. Stewardship strategies that benefit birds and their habitats also benefit a myriad of other plants and animals. These strategies go beyond those related to buildings and infrastructure just as bird-friendly design includes more than glass and lighting choices.

These Guidelines encourage participation in natural resource-based planning to protect and restore native and migratory bird species of Minnesota. This type of planning benefits communities by emphasizing vital natural assets, involving citizens in natural resource monitoring and helping to prevent unwise patterns of development which lead to disconnected fragments of open space, poor water quality and diminished community character.

Collaboration among diverse disciplines is a valuable and uniquely innovative aspect of sustainable design and development. Such an approach calls upon key participants to work beyond conventional planning and design that relies on the expertise of specialists working in isolation. Through collaboration, participants develop an enhanced understanding of how specialized knowledge can inform the design process. This new insight creates the potential for innovative design solutions to protect natural resources while improving the quality of life for communities.

Key participants in natural resource-based planning include design and engineering professionals, natural science professionals and citizen scientists, government agencies, and advocacy organizations.

Prairie planting at Thomson Reuters

Native plantings at Aveda headquarters reflect corporate commitment to the environment

Renewable energy helps birds

BIRDS AND URBAN PLANNING

The Minnesota Land Planning Act, (Minn. Stat. 473.852.869) requires that communities submit comprehensive plans in accordance with the Metropolitan Planning Council's 2030 Regional Development Framework, which includes protection of natural resources as a primary goal.[12] Native and migratory birds are a valuable natural resource.

Several North American cities have made birds a priority. The City of Chicago has developed a Bird Agenda to showcase, outline and carry forward city-wide initiatives benefiting birds. They have also signed an Urban Conservation Treaty for Migratory Birds with the US Fish & Wildlife Service, an agreement to conserve birds through education and habitat improvement.

The City of Toronto recently made history by being the first city to make it mandatory for all new construction to meet specific standards for bird safety. They have also produced and distributed a book of Bird-Friendly Development Guidelines[13] and undertaken a broad Biodiversity Campaign to educate their citizens about the natural environment in and around Toronto with birds as their initial focus.[14]

There is tremendous potential in our urban centers to make meaningful behavior adjustments to benefit the natural environment. Working collaboratively between specialties and among cities we can create a network of habitat corridors and safe areas for birds to live and breed or to pass through unharmed between summer and wintering grounds. In the process we benefit countless other creatures and ourselves.

Best Practices for Bird Safety

Best Practices included in this section make specific recommendations toward the planning, design, retrofit, and operation of buildings to minimize bird collisions. The strategies included complement the LEED (Leadership in Energy and Environmental Design) Green Building Rating System™ as well as the Minnesota Sustainable Building Guidelines (B3-MSBG).

The LEED system is the U.S Green Building Council's nationally accepted standard of sustainability for the commercial, residential, and institutional building industries. Provisions related to bird safety and landscaping are included in the latest version of LEED v3 (2009).

LEED challenges practitioners to assess the impact of building and site development on wildlife, and incorporate measures to reduce threats that buildings pose to birds. Buildings may be certified as silver, gold or platinum according to the number of credits achieved in seven categories:

1. Sustainable Sites (SS)
2. Water Efficiency (WE)
3. Energy and Atmosphere (EA)
4. Materials and Resources (MR)
5. Indoor Environmental Quality (IEQ)
6. Innovation and Design Process (ID)
7. Regional Priority (RP)

Additionally, bird-safe building criteria are planned for inclusion into Minnesota Sustainable Building Guidelines, as part of the Buildings, Benchmarks, and Beyond Program (B3-MSBG) in 2010.[2]

"By improving our cities for birds we enhance our own lives and the strength of our community. Protection of birds in an urban area presents particular challenges that can best be met by developing strong and creative partnerships."

Kent Warden
Executive Director
BOMA Greater Minneapolis

DID YOU KNOW?

If you imagine the most populous North American cities arranged horizontally as a horizon line or "birds-eye view" they cover over 40% of the width of North America. Many cities are concentrated on key migration routes, making them nearly impossible for birds to avoid.[10]

Site and Landscape Design

OBJECTIVE:
Minimize the potential for bird collisions when siting buildings near existing landscape features and when planning new landscapes in close proximity to buildings.

