

## **Interim Advice Note 116/08**

### **Nature Conservation Advice In Relation To Bats**

## Key Issues

### *Introduction*

This key issues section is intended to give a broad and simple overview of the key issues associated with bats and roads. It can be read as a stand-alone section intended for non-technical use.

### *What are they?*

Bats are mammals and there are 17 bat species known to be resident in the UK. All bats are vulnerable to the activities of man. All British bats are insectivorous and rely mainly on habitats that provide a large biomass of insects, such as woodland, wetland and some pastures, for feeding.

### *Where are they found?*

Bats can be found almost anywhere including rural and urban areas. Bats roost in buildings, bridges, trees and underground structures, and favour woodland, pasture, scrub, wetland habitats and linear features for foraging. Most species tend to use linear landscape elements such as tree-lines or hedges which not only provide important 'flyways', but are also important areas for insects; such features may, therefore, be extremely important for supporting a population of bats in a given area.

### *What protection do bats receive?*

Bats and their roost sites are strictly protected under UK and European legislation. **Licences are required for activities that will disturb bats, or damage or destroy bat roosts.**

### *How do roads affect bats?*

**Since bats occur in both urban and rural situations they can potentially be affected by any highway projects.** Any new construction, improvement or maintenance project may have an impact on bats in addition to impacts from traffic using the road. All mature trees and all structures, including road culverts, likely to be affected by, or within at least 100m of road projects should be considered as potential bat roosts. Construction of roads, road improvements and road maintenance and management can directly and indirectly affect bats by damaging or destroying roosts and feeding areas, by severing traditional commuting routes, by disturbance and by changing environmental conditions, by making habitats for roosting, commuting and foraging un-suitable. In certain circumstances, road traffic may directly result in bat mortality. Structures such as bridges may contain bat roosts and routine maintenance works affecting these structures can have serious effects on bats. Perhaps more so than for any other wildlife issue, the potential effect on bats is independent of the scale of the operation concerned. Very small structures can be important to large populations of bats or to species of critical conservation importance. **All highways projects should take account of the potential presence of bats.**

### *How do bats affect roads?*

Bats can be present in trees and structures both along and under roads and within the soft estate as well as foraging along road verges and commuting across roads. As a result, bats need to be taken into account during all highway projects (construction, improvement, and maintenance) and their presence, or likely presence, can influence a range of activities. The need to assess the impact and make licence applications where required should, therefore, be taken into account in setting project timescales.

### *What do I have to do about it?*

It will be important to ensure that highways projects do not alter the conservation status of bats. It will, therefore, be necessary to consider bats as part of the environmental assessment of any construction or improvement projects or maintenance project, regardless of scale. It is essential to ensure that appropriate survey work is undertaken to confirm bat presence or absence, and that an effective mitigation strategy is developed and implemented

should their presence be confirmed. A bat ecologist with experience of highway projects and potential mitigation should design the survey and lead the fieldwork.

At different stages of the assessment process, it will be appropriate to collate information on bats through a combination of desk study and field surveys. Assuming that the habitats that would be affected are confirmed as being suitable, targeted field surveys will generally be necessary, unless sufficient information on bat populations that would be affected by the project already exists. Targeted field surveys should be undertaken by appropriately experienced ecologists.

Should road schemes result in an unavoidable impact on a population of bats, it would be necessary to devise an appropriate mitigation strategy in consultation with Natural England; a project specific licence will also be required from Natural England in order to undertake the works. The mitigation measures should be proportionate to the importance of the populations of bats that would be affected, and the scale of the potential impacts upon them.

***How do I deal with an emergency?***

Works which are undertaken in response to other legislative requirements, for example emergency works undertaken on safety grounds, may also result in impacts on populations of bats and contravene UK legislation protecting bats. Expert ecological and legal advice should be sought and Natural England should be informed of the particulars of such works prior to, or as soon as is practicable after, the commencement of the operation. ***Such works should only proceed where it is considered that they cannot be avoided.*** In addition, it will be necessary to undertake measures to remedy any residual effects on bat populations.

**Note: there is no longer a defence under the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) of an “incidental result of an otherwise lawful operation”.**

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<b>B</b>	<b>Further reading</b>
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# 1 Introduction

## 1.1 Scope of the advice

This Interim Advice Note (IAN) supersedes HA80/99 'Nature conservation advice in relation to bats', which was published in 1999. It is aimed at those who encounter roads and bats as an issue and particularly those that need to take decisions about assessment and design. Since 1999 there have been considerable developments in legislation, knowledge of bat ecology, the effects of roads on bats and effective mitigation techniques.

