Bats & Lighting

Guidance Notes for:

Planners, engineers, architects and developers

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Bat Conservation Ireland www.batconservationireland.org info@batconservationireland.org

Bats & Lighting

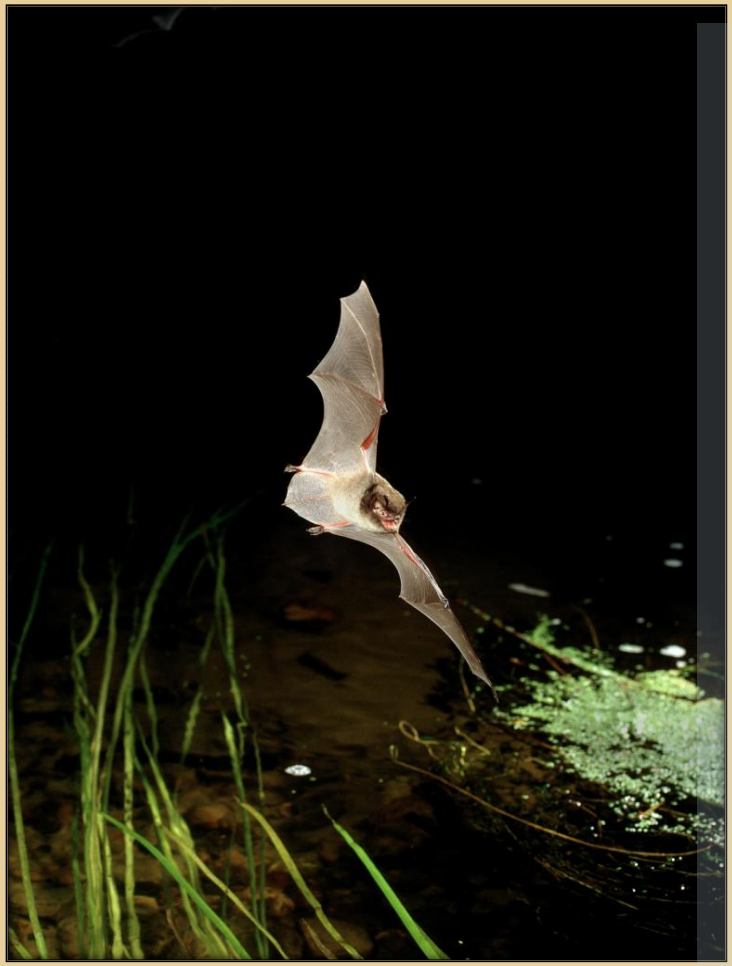
Lighting has increased dramatically over the last number of years as a result of many new developments. This includes aesthetic lighting of bridges, monuments and buildings, flood lighting of sports grounds, street and road lighting and security lighting of urban and rural areas to name but a few. Lighting can impact on bats' roosting sites, commuting routes and foraging areas. This leaflet aims to provide, for planners, lighting engineers, lighting designers and developers, information on the potential impacts of lighting on bats and how this can be reduced.

Important roosting sites

- *Attics of buildings – old and modern*
- *Underground structures e.g. caves and ice houses*
- *Crevices in stone work of old and modern bridges*
- *Tree holes, split limbs and dead wood of mature trees especially adjacent to water courses, in woodland and parkland*
- *Crevices in stone work of sluice gates, pumping stations and tidal barrages*
- *Trees with heavy ivy growth adjacent to water courses, along hedgerows and in woodland and parkland*

Important foraging areas

- *Watercourses, especially those lined with hedgerows and treelines*
- *Watercourses flowing through wooded areas*
- *Hedgerows and treelines*
- *Extensively managed and grazed pasture*
- *Woodland and parkland*



Daubenton's bat foraging over water (© Frank Greenaway)

Daubenton's bat (illustrated in the photograph above), a member of the *Myotis* family group, commutes and forages along dark wildlife corridors such as rivers and consequently shies away from highly illuminated sections. Therefore, an illuminated structure such as a bridge can impede their flight to suitable feeding areas. Consideration should be given to ensure that dark wildlife corridors remain in the landscape to allow bats and other wildlife (e.g. otters) to travel safely to and from feeding habitats.

