



Norway Lane Site, Littlehampton

Bat Survey Report (updated)

18th August 2014

Client	Mr R F Wickens
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Author	Marcus Fry	Director	18 th August 2014



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1 Introduction

1.1 Background

For information relating to the site description and previous ecological survey work conducted for the site, refer to the following reports:

- Andrew McCarthy Associates (AMA) Extended Phase 1 Habitat Survey Report, dated 19th May 2009; and
- GreenLink Ecology Ltd. report named and referenced: "Protected Species Survey Report, 09_262_Report_MF_RW", dated 15th June 2009.

In summary, the initial AMA report recommended further protected species survey work, since potential had been identified for bats, great crested newt and reptiles. The detailed surveys were undertaken in 2009 by GreenLink Ecology Ltd. without significant constraint, with a single common pipistrelle bat (*Pipistrellus pipistrellus*) recorded emerging from the uninhabited dwelling and low numbers of slow worm (*Anguis fragilis*) and common lizard (*Zootoca vivipara*) recorded as present throughout the semi-natural habitats in the overall site. There were no great crested newt recorded at any time during the lake survey and the species was considered most likely to be absent from the site.

Of relevance to this document, the 2009 GreenLink Ecology Ltd. report recommended that: *"It is considered likely, given that only one bat was recorded on one occasion that the house is only of low intermittent seasonal importance to male and/or non-breeding female common pipistrelle bats. For this reason a European Protected Species (EPS) licence is not likely to be required for bats in relation to the demolition of the building, although a mitigation and compensation strategy will need to be developed to ensure that there is no killing of or injury to bats and no net loss of roosting habitat within, or close to the site"*.

1.2 Proposed Works

It is understood that the proposed works are to be the subject of a planning application to Arun District Council, the Local Planning Authority (LPA) and would involve the demolition of the existing dwelling and subsequent construction of a replacement dwelling, with two garages and associated infrastructure/landscaping.

It should be noted that the previous 2009 survey work was undertaken in support of a planning application for proposals that affected a much larger part of the site.

1.3 Aims of Study

GreenLink Ecology Ltd. has been commissioned by Mr R F Wickens to conduct an updated bat survey for the site, in accordance with the Bat Conservation Trust's (BCT) 2012 published guidance¹ (i.e. current best practice guidelines), to establish whether bats would be legally protected species constraint to the proposed works.

The aim of this report is to present the results of the survey, make recommendations in terms of whether mitigation measures are required to avoid the risk of impacts to bats and assess the need for a European Protected Species Mitigation (EPSM) licence to be applied for.

Great crested newt and reptiles are considered in a covering letter, which accompanies this report.

¹ Hundt L (2012) *Bat Surveys: Good Practice Guidelines*, Bat Conservation Trust (2nd Edition)

2 Legislation and Policy

2.1 Bats

All species of bat native to the UK and bat habitats are protected under the Wildlife and Countryside Act 1981 (as amended by the CRoW Act 2000), and by the Conservation of Habitats and Species Regulations 2010, which consolidates all the various amendments made to the Conservation (Natural Habitats, &c.) (Amendments) Regulations 1994 in respect of England and Wales.

The 1994 Regulations transposed Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (EC Habitats Directive) into national law.

The legislation makes it illegal under the Wildlife and Countryside Act 1981 (as amended) to:

- Intentionally or recklessly kill, injure or take a wild bat;
- Be in possession or control of any live or dead wild bat, or any part of, or anything derived from a wild bat;
- Intentionally or recklessly damage, destroy or obstruct access to any place that a wild bat uses for shelter or protection; and
- Intentionally or recklessly disturb any wild bat while it is occupying a structure or place that it uses for shelter or protection.

All species of bat native to the UK are European Protected Species (EPS). As such under the Conservation of Habitats and Species Regulations 2010, it is an offence to:

- Deliberately capture, injure or kill any wild animal of a European Protected Species;
- Deliberately disturb wild animals of any such species. Disturbance of animals includes in particular any disturbance which is likely to:
 - impair their ability –
 - to survive, to breed or reproduce, or to rear or nurture their young; or
 - in the case of animals of a hibernating or migratory species, to hibernate or migrate; or
 - to affect significantly the local distribution or abundance of the species to which they belong;
- Deliberately take or destroy the eggs of such an animal; or
- Deliberately damage or destroy a breeding site or resting place of such an animal.