This IAN considers the issues and provides guidance on the effects of roads on bats, and the methods available to mitigate these effects and applies to all projects involved in operating the Strategic Trunk Road Network in England be they new construction, improvement or maintenance projects.

No particular solution will be appropriate in every instance and advice should be sought from qualified specialists and agreed with Natural England on a case-by-case basis. Relevant references to specialist guidance produced by Natural England and the Bat Conservation Trust are included as appropriate. Technical terms are explained in the Glossary (presented as Annex C of this document).

## 1.2 Structure

This IAN is structured as follows;

- Chapter 1 - Introduction
- Chapter 2 – Status & Protection
- Chapter 3 - Biology of Bats
- Chapter 4 - Bat Habitats
- Chapter 5 - Survey methods for Bats
- Chapter 6 – Licensing
- Chapter 7 – Effects of Roads on Bats
- Chapter 8 - Mitigation
- Chapter 9 - Monitoring
  
- Annex A - Legislation
- Annex B – Further Reading
- Annex C - Glossary

## 2 Status & Protection

### 2.1 Under UK and European law, all bats are strictly protected, as are their roosts even if the bats are not present at the time. Full details on European and National legislation and policy specific to bats can be found in Annex A.

There are currently 17 bat species considered to be resident in Britain, 16 of which are confirmed as breeding. However, there have been recent records of vagrant European species occurring in the UK that may be beginning to colonise (refer to Table 1.1). UK bats belong to two families, the Rhinolophidae (horseshoe bats) and the Vespertilionidae (vesper/evening bats).

Bat numbers are considered to have dramatically declined in the last 50 years due to the loss of roost sites, loss of feeding habitat, habitat fragmentation, use of pesticides and direct persecution. Despite this, **bats are widespread, occurring in rural and urban situations.**

Populations and population trends in bats are particularly difficult to measure and there are few historical records on which to base any assessment of change. A National Bat Monitoring Programme organised by the Bat Conservation Trust covering some, though not all, species is now in place. Data about population trends is now becoming available. In the absence of evidence to the contrary, Natural England takes the view that bat populations remain at risk and that the objectives of planning and licensing should be to prevent any further losses (Mitchell-Jones, 2004).

The global status of all British bats has been evaluated according to the IUCN Red List categories and criteria (IUCN, 2006) and is summarised in Table 2.1 below, along with the status of European species vagrant to the UK. There has not been a comprehensive assessment of the national status of British bats since 1993 (Hutson, 1993), and categories and criteria used have changed since that time. Therefore, the assessments of UK status given in Table 2.1 should be interpreted with caution and cannot be compared directly with the global assessments. The Bat Conservation Trust is in the process of revising the national conservation status assessments according to the new categories and criteria. The current understanding of the species' distribution and estimated population size in the United Kingdom are also included in Table 2.1.

