3.0 BIRD-WINDOW COLLISIONS

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This section describes what is currently known about BWCs in Markham, drawing on FLAP Canada's documentation. It elaborates on the primary causes of BWCs based on documentation in other parts of the GTA and North America, as well as specific observations in Markham.

3.1 Bird-Window Collisions in Markham

Approximately 900 BWCs were recorded in Markham between 2000 and 2012 (FLAP Canada 2013), though the number is suspected to be higher as less effort is spent in Markham than in other parts of the GTA (Mesure 2013 pers. comm.). BWCs were concentrated in areas shown in **Figure 2-2**. The distribution shown on **Figure 2-2** indicates that BWCs are not localized near natural areas in Markham, but tend to occur in areas where glass buildings are concentrated.

Most BWCs in Markham occurred during the day (Mesure 2013 pers. comm.). Forty-seven percent of documented collisions occurred in September, and 35% occurred in October, indicating that, as in the rest of the GTA, fall migrating birds are by far the most often involved in BWCs. Three percent of collisions occurred in April, and 10% occurred in May, showing that spring migrants are also affected. Collisions during all other months make up less than 1% of the total number, indicating that resident and breeding birds are less often involved in BWCs. However, it is known that there are undocumented collisions, for example those related to bird feeders outside residential windows.

Dr. Daniel Klem Jr. (2013 pers. comm.), who has researched BWCs for decades, noted that any building could attract BWCs if it had large amounts of glass facing areas of vegetation, even if that vegetation consisted of manicured trees and shrubs. This is borne out by the areas in which BWCs are observed outside the Greenway System.

3.2 Markham Development Structure

Markham has been mandated by the Province to intensify for future growth. The New Official Plan introduces a proposed urban structure which focuses intensification in nodes and corridors. Intensification may result in the development of more tall glass buildings with a resulting increase in night lighting.

Planted trees near windows are an amenity of urban life
Photo by North-South Environmental Inc.

Glass buildings are a feature of modern cities
Photo by North-South Environmental Inc.

3.3 Factors: Glass and Other Reflective Surfaces

Reflectivity

Surfaces that reflect habitat are seen as habitat by birds, which fly into them. Reflective surfaces can include glass, polished marble (especially dark colours as it is more reflective), or polished stainless steel. Birds may fly into glass that reflects vegetation, sky or water. Birds may even attack their own reflection in reflective surfaces.

Birds may fly into glass that reflects vegetation
Photo by North-South Environmental Inc.

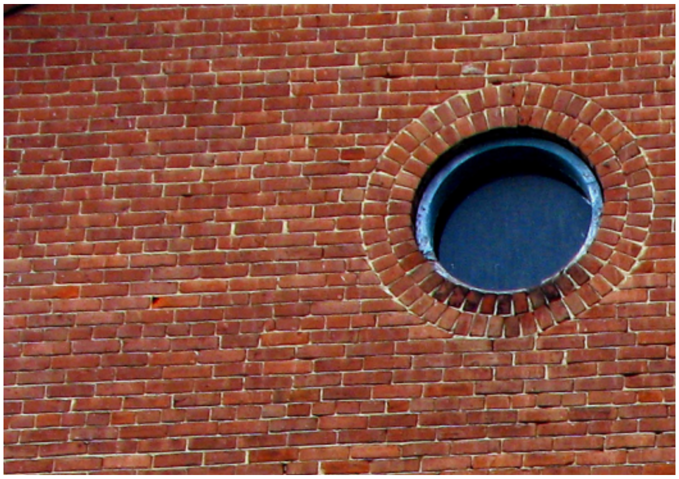
Transparency

Both research and anecdotal evidence indicate that birds do not see glass as a barrier (Klem 2013 pers. comm; Mesure 2013 pers. comm.). A bird that sees habitat through glass may fly into the glass as if it were not there. Habitat can include trees, flowers, water, sky etc. Birds may fly into glass if they can see what they perceive as habitat inside the glass (e.g. house plants), or if they can see habitat on the other side of the glass (for example vegetation, sky or water through link ways, courtyards, bus shelters, plexiglass barriers on verandas, etc.).