2.2 National Planning Policy Framework

The Government published the National Planning Policy Framework (NPPF) on 27th March 2012, which replaced previous policy documents, including Planning Policy Statement 9 (PPS9): Biodiversity and Geological Conservation. The NPPF states that, "the planning system should contribute to and enhance the natural and local environment by:

- Protecting and enhancing valued landscapes, geological conservation interests and soils;
- Recognising the wider benefits of ecosystem services;
- Minimising impacts on biodiversity and providing net gains in biodiversity, where possible contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

- Preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and
- Remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate.”

The NPPF (Section 117) indicates that Local Planning Authorities (LPAs) should take measures to “promote the preservation, restoration and re-creation of priority habitats, ecological networks and the protection and recovery of priority species” linking to national and local targets through local planning policies.

Priority species are those species shown on the England Biodiversity List published by the Secretary of State under Section 41 of the Natural Environment and Rural Communities (NERC) Act 2006. LPAs have a duty under Section 40 of the NERC Act to have regard to priority species and habitats in exercising their functions including development control and planning.

In addition, the NPPF (Section 118) states that when determining planning applications, LPAs should aim to conserve and enhance biodiversity by encouraging opportunities to be taken for the incorporation of biodiversity in and around developments.

3 Methodology

In accordance with the BCT 2012 published guidance, two dusk emergence survey visits and one pre-dawn re-entry survey visit were conducted for the building. These survey visits were undertaken during June 2014, by Natural England bat licence holder Marcus Fry MCIEEM² (licence no. CLS01400) assisted by Rachel Masters GradCIEEM³.

The surveyors covered opposite aspects of the building, using Anabat SD1 and BatBox IIID bat detectors, to enable any bats emerging at dusk/re-entering at dawn to be recorded.

The dusk emergence survey visits began approximately half an hour before sunset and continued until approximately two hours after sunset. The pre-dawn survey visit began approximately 90 minutes before sunrise and continued until the sun was visible.

During the survey visits, observations were made regarding bat activity around the area, and any bat ultrasonic echolocation calls that made within range of the bat detectors were recorded and later analysed on a computer to determine which species of bat made them.

² Member of the Chartered Institute of Ecology and Environmental Management (Full)

³ Member of the Chartered Institute of Ecology and Environmental Management (Graduate)

4 Results

In summary, the results of the 2014 survey were similar to the results of the 2009 survey, with only a single common pipistrelle bat recorded emerging from the building at dusk.

During the first dusk survey visit conducted on 2nd August 2014, one common pipistrelle bat was recorded emerging from the corner of the dormer window on the western aspect of the dwelling's roof. Low numbers of common pipistrelle and soprano pipistrelle (*Pipistrellus pygmaeus*) bats were recorded foraging around the lake area to the west but no activity was recorded in association with the site other than one noctule bat (*Nyctalus noctula*), which was briefly recorded foraging high above the site.

During the pre-dawn survey visit conducted on 3rd August 2014, there were no bats recorded re-entering the building and distant foraging calls were recorded only intermittently, made by common pipistrelle bats.

The results of the second dusk survey visit conducted on 17th August 2014 were similar to the first visit, with a single common pipistrelle bat recorded emerging from the corner of the dormer window on the eastern aspect of the dwelling's roof (i.e. opposite aspect to the previous emergence). Low numbers of common pipistrelle and soprano pipistrelle bats were recorded foraging around the lake area to the west but no other bat activity was recorded in association with the site.

Table 1: Details of the bat survey

Date	Weather conditions	Time of sunset/rise	Species of bat emerging/re-entering (numbers)	Bat activity (calls, not individuals)
02/08/2014	Clear skies, 22°C	20:45	Common pipistrelle (1)	Common pipistrelle (18) Soprano pipistrelle (8) Noctule (3)
03/08/2014	Scattered cloud, 11°C	05:26	None	Common pipistrelle (5)
17/08/2014	Clear skies, 17°C	20:18	Common pipistrelle (1)	Common pipistrelle (21) Soprano pipistrelle (6)

5 Assessment

5.1 Constraints

The scope of the survey was in accordance with the 2012 BCT published guidance (i.e. to have confidence in a negative result), the survey work was undertaken by suitably experienced and licensed ecologists, during an appropriate time of the year and under optimal climatic conditions. It is therefore considered that there were no significant constraints to the bat survey.