**Table 2.1 Conservation status of British bats**

Species	Global Status <sup>1</sup>	UK Conservation Status <sup>2</sup>	UK Distribution <sup>3</sup>
Greater horseshoe bat <i>Rhinolophus ferrumequinum</i>	Lower risk, near threatened (close to qualifying for vulnerable)	Endangered	Mainly confined to south-west England and Wales
Lesser horseshoe bat <i>Rhinolophus hipposideros</i>	Lower risk, least concern	Endangered	Mainly confined to south-west England and Wales
Bechstein's bat <i>Myotis bechsteinii</i>	Vulnerable	Rare	Restricted to south England and south Wales
Natterer's bat <i>Myotis nattereri</i>	Lower risk, least concern	Vulnerable	Throughout the UK, apart from some Scottish islands
Daubenton's bat <i>Myotis daubentonii</i>	Lower risk, least concern	Not Threatened	Throughout the UK
Whiskered bat <i>Myotis mystacinus</i>	Lower risk, least concern	Vulnerable	Throughout England and Wales, south Scotland and Northern Ireland
Brandt's bat <i>Myotis brandtii</i>	Lower risk, least concern	Vulnerable	Throughout England and Wales
Serotine bat <i>Eptesicus serotinus</i>	Lower risk, least concern	Vulnerable	Southern England and occasionally in Wales.
Noctule bat <i>Nyctalus noctula</i>	Lower risk, least concern	Vulnerable	Throughout England and Wales and southwest Scotland.
Leisler's bat <i>Nyctalus leisleri</i>	Lower risk, near threatened (close to qualifying for vulnerable)	Vulnerable	Sparse records throughout England, no records for Wales, common in Northern Ireland
Common pipistrelle <i>Pipistrellus pipistrellus</i>	Lower risk, least concern	Not Threatened	Throughout the UK
Soprano pipistrelle <i>Pipistrellus pygmaeus</i>	Lower risk, least concern	Not Threatened	Throughout the UK
Nathusius' pipistrelle bat <i>Pipistrellus nathusii</i>	Lower risk, least concern	Not Threatened	Throughout the UK
Brown long-eared bat <i>Plecotus auritus</i>	Lower risk, least concern	Not Threatened	Throughout the UK
Grey long-eared bat <i>Plecotus austriacus</i>	Lower risk, least concern	Rare	South of England and Isle of Wight
Barbastelle bat <i>Barbastella barbastellus</i>	Vulnerable	Rare	Widespread throughout England (although more records from the southern half of country) and Wales
Greater mouse-eared bat <i>Myotis myotis</i>	Lower risk, near threatened (close to qualifying for Vulnerable)	Extinct <sup>4</sup>	Sussex
Pond bat <i>Myotis dasycneme</i>	Vulnerable	(Vagrant to UK)	Two records in Suffolk 2005 <sup>5</sup> and one in Kent 2005 <sup>6</sup>
Kuhl's pipistrelle <i>Pipistrellus kuhlii</i>	Lower risk, least concern	(Vagrant to UK)	<10 records since 1991 <sup>6</sup>
Savi's pipistrelle <i>Hypsugo savii</i>	Lower risk, least concern	(Vagrant to UK)	One record from East Sussex coast in 1993, one record from near Liverpool in 1996 <sup>6</sup>
Particoloured bat <i>Vespertilio murinus</i>	Lower risk, least concern	(Vagrant to UK)	Occasional records from Shetland to Plymouth and Isle of Wight <sup>6</sup>
Northern bat <i>Eptesicus nilssonii</i>	Lower risk, least concern	(Vagrant to UK)	One record; hibernating in Surrey <sup>6</sup>
European free-tailed bat <i>Tadarida teniotis</i>	Lower risk, least concern	(Vagrant to UK)	One record from Cornwall in 2003 <sup>6</sup>

<sup>1</sup> IUCN (2006)

<sup>2</sup> Hutson (1993)

<sup>3</sup> Richardson (2000); Altringham (2003)

<sup>4</sup> Although officially declared extinct in 1990, two individuals have been found at a hibernation site in Sussex – an elderly female in January 2001 and a young male first recorded in December 2002 and then again in the winters of 2003, 2004 and 2005.

<sup>5</sup> G. Billington, pers. comm.

<sup>6</sup> Hutson (2005)

## 2.2 Biodiversity Action Planning

Currently, barbastelle, Bechstein's, noctule, soprano pipistrelle, brown long eared bat, greater horseshoe and lesser horseshoe bats are listed as Priority Species within the UK BAP. A generic SAP for bats is included in the Highways Agency BAP (HABAP)

Bats are listed as Priority Species in numerous regional and local BAPs within their UK range. Further details with regard to Action Plan objectives for bats are presented in Annex A.

## 2.3 UK distribution

The most recent comprehensive account of bat species distribution in the UK is presented in the *Distribution atlas of bats in Britain and Ireland* (Richardson, 2000). Records are from 1980 to 1999 and are based on 10km squares. Records are divided into three categories:

- Bats at summer roosting sites
- Records of bats away from roost sites
- Bats in hibernation.

Battersby (2005) provides a less detailed but more up to date account with records taken from the National Biodiversity Network (NBN)<sup>1</sup>.

All species of native UK bats (refer to Table 2.1) are present in England. Some species are restricted in their range (refer to Table 2.1).

## 2.4 Climate change and other factors affecting populations and distribution

Climate change is likely to affect the regional and national distribution of bat species, perhaps encouraging species to expand their range northwards. Winters are likely to be warmer and wetter; while summers could be drier with less rain. Walmsley et. al. (2007) in the Monarch III report, suggest a substantial expansion of suitable climate space northwards is projected across much of Britain and Ireland for greater and lesser horseshoe bats, whilst an expansion of barbastelle is also expected until the 2080s under a high emissions scenario when significant areas of climate space are projected to be lost in southern England as the climate becomes more akin to that in parts of southern Europe where the distribution is very fragmented. It should be borne in mind that the Monarch assessment makes several assumptions in its predictions and should be referred to for further detailed analysis. Should temperatures continue to increase, this may be of particular benefit to species such as grey long-eared bats, which are considered to be at the northern extent of their range. The range of some bat species does appear to be increasing, however, this may be a result of increased survey efforts and an increase in bat records. The National Bat Monitoring Programme Annual Report 2005<sup>2</sup> (Bat Conservation Trust, 2006) includes population trends for those species covered by the BCT's bat monitoring programme. Temperature changes which affect the supply of food to bats would have significant consequences for bats.