Birds that see habitat through the glass may fly into the glass

Black Hole/Passage Effect

Birds may fly into what they perceive as a "gap" in an obstacle. For example a dark, reflective spot in an otherwise impermeable building may appear to be a way through the building. The size of the bird is an important determinant of the size of the glass that may be a problem: e.g. hummingbirds may collide with smaller perceived passages (Mesure 2013 pers. comm.).



Birds may fly into what they perceive as a gap in an obstacle
Photo by dok1/Creative Commons

3.0

Building largely composed of glass

Glass reflects elements perceived as habitat such as sky, vegetation or water

Size of a building is not necessarily associated with numbers of collisions

Overall Design

The highest numbers of BWCs in Markham are associated with buildings that are largely composed of glass (Mesure 2013 pers. comm.). However, the "threshold" percentage of glass associated with collisions is poorly understood, since most monitoring has been conducted at "high collision" areas, and these are usually at glass buildings. However, it is known that under certain circumstances, even small areas of glass can cause problems. Research has not been conducted to show what types of buildings are consistently free of collisions.

Types of Glass

Almost any type of glass can be associated with BWCs. If the glass is transparent, it can be perceived as leading to habitat. If it is reflective, it generally reflects elements perceived as habitat such as sky, vegetation or water.

Building Size

The size of a building is not necessarily associated with numbers of collisions; except in the case where the amount of glass is proportionally high in relation to the size of the building. The surface area of glass is one of the most important factors in predicting the number of BWCs. The larger the glass surface, the higher the BWCs (Hager *et al*. 2013).

Orientation

Though each façade of a building tends to have a unique "signature" when it comes to BWCs, there is little information on the effect of orientation. For example, there is no evidence that south-facing facades are more likely to have BWCs than north-facing facades.

Proximity to Natural Features

The proximity of development and the relationship to the surrounding landscape (along with the area of glass) has been noted as one of the most important factors associated with BWCs. The closer the glass building is to natural features, generally the higher the BWCs except in some circumstances where vegetation is in very close proximity (see below). There are fewer collisions in areas with a high percentage of buildings and pavement. Hager *et al.* (2013) found that BWCs were affected by proportion of development in the immediate vicinity of a building (i.e. within 50m), as well as by the surface area of glass. There are two reasons for this: birds are attracted to natural habitat to rest and feed during migration and thus if the vegetation is closer to the building, birds have a higher probability of colliding with the building. Second, the larger the area of vegetation, the more birds are likely to be attracted to it. However, some buildings have high numbers of BWCs even though they are not immediately adjacent to large areas of natural habitat. The birds may be just as attracted by lush landscaping.

Siting

Siting of the building is very important, mainly because the building's relationship to the surrounding vegetation is so important. Building siting can deter potential BWCs to some extent. For example, it is noted that buildings sited in areas where there is a higher concentration of development (i.e. buildings and other impervious surfaces) are less likely to be involved in BWCs. This is probably because birds are more attracted to areas that appear to contain suitable habitat. However, birds tend to seek out smaller areas of habitat during migration, which can include landscaped gardens even in highly developed areas. If landscaped gardens are reflected in the glass, this may be more important than the siting of the building.

The following passage emphasizes the importance of window treatment in allowing flexibility in siting and landscaping:

- "A building that is designed to deter bird collisions will allow for most any type of site landscape design. Although the proximity and height of landscape material have been shown to influence the number of bird collisions, if the building facade is designed to be 'bird-friendly', the landscape material will not reflect and cause confusion to birds." – LEED Manual

3.0

Proximity of development and relationship to surrounding landscape is one of the most important factors associated with BWCs

Siting of the building in relation to surrounding vegetation is very important


Birds are attracted to vegetation in courtyards


Generally collisions occur from the ground to the top of reflected trees (16m)


Reflections on green roofs may only reach a few metres above the roof
Photo by Brian Roth

Design Traps

Enclosed features such as window-lined courtyards can "trap" birds, especially if the courtyard is highly vegetated, and/or contains a water feature (Mesure 2013 pers. comm.). Birds are attracted to the vegetation within the courtyard and then fly into the surrounding windows.