5.2 Potential Impacts

Bats would be affected by the permitted works, since the survey work (2009 and 2014) has determined that one common pipistrelle bat uses various parts of the uninhabited dwelling for roosting purposes, which is proposed to be demolished.

As referred to in Natural England's published guidelines⁴, the roost status is "*small numbers of common species, not a maternity site*", which is of "*low conservation significance*", with the permitted works causing a "*low scale of impact*".

Without appropriate mitigation, the demolition of the building could result in direct impacts to bats through injury or mortality and the disturbance, damage and destruction of actual roost sites, all of which would be an offence against domestic and European law.

However, despite these potential impacts, by using best practice mitigation measures, as recommended in a subsequent section, it is considered that negative impacts to individual bats and to the conservation status of the local bat population can be avoided.

⁴ Bat Mitigation Guidelines. A.J. Mitchell-Jones: English Nature (2004).

6 Recommendations

The 2009 GreenLink Ecology Ltd. report recommended that "...a European Protected Species (EPS) licence is not likely to be required for bats in relation to the demolition of the building", which was at the time informed by unofficial advice from Natural England concerning very low numbers of bats (of common/widespread species) in association with low conservation status roosts. Subsequently, in July 2011, Natural England clarified the official position in that: "Destruction of a bat roost is an absolute offence and requires a mitigation licence from Natural England".

Therefore, since the survey work has confirmed that very low numbers of common pipistrelle bats use parts of the uninhabited dwelling for roosting purposes and it is considered that there is a risk of the proposed works impacting upon bats, it is recommended that an EPS licence should be applied for, to ensure that the permitted works do not cause an offence against the legislation detailed in Section 2.1.

An EPS licence allows the strict protection afforded to bats to be set aside (derogation) but does not legitimise killing or injury. As would be specified in detail in the EPS licence method statement, mitigation measures will be required to ensure that bats are protected during the permitted works and that the favourable conservation status of the species is maintained.

The issuing of EPS licences in England in relation to development work is currently dealt with by Natural England's Wildlife Management and Licensing Unit, which takes up to 30 working days to process EPS licence applications. A licence cannot be issued until planning permission has been granted and all relevant conditions have been discharged.

The EPS licence application comprises three documents, including a basic details document, a reasoned statement document and a detailed method statement document. The latter document describes how mitigation works will be undertaken in accordance with best practice, to avoid significant disturbance, killing of, or injury to bats.

Mitigation will need to be carried out during an appropriate time of the year, to avoid impacting upon bats during vulnerable life-cycle stages and under the supervision of an appropriately experienced and licensed ecologist. In this situation, since a maternity roost is not present but the building could be used by hibernating bats, the implementation of mitigation measures should take place outside of winter (i.e. avoiding November to February), when bats will be able to naturally disperse away from disturbance.

In advance of any works taking place with the potential to impact on bats, three Schwegler bat boxes (models 1FF, 2F and 2FN) will need to be installed on mature trees within the overall site, above at least five metres and on a variety of orientations. These boxes will provide short-term alternative roosting opportunities whilst the building is demolished and will need to be retained in-situ in the long-term.

As will also be specified in detail in the EPS licence method statement, exclusion devices will need to be installed to confirmed and potential roosting locations on the building (where practical from a health and safety perspective), to allow bats to leave (if present) but not return to them. Where this is not practical, artificial lighting will be used to illuminate the features from approximately two hours after dusk until approximately one hour after dawn, which should have the same exclusion effect.

Exclusion devices to be used will need to be one way tubes, plastic pockets or membranes - in accordance with/adapted from the designs provided in the Bat Worker's Manual (Section 9.1.2), which shall be installed at known and potential access points throughout the building (where practical from a health and safety perspective) during a period of optimal climatic conditions for

the season (i.e. no frost, snowfall and minimum night time temperatures circa $>10^{\circ}\text{C}$). These exclusion devices will be left for five nights prior to dismantling works taking place.

Subsequently, dormer windows, roof tiles and any other features with bat roost potential will be carefully dismantled under the supervision of an appropriately experienced and licensed ecologist/accredited agent.