A WELL-INTEGRATED SUSTAINABLE DESIGN enhances open space and protects and restores habitat while enhancing the overall architectural and operational quality of a built facility. Efforts to integrate nature and attract wildlife should be balanced with specific considerations of a site's impact on birds. Birds attracted to on-site habitat are vulnerable to collisions with glass. These guidelines encourage bird-safe design strategies early in the collaborative design process through consideration of site, existing habitat, and bird-safe landscaping.

CONSIDER SITE ANALYSIS

Urban parks attract birds

Analyze the site to determine potential attractions for bird populations.

- Consult with an ecologist or bird specialist to inventory the site.
- Document the location of nearby vegetated streetscapes and urban parks.
- Identify all sources of food and shelter for migratory and resident bird populations, including plants, water and other natural features.
- Identify human-made features that attract birds, including water sources, nesting and perching sites, and shelter from adverse weather.[15]

LEED
Coordinate with LEED Credits
SS 5.1 Site Development: Protect or Restore Habitat

CONSIDER EXISTING HABITAT

Treat windows near habitat

Site building(s) to reduce conflicts with existing and planned landscape features that may attract birds.

- Where buildings cannot be located away from bird sensitive areas, take special care in treating windows. See "Exterior Glass" pages 20-21.
- Where strategic reductions to building footprint have been made in order to enhance vegetated open space and habitat, assess site conflicts and include bird safe treatments.
- Use soil berms, furniture, landscaping, or architectural features to prevent reflection in glazed building facades.

LEED
Coordinate with LEED Credits
SS 5.2 Site Development: Maximize Open Space

WHILE BIRDS COLLIDE WITH BUILDINGS AT ALL LEVELS, ground-level stories are considered the most dangerous because this is where habitat reflections, glazing and internal planting are often all quite prominent. Analysis of bird collision data over 10 years in New York City showed that "most collisions were documented to occur during the day at the lower levels of buildings where large glass exteriors reflected abundant vegetation, or where transparent windows exposed indoor vegetation."[16]

CONSIDER LANDSCAPE PLACEMENT

Dangerous reflections

Birds are vulnerable to collisions nearly anywhere glass occurs. Habitat in proximity to glass exacerbates this threat unless reflections are avoided or eliminated or visual cues are incorporated in glazing.

- When planning new landscapes be aware of reflections and see-through effects created by habitat in relation to building features. Place plantings to minimize these effects.
- Alternatively, situate trees and shrubs immediately adjacent to the exterior glass walls, at a distance of less than three feet from the glass.[17] Close proximity will minimize habitat reflections. In addition, if a bird does try to fly to a reflection at this range, flight momentum will be minimal, thereby reducing fatal collisions. This planting strategy also provides beneficial summertime shading and reduces cooling loads.
- If any bird-attracting features (food, water, shelter) are in reflective range of the building(s), use fritting, shading devices or other techniques to make glass visible. See "Exterior Glass" pages 20-21.

CONSIDER INTERIOR LANDSCAPING

Confusing interior plants

Birds will mistakenly seek shelter in landscaping located behind glass.

- Mask views of interior plantings from outside the building.
- Use screening, window films or treatments to make glass visible.

CONSIDER ROOFTOP LANDSCAPING

With the increased use of green roof technology, impacts on birds must be considered.

- Treat glass to minimize the reflection of rooftop landscaping in adjacent building features.
- Consider foregoing green roof installation or eliminating access to birds if reflection in adjacent buildings will occur.

LEED

Coordinate with LEED Credits
SS 7.1 Heat Island Effect: Non-Roof
SS 7.2 Heat Island Effect: Roof

CANOPY HEIGHT

Glass treatments should be applied to the height of the top of the surrounding tree canopy or the anticipated height of surrounding vegetation at maturity.[13]

Building Layout and Massing

OBJECTIVE:
Include bird-safe strategies as part of an integrated design approach before construction rather than retrofitting a building that proves problematic.

BIRD-SAFE STRATEGIES do not restrict the ability to design creatively. These guidelines encourage an integrated design approach, challenging building designers to include bird-safe strategies to enhance aesthetic, functional, and building performance goals. The layout of individual buildings and their relationship to other structures on the site can affect the number of bird collisions that occur. Building layout and massing can be planned along with landscaping to minimize the likelihood of bird collisions.

CONSIDER SPECIFIC SITE FEATURES

These two birds were fooled by habitat reflections

Clear barriers create a deadly hazard for birds

Ground level stories are the most hazardous areas of all buildings and should be designed to minimize bird collisions.