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<sup>1</sup> [www.searchnbn.net](http://www.searchnbn.net)

<sup>2</sup> [http://www.bats.org.uk/nbmp/nbmp\\_news\\_reports.asp](http://www.bats.org.uk/nbmp/nbmp_news_reports.asp)



What is clear is that climate change may mean that the reliance on old data may not be relevant so that surveyors should seek the most up to date survey information possible.

During the 20<sup>th</sup> century bat numbers plummeted in parallel with dramatic changes in the countryside (Entwistle *et al*, 2001). Future landscape change has the potential to further affect bat populations. Continued loss of habitats is likely to continue this decline, whilst some initiatives, such as agri-environment schemes, community forests and vegetation along the soft estate of trunk roads may assist migration and expansion of range.

It is considered that an overall increase in water quality towards the end of the 20<sup>th</sup> century has benefited bats because of an increased diversity of invertebrates associated with cleaner water. Further improvement to water quality could therefore benefit bats, however, some species, e.g., Daubenton's bat may be able to benefit from eutrophication (Vaughan *et al*, 1996), perhaps due to a greater biomass of particular prey items, e.g., chironomids or reduced competition with other species that prefer to forage over cleaner water.

### 3 Biology of Bats

#### 3.1 Description

This section of the Interim Advice Note seeks to give a general account of bat biology, occasionally referring to specific species, but it must be recognised that there is much variation both between and within species.

The most recent detailed account of British bats can be found in the *Handbook of British Mammals* (Corbet & Harris, 1991: 4<sup>th</sup> edition (published in 2008)) and those looking for an abundance of source material should refer to that document. Altringham (2003) gives a brief overview of up to date species accounts and natural history.

British bats are relatively small, ranging from 35 to 85 mm in length and weighing between five and 40g, depending on the species. They can crawl into holes and crevices of just 15mm x 20mm. Their bodies are covered in brown-grey fur and they have dark wings which are folded against the body when roosting. Bats in flight appear much larger than when at rest, their wingspan being 220-400mm. They are the only true flying mammals.



Photo © Abigail Meddings

**Image 3.1 Daubenton's bat roosting in a brick culvert underneath a road**

#### 3.2 General Life cycle and behaviour

The following information is of a broad general nature that is relevant to most bat species.

Bats are long-lived, intelligent, have a complex social life and have evolved a number of unusual biological and behavioural features. They have developed a highly sophisticated echolocation system that allows them to avoid obstacles and catch tiny insects in complete darkness.

Bats roost in a range of areas including: buildings, trees (hollows, splits, woodpecker holes, cracks in branches, under loose bark, within thick ivy, within complex root structures), highway structures (not just bridges), underground sites (caves, cellars, mines, underground bunkers, culverts and underpasses), dry-stone walls and rock fissures.

Bats select different types of roosts at different times of the year, in order to suit their metabolic and social requirements. These include hibernation and winter roosts, summer and nursery roosts, temporary roosts, night feeding roosts and mating roosts/swarming sites. These different seasonal roosts may be many kilometres apart or in different parts of one roost structure or building.

Bats hibernate to conserve energy during the winter months when their insect food is in short supply. Hibernation roosts (hibernacula) may be in caves, underground and other structures, buildings or trees, where there is low temperature variation and a high relative humidity. Bats may hibernate singly, or many bats may use the same roost site.

Female bats tend to be colonial during the summer months, congregating at nursery roosts mostly in trees or buildings to give birth (some give birth in tunnels, mines and caves). Bats are very faithful to their natal nursery colony and return year after year. Female bats give birth in the summer usually to only one young, averaging one birth every second year. For this reason bat population numbers do not increase rapidly, unlike other small mammal species such as rodents.

## 4 Bat Habitats

### 4.1 General Habitat Preference

All British bats are insectivorous and rely mainly on habitats that provide a large biomass of insects, such as woodland, wetland and some pastures, for feeding. The loss of such habitat types due to large-scale landscape and agricultural change has led to a significant decline in bat numbers over the last fifty years.