Contractors will need to be briefed by the licensed ecologist about what to do in case of encountering bats during unsupervised works, which will entail leaving the bat undisturbed whilst a licensed ecologist is contacted, unless there is a perceived risk of killing/injury through inaction.

If any bats are found during the dismantling works, they will need to be carefully captured by hand by the licensed ecologist/accredited agent, checked for injury and transferred to one of the bat boxes that will have already been installed on mature trees around the site. The entrance to the box will be blocked with a breathable membrane until after dusk. If a bat is found to be injured, it will be placed in a handling bag and kept warm whilst being transported to the Forest Row bat hospital.

To provide compensatory roosting opportunities, like-for-like replacement features will need to be installed on the new building, to include two small cavity wall boxes, on different aspects, at eaves level. The exact location of these features will be determined in consultation between the licensed ecologist and building contractor.

The artificial lighting scheme for the site should comply with the BCT published guidance⁵ (Appendix 2) so as not to illuminate the adjacent lake, hedgerows and trees, which are used by foraging bats.

Regular checks will need to be made by the licensed ecologist/accredited agent during works to ensure compliance with legislation. In particular, checks will be made to ensure that mitigation has been carried out in accordance with the mitigation strategy. Where deficiencies are found, the client will be advised what is required to remedy the situation and checks will be made to ensure this has been done. If the ecologist is not satisfied that the mitigation strategy is being followed and the client has not taken steps to rectify the situation having been made aware of the fact, the licensing authority will be informed.

Due to the low conservation status of the roost, no post-construction monitoring is recommended, other than remedial checks described above.

⁵ Bat Conservation Trust, *Bats and Lighting in the UK, Bats and the Built Environment Series*, May 2009.

7 Conclusions

GreenLink Ecology Ltd. was commissioned to conduct a bat survey for the uninhabited dwelling, to update the 2009 survey report and inform a planning application.

The dusk/pre-dawn bat survey that was conducted without significant constraint during August 2014, recorded a single common pipistrelle bat emerging from different parts of the dwelling's roof, which is consistent with the results of the 2009 survey.

The roost status is therefore considered to be *"small numbers of common species, not a maternity site"*, which is of *"low conservation significance"*, with the permitted works causing a *"low scale of impact"*.

Since it is considered that there is a risk of the proposed works impacting upon bats, an EPS licence will need to be applied for to ensure that the permitted works do not cause an offence against the legislation. The EPS licence will include a detailed method statement that will incorporate the mitigation and compensation measures described in this report.

Provided the measures detailed in this report and the EPS licence method statement are implemented correctly, there should be no significant impacts to individual bats, or to the favourable conservation status of the local bat population.

8 Disclaimer

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Any recommendation, opinion or finding stated in this report is based on circumstances and facts as they existed at the time that GreenLink Ecology Ltd. performed the work.

Nothing in this report constitutes legal opinion. If legal opinion is required the advice of a qualified legal professional should be secured.

9 Appendices

Appendix 1: Approximate emergence locations

Photograph 1: Corner of dormer window on the eastern aspect of the dwelling



Photograph 2: Corner of dormer window on the western aspect of the dwelling



Appendix 2: BCT publication - Bats and Lighting in the UK



BATS AND LIGHTING IN THE UK

Bats and the Built Environment Series

This document is aimed at lighting engineers, lighting designers, planning officers, developers, bat workers and anyone specifying lighting. It is intended to raise awareness of the impacts of lighting on bats and mitigation is suggested for various scenarios. It also offers an explanation of the facts associated with the lighting industry for the benefit of bat workers.

This is a working document and as such the information contained will be updated in line with advances in our knowledge both into the impact on bats and also to reflect the advances in technology available in the lighting industry.

The information provided here is believed to be correct. However, no responsibility can be accepted by the Bat Conservation Trust, the Institution of Lighting Engineers or any of their partners or officers for any consequences of errors or omissions, nor responsibility for loss occasioned to any person acting or refraining from action as a result of information and no claims for compensation for damage or negligence will be accepted.

ABOUT BATS – FOR THE LIGHTING INDUSTRY

General Ecology

Bats are the only true flying mammals. Like us, they are warm-blooded, give birth and suckle their young. They are also long-lived, intelligent and have a complex social life. In Britain there are 17 species, all of which are small (most weigh less than a £1 coin) and eat insects.