Reflected Vegetation

Bird-Window Collisions are most often associated with glass that reflects vegetation. The reflections can be associated with a natural feature, or can be associated with planted gardens. Both features seem to attract birds and are associated with BWCs. The height of the vegetation is the most important factor in dictating the height at which BWCs will occur. Generally, collisions occur from the ground to the top of the reflected trees (approximately 16m is considered to be the height to which urban trees usually grow). However, if a building is next to a slope, the height of the reflected vegetation may be greater than when the building is on flatter ground. Moreover, the height of mature trees in a natural area can reach 25m or more. In this case, BWCs will occur at higher levels of the building.

Green Roofs, Gardens and Walls

Green roofs adjacent to glass may attract birds and these birds may become involved in BWCs. As with vegetation on the ground, it is the height of the vegetation that dictates the height of BWCs. Vegetation on green roofs is generally adapted to shallow soils so is usually composed of grasses and herbaceous plants, possibly with a few shrubs. These generally do not reach the height that trees can reach, so reflections in the glass may potentially only reach few metres above the roof. However, some roof gardens have planted trees.

3.4 Factor: Lighting

Fatal Light Attraction

Migrating birds are attracted to artificial urban light at night under specific circumstances. The attraction is not well understood, as songbirds migrate well above cities at night, and may use brightly lit objects such as the moon and stars as navigational cues. Different colours may differ in their attractiveness to birds. Light may be particularly attractive to birds during bad weather when birds descend to rest until the weather improves and becomes more conducive to navigation.

Beacon Effect and Urban Glow

Birds attracted by urban lights that form a "cone" or beacon of light in fog may be reluctant to leave the light and fly into the darkness beyond. Under these circumstances they become disoriented and panicky, flying into anything that they cannot see clearly such as windows, tall communication towers, wires, and even structures that they would normally be able to see such as smokestacks, the ground and even each other. Some mortality events at tall buildings have involved extensive numbers of birds (Erickson *et al.* 2005).

3.5 Factor: Building Height and High Risk Bird-Window Collision Areas

The science of BWCs is evolving. While it used to be thought that night lighting was primarily responsible for collisions, it is now known that many collisions occur in the daytime within Markham (Mesure 2013 pers. comm.). There may be an interaction between night lighting and daytime bird collisions, which is poorly understood (Sheppard 2013 pers. comm.). Lighting may draw birds to seek habitat in cities where they are at risk of collisions. It is possible that the majority of nighttime bird collisions occur only in bad weather, where rain and fog cause birds to come down to the height of buildings (Gelb & Delacretaz 2009); and predicting locations and numbers of these collisions may be very difficult. Night collisions are much more prevalent in Toronto near the waterfront (Mesure 2013 pers. comm.). It is worth considering flight patterns of birds in relation to buildings of various heights, especially relative to night lighting within cities.

Migrating birds are attracted to artificial urban light

3.0

Nighttime Migration Path Threat

Songbirds generally migrate from approximately April to late May in spring, and September to late October in the fall. As shown by **Figure 3-1**, in good weather most songbirds migrate over the height of most buildings, but may rarely reach the height of the tallest in some cities. Over land, they usually fly at 640-730m (2,100 to 2,400 feet) but sometimes much lower (Cornell Laboratory of Ornithology 2007). Over water, migration takes place at a much higher altitude, from 1829-3658m (6,000 to 12,000 feet). Weather conditions often affect the migratory altitude as birds may fly higher or lower to avoid or take advantage of prevailing winds. **Figure 3-1** illustrates the height at which birds migrate in relation to buildings in the GTA.