**Any highway construction, improvement or maintenance projects may have an effect on bats.** It should be noted that bats regularly roost and forage in urban areas too, and some will cross apparently unfavourable areas to reach distant foraging and roosting sites. Bats may even be found in areas of exposed high ground at altitudes of up to 840m. Even in areas of highly intensive arable land where insect diversity and abundance are reduced, surprisingly high densities of bats can be present (as surveys for the A303 proposals around Stonehenge have shown). Bats can be found almost anywhere. Most species tend to use linear landscape elements such as tree-lines or hedges which not only provide important 'flyways', but are also important sheltered areas for insects; such features may, therefore, be extremely important for supporting a population of bats in a given area.



Flyway provided  
by double tree line

Photo © Richard Green

**Image 4.1 A double row of trees provides a sheltered tunnel effect, which has a very high potential as a bat flyway for a range of bat species. However, bats will also use much simpler features, e.g., post and wire fences**

### 4.2 Foraging and roosting preferences

Favoured foraging and roosting habitats vary between bat species and according to the time of year as insect availability changes seasonally. Further information on preferences is to be found in Bat Surveys; Good Practice Guidelines<sup>3</sup> (Bat Conservation Trust, 2007), Bat Workers Manual<sup>4</sup> (JNCC, 2004) and Bat Mitigation Guidelines<sup>5</sup> (English Nature, 2004).

<sup>3</sup> [www.bats.org.uk/news\\_events/BatSurveys.asp](http://www.bats.org.uk/news_events/BatSurveys.asp)

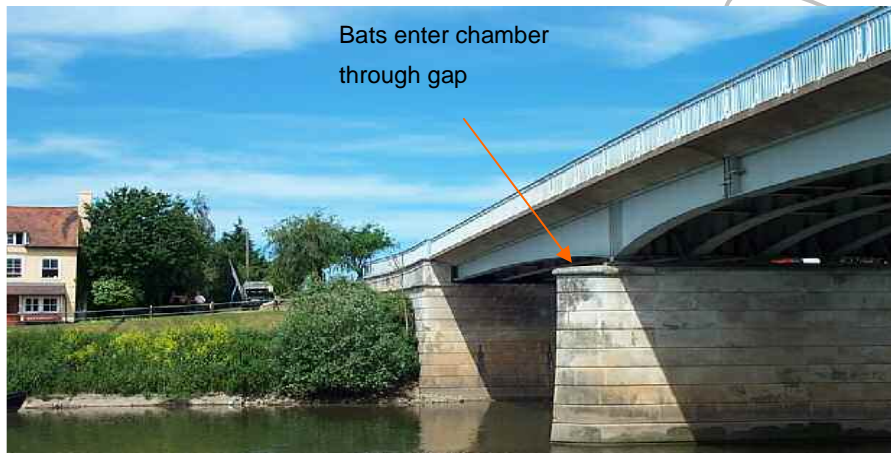
<sup>4</sup> [www.jncc.gov.uk/page-2861](http://www.jncc.gov.uk/page-2861)

<sup>5</sup> <http://naturalengland.twoten.com/naturalenglandshop/docs/IN13.6.pdf>

#### 4.3

##### **Distribution and occurrence on the road network**

**Bats should be expected to be present on or around the entire UK road network.** Bats may be found foraging alongside or even over roads and will have to cross roads to commute between roost sites and foraging areas. They may also roost in trees on the soft estate and in network structures, such as bridges and culverts (refer to Image 3.2).



**Image 4.2 Lesser horseshoe bat nursery roost in a box chamber in the abutments of a bridge over a river**



## 5 Survey Methods for Environmental Assessment

### 5.1 Introduction

A variety of survey techniques are typically employed for schemes where an assessment of the likely impacts on bats is required. This is because the different survey techniques for bats are, to a greater or lesser degree, selective, and therefore it may not be possible to obtain all of the required information from a single survey method. The most appropriate technique(s) will be determined by the information required and the species likely to be present. Typically, where an assessment of likely impacts on bats is required, surveys would be expected to provide sufficient information to determine:

- which bat species are present;
- where they roost and forage at different times of the year;
- what routes they use to travel between roosts and foraging areas within the immediate vicinity of the road/structure concerned; and
- how the project will impact on the bats and what mitigation can be included to reduce the effects.

More detailed information on environmental assessment can be found in DMRB Volume 11: Environmental Assessment.