Recognising potential roosting sites for bats

It is often difficult to tell if a structure is used as a bat roost because these small mammals can tuck themselves away out of sight. Therefore, it is important to be vigilant for suitable roosting sites and for more obvious signs of occupation such as bat droppings.

Irish bats are very small and a crevice greater than 50mm deep and 12mm wide can be used as a bat roost or allow the bat to access a larger chamber within the structure behind the crevice.

This 3D shape is 12mm high/wide and 50mm long, illustrating the dimensions of a suitable crevice for a single bat to use as a roost or access a roost.

Other evidence to be aware of includes grease stains around access holes. As bats squeeze themselves through crevices oil from their fur can leave dark polished surfaces indicating bat usage. In addition, the lack of cobwebs around a crevice can also indicate that it is used by bats.

Crevices should be checked by using a high powered narrow beam torch light or an endoscope. A single soprano pipistrelle was found in this crevice.

Ireland's bat fauna

Ireland's bat fauna is comprised of nine resident species, forming one third of Ireland's land mammals. Eight species are vesper bats and all vespertilionid bats have a tragus (cartilaginous structure found inside the pinna of the ear). Vesper bats are distributed throughout the country. Nathusius' pipistrelle is a recent addition to the Irish list while the Brandt's bat is a potential tenth species.

Common pipistrelle *Pipistrellus pipistrellus*

Soprano pipistrelle *Pipistrellus pygmaeus*

Nathusius' pipistrelle *Pipistrellus nathusii*

Leisler's bat *Nyctalus leisleri*

Brown long-eared bat *Plecotus auritus*

Natterer's bat *Myotis nattereri*

Whiskered bat *Myotis mystacinus*

Brandt's bat *Myotis brandtii*

Daubenton's bat *Myotis daubentonii*

The ninth resident species, the lesser horseshoe bat *Rhinolophus hipposideros*, belongs to the Rhinolophidea and has a complex nose leaf structure. This species' current distribution is confined to the western counties of: Mayo, Galway, Clare, Limerick, Kerry and Cork.

Bats are widely distributed throughout a range of habitats in the Irish landscape. Due to their reliance on insect populations, specialist feeding behaviour and habitat requirements, they are considered to be valuable environmental indicators of the state and condition of the wider countryside.

Above: Natterer's bat (Photo: Tina Aughney).

Below: Daubenton's bat (Photo: Tina Aughney).

Bats and the Law

Due to increasing pressure on bat populations, all Irish bat species are protected by the 1976 Wildlife Act and 2000 Amendment. They are also protected under the EU Habitats Directive.

Consequently, it is a criminal offence to

- *Intentionally kill, injure or take a bat*
- *Possess or control any live specimen or anything derived from a bat*
- *Wilfully interfere with any structure or place used for breeding or resting by a bat*
- *Wilfully interfere with a bat while it is occupying a structure or place which it uses for that purpose*

This is a brief summary of the main points of the law. Further details of the Wildlife Act and the Habitats Directive may be found on www.npws.ie.

More information about bats and their conservation can be sourced from the following documents:

McAney, K. (2006) A conservation plan for Irish Vesper bats. *Irish Wildlife Manuals* No. 25. National Parks & Wildlife Service, DoEHLG. www.npws.ie/en/PublicationLiterature/IrishWidlifeManuals

Kelleher, C. & Marnell, F (2006) Bat mitigation guidelines for Ireland, *Irish Wildlife Manuals* No. 25. National Parks & Wildlife Service, DoEHLG. www.npws.ie/en/PublicationLiterature/IrishWidlifeManuals

Marnell, F. & Presetnik, P. (2009) Protection of Overground roosts for bats, *EUROBATS Publication Series* No. 4. www.eurobats.org/publications/publications_series.htm

Mitchell-Jones, A.J. & A. P. McLeish [Eds.] (2004) *Bat Worker's Manual*, 3rd Edition. Joint Nature Conservation Committee Peterborough.

If a bat is encountered during operations, please stop works and contact your local NPWS Conservation Ranger. The national helpline number is 1800 405 000.