Bats have evolved a number of unusual features, mainly connected with their ability to fly. Their wings are formed from a web of highly elastic skin stretched over greatly elongated finger bones, the legs and tail, though their thumbs remain free to help them cling on when roosting. Bats have also developed a highly sophisticated echolocation system that allows them to avoid obstacles and catch tiny insects, which they seize in flight or pick off water, the ground or foliage, even in complete darkness. When they're flying, bats produce a stream of high-pitched calls and listen to the echoes to produce a sound picture of their surroundings.

Some bats specialise in catching large insects such as beetles or moths but others eat large numbers of very small insects, such as gnats, midges and mosquitoes. Bats gather to feed wherever there are lots of insects, so the best places for them include traditional pasture, woodland, marshes, ponds and slow moving rivers.

During the winter there are relatively few insects available, so bats hibernate. In September and October they put on weight and then, as the weather gets colder, they seek out appropriate sheltered roosts, let their body temperature drop to close to that of their surroundings and slow their heart rate to only a few beats per minute. This greatly reduces their energy requirements so that their food reserves last as long as possible. Bats don't hibernate right through the winter but may wake up and go out to feed on mild evenings when insects are active.

During the spring and summer period female bats gather together into maternity colonies for a few weeks to give birth and rear their young (called pups). Usually only one pup is born each year. This is looked after carefully and suckled for between four and six weeks until it is old enough to fly out and hunt for itself. Bats don't build nests and don't bring food back to the roost to feed their young, so the baby lives only on its mother's milk until it is old enough to fly. Once the baby is independent, the colony breaks up and the bats generally move to other roosts. Bats may gather together from a large area to form these maternity roosts, so any disaster at the summer breeding site can affect the whole colony of bats from a wide surrounding area. Many of these maternity sites are used every summer as bats have a strong tradition of returning to the same site year after year.

Legal Protection of bats

Due to the decline in bat numbers, all species of bat are protected by the Wildlife & Countryside Act (1981) (as amended) and the Conservation (Natural Habitats, &c.) Regulations 1994 (as amended). This makes it illegal to: kill, injure, capture or disturb bats, obstruct access to bat roosts or damage/destroy bat roosts. Lighting in the vicinity of a bat roost causing disturbance could constitute an offence, so it is important that Natural England, Countryside Council for Wales, Scottish Natural Heritage or Environment and Heritage Service, Northern Ireland is consulted and allowed time to provide advice on lighting proposals in the vicinity of bats and roosts.

Impacts on bats**Roosts**

Illuminating a bat roost creates disturbance and may cause the bats to desert the roost. Light falling on a roost access point will at least delay bats from emerging and this shortens the amount of time available to them for foraging. As the main peak of nocturnal insect abundance occurs at and soon after dusk, a delay in emergence means this vital time for feeding is missed.

Insects and foraging

In addition to causing disturbance to bats at the roost, artificial lighting can also affect the feeding behaviour of bats. There are two aspects to this. One is the attraction that light from certain types of lamps has to a range of insects; the other is the presence of lit conditions.

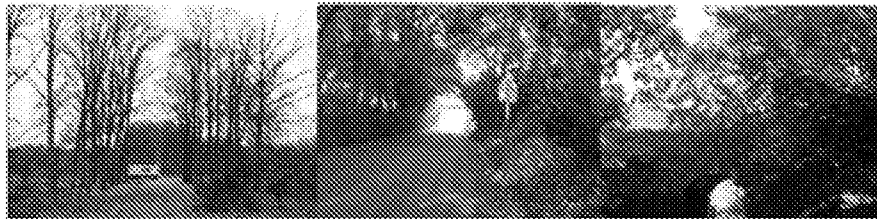
Many night flying species of insect are attracted to light, especially those lamps that emit an ultra-violet component and particularly if it is a single light source in a dark area. As well as moths a range of other insects can be attracted to light such as crane flies, midges and lacewings. Studies have shown that, although noctules, Leisler's, serotine and pipistrelle bats swarm around white mercury street lights (this would also apply to metal halide) feeding on the insects attracted to the light, this behaviour is not true for all bat species. The slower flying broad winged species such as long-eared bats, *Myotis* species (which include Brandt's, whiskered, Daubenton's, Natterer's and Bechstein's), Barbastelle and greater and lesser horseshoe bats generally avoid street lights. In addition it is also thought that insects are attracted to lit areas from further afield. This is thought to result in adjacent habitats supporting reduced numbers of insects. This is a further impact on the ability of the light avoiding bats to be able to feed. It is noticeable that most of Britain's rarest bats are among those species listed as avoiding light. Clearly, effective mitigation where there is potential for impact on bats has importance in the conservation of these species.