- Minimize those hazards that bring birds close to buildings such as vegetation, water and other features.
- Provide uniform covering with bird-safe materials, especially adjacent to landscapes. See "Exterior Glass" pages 20-21.
- Use angled glass, between 20 and 40 degrees from vertical, to reflect the ground instead of adjacent habitat or sky.[18]

Clear barriers such as transparent bus-shelters, skyways, linkways, railings, windscreens and noise barriers create a serious hazard for birds because they are invisible, causing a deadly fly-through hazard.

- Avoid use of transparent materials in these structures in any location where birds may be present. Use translucent or decorative glazing as an alternative.
- If clear panels of any kind are in use, incorporate surface treatments to make glass visible. See "Exterior Glass" pages 20-21.

Confusing corners with multiple reflections

Birds can fall through grates after hitting windows

"Bird safety is easier to sell when it overlaps with other green strategies. Slanted glass reduces solar heat gain but also works to effectively reduce bird injuries. Fritted glass reduces heat gain, and if it's 50% you can still see through it."

Jeanne Gang, Studio Gang Architects, Chicago

Courtyards may contain landscaping and confusing internal corners that limit bird escape routes. These areas often allow sudden access by people that flush birds into glass.

- Control access to enclosed areas so birds flush away from glass into open areas.
- Treat glass with bird-safe materials so birds see and avoid glass.

Rooftop obstacles such as antennas and media equipment can injure or kill birds and should be minimized. In poor weather and bright lighting conditions birds may congregate on and around rooftops.

- Co-locate antennas and tall rooftop media equipment to minimize conflicts with birds.
- Utilize self-supporting structures that do not require guy wire supports.
- Avoid up-lighting rooftop antennas and tall equipment, as well as decorative architectural spires. See "Lighting Design" pages 24-25.

Site ventilation grates also present a unexpected danger for birds. An injured bird that falls onto a ventilation grate with large pores can become trapped.

- Specify ventilation grates with a porosity no larger than 0.8 inches.[13] Cover larger grates with netting.
- Never up-light ventilation grates.

Driveways can also cause birds to flush from landscaping into reflective glazing as vehicles approach.

- Ensure routes of escape for birds that are using landscaping along driveways and access roads.
- Take care in routing driveways adjacent to landscaping and reflective glazing.

Exterior Glass

OBJECTIVE:
Prevent bird collisions with glazed surfaces, while maintaining transparency for views, daylighting and passive environmental control.

MOST BIRD COLLISIONS OCCUR at the glazed surfaces of buildings. While circumstances such as lighting and other obstacles do contribute, glass areas are the primary focus of bird-safe design and retrofit strategies regardless of the overall site, landscape, layout and massing features. Bird-friendly glass products can contribute to aesthetics, energy efficiency, and effective daylighting. For bird safety, efforts focus on creating visual markers to make glass visible to birds and minimize reflection of habitat and sky.

CONSIDER VISUAL MARKERS

Interior shades and exterior film at the Minneapolis Central Library

White fritted pattern on glass facade at IAC Offices in New York City

NYC AUDUBON

"Visual noise" is what allows us to see glass. It is created by varying materials, textures, colors, opacity, or other features and helps to break up glass reflections and reduce overall transparency.[19] Creating these visual markers can alert birds to the presence of glass as an obstacle. This is the most effective way to mitigate the danger that glass poses to birds.

- Utilize etching, fritting, translucent and opaque patterned glass to reduce transparency and reflection, while achieving solar shading. (Note: Although fritting is useful for creating visual noise, it is less effective at reducing reflectance since it is generally applied on the interior face of the glass.)
- Incorporate windows with real or applied divided lights to break up large window expanses into smaller subdivisions.
- Consider applying acid-etched or sandblasted patterns to glass on the outside surface to "read" in both transparent and reflective conditions.
- Create patterns that follow the "hand-print" rule (below).
- Use window films featuring artwork or custom patterns permanently or on a rotating basis.
- Low-reflectivity glass has not been sufficiently tested for bird safety but may prove beneficial in certain installations.

DID YOU KNOW?

Studies show that small birds will attempt to fly through any opening larger than 4 inches wide or 2 inches tall or about the size of a child's handprint oriented horizontally. When creating "visual noise" on or around a window, optimal openings are no larger than a small handprint.[19]