Bat Vision and Lighting Impacts

Contrary to common belief, bats are not blind. While bats tend to rely on a type of sonar, known as echolocation, for orientation and hunting during the hours of darkness, vision is still an important sense for bats. When bats emerge from roosts early in the evening, they tend not to echolocate but rely on eyesight to fly from the roost to adjoining treelines or hedgerows. Various studies have shown that bats' eyesight works best in dim light conditions.

Where there is too much luminance, bats' vision can be reduced resulting in disorientation. While light sensitivity varies between species, bats tend to have a higher tolerance for red visual light than white light. Short wave frequency (UV) light is most disturbing for bats. This is due to the fact that bats have a higher proportion of rods in their retina compared to cones. The rods allow greater absorption of light in dim conditions.

Too much luminance at bat roosts may cause bats to desert a roost. Light falling on a roost exit point can delay bats from emerging and miss peak levels of insect activity at dusk. Any delays of emergence can reduce feeding periods.

Lighting can also disturb bats' feeding behaviour. Many night flying insects are attracted to lights especially those lamps that emit UV light. A single source of light in a dark area can cause local insect populations to congregate in concentrations around the light source. While some Irish bat species such as Leisler's bats will opportunistically feed on such insect gatherings, the majority of Irish bat species are too sensitive to such light sources and suffer from insect populations being reduced in traditional feeding areas. In addition, artificial lighting can increase the chances of bats being preyed on. Lighting can be particularly harmful to bat populations along river corridors, woodland edges, along hedgerows and treelines and at lake edges.

Below: Lesser horseshoe bat, an Annex II species

Bat species such as the lesser horseshoe bat (above) regularly light sample before leaving the roost to feed at night time. Light sampling is where the bat flies in and out of the exit point to determine the light levels. The bat will not fully leave the roost until the light levels are low enough for it to leave the roost safely. This process of light sampling emphasises the need to strictly control lighting being used around bat roosts. Delayed emergence can occur as a result of lighting and this can impact on the bats by reducing the time available for feeding.

Each species of bat has an optimum level of light for emergence. For example, Daubenton's bats prefer a light level of less than 1 lux. To put this in perspective, 0.2 lux level is equivalent to moonlight. While all bat species have a low tolerance for light levels, the following bat species are particularly sensitive to elevated light levels: brown long-eared bat, whiskered bat, Natterer's bat, Daubenton's bat and lesser horseshoe bat.

How can planning influence lighting strategies?

Planning conditions in relation to lighting are an important way for planning authorities to influence the design of light installations and potentially mitigate their impacts. Such conditions could include:

1. *Hours of illumination – provide some hours of darkness.*
2. *Light levels – install lighting that meets the lowest light levels permitted under health and safety. Specification and colour of light treatments Use low-pressure sodium lights instead of high-pressure sodium lights or mercury lamps. If mercury lamps are to be used, fit them with UV filters.*
3. *Column heights of lamp posts – reduce the amount of light spillage where it is not needed by restricting the height of lamp columns (e.g. <8m where possible).*
4. *Type of lamps and luminaries to be installed – directional lighting means lighting is directed to where it is needed and thus prevent light spillage and light pollution.*
5. *Using modern light technology that restricts the horizontal plane of the luminaries thereby directing the lighting to where required (e.g. HiLux Projectors). Use luminaries that ensure light is not directed at an angle greater than 70° from the vertical plane (i.e. using flat glass protector).*

In addition, attention could also be given to:

1. *Sensor lighting to reduce energy wastage*
2. *Use of planting to reduce impacts of lighting*
3. *Use of demountable columns*
4. *Screening to reduce impacts of lighting*
5. *Assessment of lighting regime after installation*
6. *Greater use of the solar clock to control timing of lighting*

Types of light

Low Pressure Sodium (SOX) – this light (typically orange light) is emitted at a single wavelength with a very low amount of UV. Therefore very few insects are attracted to this light source and it has a minimal effect on bats.

High Pressure Sodium (SON) – this light (typically pinkish-yellow light) is emitted over a slightly broader wavelength spectrum. It is a more intense light so attracts more insects and has a greater impact on bats.