Artificial lighting is thought to increase the chances of bats being preyed upon. Many avian predators will hunt bats which may be one reason why bats avoid flying in the day. Observations have been made of kestrels (diurnal raptors) hunting at night under the artificial light along motorways.

Lighting can be particularly harmful if used along river corridors, near woodland edges and near hedgerows used by bats. In mainland Europe, in areas where there are foraging or 'commuting' bats, stretches of road are left unlit or lighting is designed in such a way as to avoid isolation of bat colonies.

Other behaviours

Artificial lighting disrupts the normal 24-hour pattern of light and dark which is likely to affect the natural behaviour of bats. Bright light may reduce social flight activity and cause bats to move away from the light area. Studies have shown that continuous lighting along roads creates barriers which some bat species cannot cross. For example, Daubenton's bats move their flight paths to avoid street lamps. The following images indicate possible scenarios where bats' commuting routes may cross a road. They are linear features such as tree lines, river corridors, hedgerows or where tree canopies form a link over the road.



ABOUT THE LIGHTING – FOR BAT WORKERS

Types of lights in use

A range of lighting equipment is available:

- 1) **Low pressure sodium lamps (SOX)** (typical orange lamps seen along roadsides). Light is emitted predominantly at one wavelength, contains minimal ultraviolet (UV) light and has a low attraction to insects. The lamps tend to be large which makes it more difficult to focus the light from these lamps. These are in the gradual process of being removed or replaced.
- 2) **High pressure sodium lamps (SON)** (brighter pinkish-yellow lamps). Commonly used as road lighting. Light is emitted over a moderate band of long wavelengths including a small UV component. Insects are attracted to the brighter light. The lamp is of medium size and the light can be more easily directed than low pressure sodium. This is the predominant lamp now in use.
- 3) **Mercury lamps (MBF)** (bluish-white lamps). These emit light over a moderate spectrum including a larger component of UV light to which insects are particularly sensitive. Insects are attracted in large numbers along with high densities of bat species. (Rydell & Racey 1993). They are rare now and are not used in new developments.
- 4) **White SON**. This is whiter than High Pressure Sodium and has a larger component of UV light.
- 5) **Metal Halide**. A small lamp and therefore more easy to focus light and make directional. Emits less UV light than mercury but more than high pressure sodium. It comes in three forms a) Quartz arc tube (HQI); b) Ceramic arc tube (CDM-T) and c) Cosmo which is a new ceramic form.

- 6) **Light Emitting Diodes (LEDs)**. Predicted to compete with metal halide and high pressure sodium as a widely used light source within the next few years. The light emitted is more directional. The light is produced in a narrow beam. It is instant light.
- 7) **Yungsten Halogen** (more directional). It is not used in new lighting schemes but may be encountered as security light on a private household.
- 8) **Compact Fluorescent** Mostly in use in residential street lighting. It produces a white light; variants are available with minimal UV output. It can be used at a low wattage and therefore on a low output to achieve low lux.

Legal requirements for lighting

There is no legislation requiring an area or road to be lit.

The Building Regulations specify that 150 W is the maximum for exterior lighting of buildings but this does not apply to private individuals.

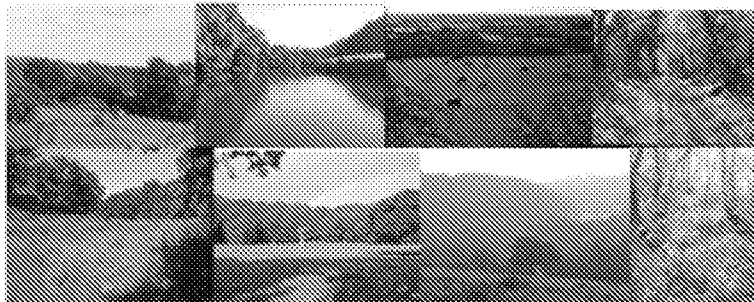
There are a number of British Standards that relate to various components of lighting and there are also guidelines that relate to crime prevention, prevention of vehicular accidents and amenity use.