What does this mean in relation to the height of buildings in the GTA, and in Markham in particular? The height of the CN Tower, the tallest free-standing structure in the GTA, is 553m. First Canadian Place in Toronto, the tallest building in Canada, is 298m (72 storeys). The tallest buildings in Markham generally range from 56m (18 storeys) to 31m (10 storeys). However, four buildings of over 20 storeys are under construction in Markham, two of which are 33 storeys, with several more planned for the near future (Emporis 2013a). Buildings that reach the height of migrating songbirds are rare in the world, and in North America. For example, One World Trade Centre in New York is the tallest building in North America and the fourth tallest building in the world (Emporis 2013b) but reaches only 541m (104 floors): below the height of the CN Tower. Even these buildings are below the height at which songbirds normally migrate. However, the degree to which birds are drawn down to lighted buildings at night in good weather is still unknown. What is known is that turning lights out on a building where high collisions have been documented can reduce the number of collisions dramatically (ABC 2011).

Seasonal Migratory Threat / Bad Weather Threat

The greatest potential threat to migratory songbirds from tall buildings is thought to occur in bad weather. During bad weather, when navigational cues may be impeded by rain, low cloud and fog, birds descend to much lower heights, as needed, to improve visibility. In the most extreme conditions they stop wherever they can to rest until the weather improves. As noted above, they may be trapped by light and become disoriented, and are especially likely to collide with structures at this time. Bad weather does not appear to contribute to a greater likelihood of BWCs in resident or breeding birds.

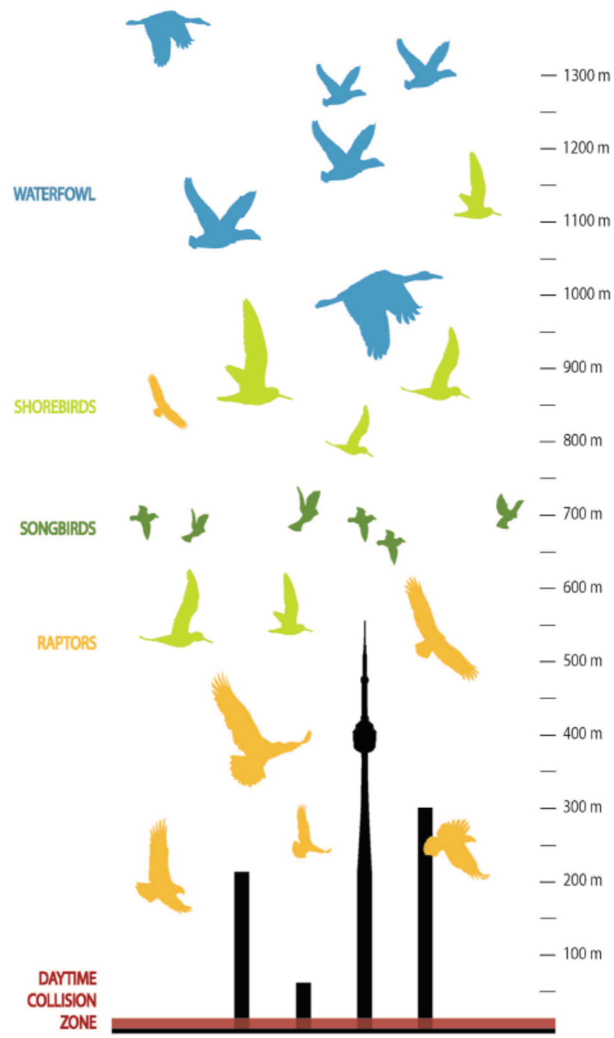


***Figure 3-1**: Approximate range of bird migration heights over land, in good conditions: adapted from figure in New York's Bird-Safe Guidelines*
Graphic adapted from New York's Bird-Safe Guidelines by North-South Environmental Inc.