Metal Halide & Mercury vapour– these are white light sources that emits light at wavelengths across the colour spectrum and emits high levels of UV. These light types can attract high levels of insects and because it is a close match to daylight has a greater impact on bats. Metal halide typically comes in three types: Quartz arc tube; Ceramic arc tube and Cosmo ceramic.

Luminary (Light) accessories

Shields – these can be mounted at the front or back of luminaire.

Masking – by painting a section of the luminaire protectors, light will be blocked from penetrating through.

Louvres – these can be either internal or external rows of slates angled to block light in a certain direction.

A study on the above accessories was undertaken by Emery (2008) and concluded that shielding and masking can reduce light spillage by as much as 40%. Internal and external louvres are more effective than shields and masking and can, in fact, reduce light spillage by as much as 97%.

Emery, M. (2008) The effect of street lighting on bats. UBRIS Lighting Ltd. Unpublished.

Good Practice for minimising light impacts on bats

Bat Roosts

- No direct illumination especially on exit points
- Position lights to avoid sensitive areas
- Use low pressure sodium or high-pressure sodium lights
- Avoid the use of mercury or metal halide lamps
- Restrict lights the timing of lights to avoid bat activity
- Restrict lights to ensure that there are dark areas

Foraging and Commuting

- Avoid lighting along rivers, lakes and canals.
- Avoid lighting along important commuting routes.
- Avoid the use of mercury or metal halide lamps
- Minimise light spills using shields, masking & louvres
- Keep light columns as low as possible
- Restrict lights to ensure that there are dark hours

Vertical Luminance *– employing modern technology to minimise light spill and subsequent glare to the neighbouring environment. Light can be restricted and directed to below the horizontal plane, preferably at an angle of less than 70°.*

Sport Flood Lighting

The use of asymmetric beam floodlights, as opposed to symmetric ones, orientated so that the glass of the luminaries is positioned parallel to the ground is recommended. This will ensure that the light is cast in a downward direction and avoids horizontal spillage of the light.

General recommendations for lighting of Sport Playing Pitches:

1. Lighting levels of 3 Lux or less where feasible.

2. Buffer zone of 50m between areas requiring lighting (e.g. flood lights, pedestrian lights and car parks) and habitats (e.g. treelines, hedgerows and woodland).

3. No lighting adjacent to rivers or lakes.

4. Use lighting with no UV component.

Bibliography

Stone, E. L., Jones, G. And Harris, S. (2009) Street lights disturbs commuting bats. Current Biology,19,1-5.

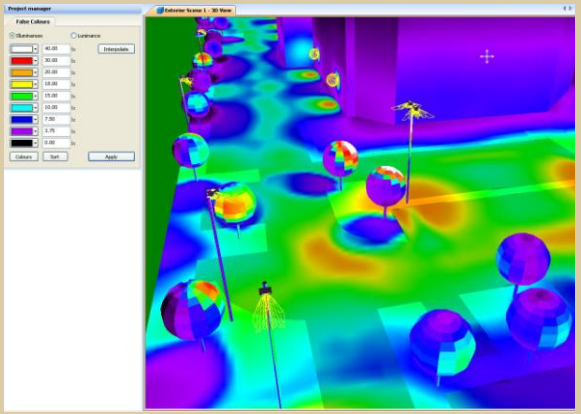
Fure, A. (2006) Bats and Lighting. The London Naturalist, No. 85.

BCT (2008) Bats and Lighting in the UK. Bats and the Built Environment Series.

Above: Example of directional lighting (Photo: Faith Wilson)

UV light component of Mercury or metal halide lights can attract up to eight times more insects than high pressure sodium lights. This can lead to a transfer of insect populations from the surrounding habitats to the light source.

Light Modelling



Modelling the dispersal of light (luminance) pre- and post development sites can help to determine where dark zones are required for bat activity locations. In relation ot the artifical colours expressed in the above illustration, the darker colours reflect areas with less light as opposed to colour gradient towards red and white reflecting areas of high luminance.

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Bat Conservation Ireland welcomes any comments on this leaflet. Please send them to info@batconservationireland.org. Leaflets will be reviewed and updated as required.

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