Many County councils and less often District and Borough councils set out standards in local guidance policy documents. These are sometimes based on the advice given by the Highways Authority 'TA49 – Approval of new and replacement lighting on trunk roads and trunk road motorways'.

In assessing the need for lighting it would be beneficial to ask the local authority for their lighting policy document as this should incorporate all of the above.

The installation of lighting and the planning system

Domestic lighting needs no planning permission and depends on direct advice being given to the householder. Lighting associated with new development or a listed building does require planning permission. Planning officers or developers when dealing with applications for lighting in an area of suitable bat habitat eg. woodland, old pasture, linking hedgerows and water habitats) should seek information on bat roosts in the area.



If assistance is needed they can contact the BCT Bat Helpline 0845 1300 228 who may be able to suggest how best to access information on bat roosts known in the area. If bat

roosts are suspected, it may be necessary to conduct a bat survey. A survey may need to determine the species of bat affected, their population levels, the likely impact of the lighting on the bats and possible mitigation.

The need to install lighting should be questioned. Where lighting is permitted, as may be necessary for public safety, conditions should be imposed to ensure the impact of the lighting on the bats is kept to a minimum. The use of a lighting design computer program that predicts where light will fall should be used to predict the potential impact and to plan mitigation.

The consultation on the addition to PPS23 on Pollution Control of Annex 3 on lighting is on hold at the present time (July 2007) until the outcome of the Baker review is known.

MITIGATION OF LIGHTING IMPACTS ON BATS

1. BAT ROOSTS

No bat roost (including access points) should be directly illuminated. If it is considered necessary to illuminate a building known to be used by roosting bats, the lights should be positioned to avoid the sensitive areas. Close offset accent lighting causes less light pollution; it is more specific and can be designed to avoid bat sensitive areas, and better highlights the features of the subject of the illumination.

2. FORAGING AND COMMUTING

Type of lamp (light source)

The impact on bats can be minimised by the use of low pressure sodium lamps or high pressure sodium instead of mercury or metal halide lamps where glass glazing is preferred due to its uv filtration characteristics.

Luminaire and light spill accessories

Lighting should be directed to where it is needed and light spillage avoided. This can be achieved by the design of the luminaire and by using accessories such as hoods, cowls, louvres and shields to direct the light to the intended area only. Planting can also be used as a barrier or manmade features that are required within the build can be positioned so as to form a barrier.

Lighting column

The height of lighting columns in general should be as short as is possible as light at a low level reduces the ecological impact. However, there are cases where a taller column will enable light to be directed downwards at a more acute angle and thereby reduce horizontal spill. For pedestrian lighting this can take the form of low level lighting that is as directional as possible and below 3 lux at ground level. The acceptable level of lighting may vary dependent upon the surroundings and on the species of bat affected.

Predicting where the light cone and light spill will occur

There are lighting design computer programs that are widely in use which produce an image of the site in question, showing how the area will be affected by light spill when all the factors of the lighting components listed above are taken into consideration. This should be a useful tool to inform the mitigation process.

Light levels

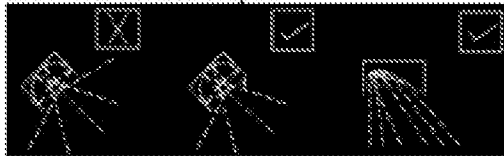
The light should be as low as guidelines permit. If lighting is not needed, don't light.

Timing of lighting

The times during which the lighting is on should be limited to provide some dark periods. Roads or trackways in areas important for foraging bats should contain stretches left unlit to avoid isolation of bat colonies. These unlit stretches should be 10 metres in length either side of commuting route.

3. FLOODLIGHTING OF SPORTS OR EVENTS

The use of asymmetric beam floodlights (as opposed to symmetric) orientated so that the glass is parallel to the ground will ensure that the light is cast in a downward direction and avoids horizontal spill.



See the National Trust guide to 'Events, concerts and bats' at http://www.nationaltrust.org.uk/main/w-bat05_events.pdf for further advice on ways to reduce the impact of event lighting.

4. SECURITY LIGHTING

Power It is rarely necessary to use a lamp of greater than 2000 lumens (150 W) in security lights. The use of a higher power is not as effective for the intended function and will be more disturbing for bats.

Movement sensors Many security lights are fitted with movement sensors which, if well installed and aimed, will reduce the amount of time a light is on each night. This is more easily achieved in a system where the light unit and the movement sensor are able to be separately aimed.

Timers If the light is fitted with a timer this should be adjusted to the minimum to reduce the amount of 'lit time'.

Aim of light The light should be aimed to illuminate only the immediate area required by using as sharp a downward angle as possible. This lit area must avoid being directed at, or close to, any bats' roost access points or flight paths from the roost. A shield or hood can be used to control or restrict the area to be lit. Avoid illuminating at a wider angle as this will be more disturbing to foraging and commuting bats as well as people and other wildlife.

Alternatives

It may be a better solution for security lighting on domestic properties to use a porch light.

Ongoing areas of research

- The impact of light on commuting corridors used by lesser horseshoe bats. Emma Stone, University of Bristol
- The effects of lighting on prime bat foraging areas within London, concentrating on riparian habitats and open spaces. Alison Fure.
- The effect of light and noise on British bat species. Frank Greenaway.

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Glossary of terms

(used in this article or that may be used by the lighting industry)

Arc tube	A tube normally ceramic or quartz enclosed by the outer glass envelope of a HID lamp that contains the arc stream.
Asymmetric beams	Lamp is off-centre in a reflector more steeply curved at one end.
Candela	The intensity of a light source in a specific direction. Unit of Luminous intensity
Contrast	The relationship between the luminance of an object and its background. The higher

	the contrast the more likely it is an object can be seen.
Cowl	Physical light spill control accessory.
Diffuse	Term describing dispersed light distribution referring to the scattering of light.
Efficacy	A measure of light output against energy consumption measured in lumens per watt.
HID	High Intensity Discharge. Describes mercury vapour, metal halide and high pressure sodium lamps.
High Pressure Sodium Lamp	A HID lamp whose light is produced by radiation from high pressure sodium vapour which usually includes a small amount of UV light.
Hood	Physical light spill control accessory.
Illuminance	Illuminance is the quantity of light, or luminous flux, falling on a unit area of a surface. It is designated by the symbol E. The unit is the lux (lx).
Lamp	Light source.
Light cone	The angle at which the beam falls off to 50% of peak intensity.
Light Pollution	The spillage of light into areas where it is not required. Also known as obtrusive light.
Light spill	The light that falls outside the light cone.
Light Trespass (nuisance)	Light that impacts on a surface outside of the area designed to be lit by a lighting installation. The correct legal term is nuisance.
Louvres	Physical light spill control accessory.
Low Pressure Sodium	A discharge lamp in which light is produced by radiation from low pressure sodium vapour. Emits light predominantly at 589nm.
Lumen	The unit of light output from a lamp.
Luminaire	Light fitting or unit designed to distribute light from a lamp or lamps.
Luminance	The physical measure of the stimulus that produces the sensation of brightness measured by the luminous intensity reflected in a given direction. The unit is the candela per square metre (cd/m ²).
Lux (LX)	Illuminance is the quantity of light or

	luminous flux, falling on a unit area of a surface in the environment. It is designated by the symbol E. The unit is lux (lx).
Metal Halide (includes CDM-T)	A type of HID lamp in which most of the light is produced by radiation of metal halide and mercury vapours in the arc tube. Emits UV light. UV poor variants are available. It comes in three forms a) Quartz arc tube (HQI); b) Ceramic arc tube (CDM-T) and c) Cosmo which is a new ceramic form
Mercury	High pressure white light lamp that emits significant UV light.
Optic	The components of a luminaire such as reflectors, refractors, protectors which make up the directional light control section.
Photo cell	A unit which senses light to control luminaires.
Reflector	A device used to reflect light in a given direction.
Refractor	A device used to redirect the light output from a lamp when the light passes through it. It is usually made from prismatic glass or plastic.
Shield	Physical light spill control accessory.
Sky glow	The brightening of the night sky caused by artificial lighting.
Symmetric beams	Lamp mounted in the centre of the reflector.
Ultra violet (UV)	Radiation that is shorter in wavelength and higher in frequency than visible violet light.
Voltage	The difference in electrical potential between two points of an electrical circuit.
Watt (W)	The unit for measuring electrical power.

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