A bat ecologist with appropriate licence and experience of highway projects should design the survey and lead the fieldwork. Members of the survey team should also be competent in bat ecology, and the use of specific survey techniques for identification of species and their behaviour.

### 5.2 When are surveys necessary?

It will be necessary to consider bats as part of the environmental assessment of any works that may affect suitable bat habitat or bats (refer to Chapters 2 & 3). This may apply to any new construction, improvement or maintenance projects.

During the assessment process, it will usually be necessary to collate information on bats through a combination of desk and field surveys. Assuming that the affected habitats are confirmed as being suitable, targeted field surveys will generally be necessary.

### 5.3 Environmental Impact Assessment: Scoping

The scoping stage is used to determine the type and level of survey required for the impact assessment, primarily based on an initial desk-based assessment. This will enable a preliminary assessment of the value of the proposed development area for bats to be undertaken.

If the results of the scoping exercise suggest that significant impacts on bats are likely, then it may be appropriate to proceed directly to a 'detailed assessment'. The two assessment types are described in the following sections.

More detailed information on scoping, planning and preparation of bat surveys and bat survey methods can be found in Bat Surveys; Good Practice Guidelines<sup>6</sup>

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<sup>6</sup> [www.bats.org.uk/news\\_events/BatSurveys.asp](http://www.bats.org.uk/news_events/BatSurveys.asp)

(Bat Conservation Trust, 2007), Bat Workers Manual<sup>7</sup> (JNCC, 2004) and Bat Mitigation Guidelines<sup>8</sup> (English Nature, 2004).

#### 5.4 Environmental Impact Assessment: Simple

Where the scoping exercise suggests only minor impacts are foreseen, a 'simple assessment' may initially be undertaken. Another occasion where a simple assessment may be undertaken would be to understand impacts on a broad scale such as reviews of route corridors, or choosing a preferred route option. It should seek to collate and review existing data and to identify the extent of survey work that will be required. A simple assessment should consist of a desk study and a daytime walkover survey at appropriate geographical extent.

The main objectives of the simple assessment are to:

- make an initial evaluation of a site or surrounding area (in terms of bats);
- review any existing information on bats within the study area;
- determine if there is suitable habitat for bats within the area;
- identify any risk of potential impacts on bats; and
- identify whether there is a need for further survey work, and if so, what potential methods should be used.

##### 5.4.1 Desk study and review of existing information

A desk study should be undertaken to help identify potential habitats for bats and existing information on bats in the area (refer to Image 4.1). This should include review of the following sources:

- aerial photographs/OS maps/habitat survey map (e.g. Phase 1);
- national species distribution maps (e.g. the Bat Atlas);
- for built structures associated with existing highways, structural records to identify potential cracks, crevices, etc.; and
- the overseeing organisation's or other Service Provider's environmental databases, such as the Environmental Information System (EnvIS).

Consultation should be undertaken with organisations that may hold data on bats, such as:

- Local bat groups
- National Biodiversity Network
- Local biological records centres/local wildlife trusts

##### 5.4.2 Walkover survey

As part of the simple assessment, a walkover survey should be undertaken to identify/confirm potential features within the survey area that could be used by bats. Refer to Table 5.1 for habitat features of importance for bats. The actual area that would be surveyed is likely to be at a smaller scale than for landscape assessments, typically between 500m and 3km from the proposed works depending on their scale and potential effects. This survey should take a broad-scale approach and identify the possible functions of each part of the survey area, e.g. potential use for roosting, foraging and commuting. The potential

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<sup>7</sup> [www.jncc.gov.uk/page-2861](http://www.jncc.gov.uk/page-2861)

<sup>8</sup> <http://naturalengland.twoten.com/naturalenglandshop/docs/IN13.6.pdf>

importance or value of habitats and features of the survey area should be assessed.

Three levels, high, medium and low importance for bats, should be used to generally classify key features of the survey area. (Please note – the lists contained in Table 5.1 below are not exhaustive).

**Table 5.1 Features of importance for bats**

Features of high importance	Features of medium importance	Features of low importance
Underground sites	Improved pasture	Intensive arable
Buildings with high bat roost potential	Drainage ditches	Dense urban, particularly lit areas
Broadleaved woodland and scrub	Walls and fences	
River valleys	Minor roads (no hedges)	
Small field systems with low intensity pasture	Exposed upland sites	
Tree lines and hedgerows	Coniferous woodland	
Bridges and structures with high bat roost potential		



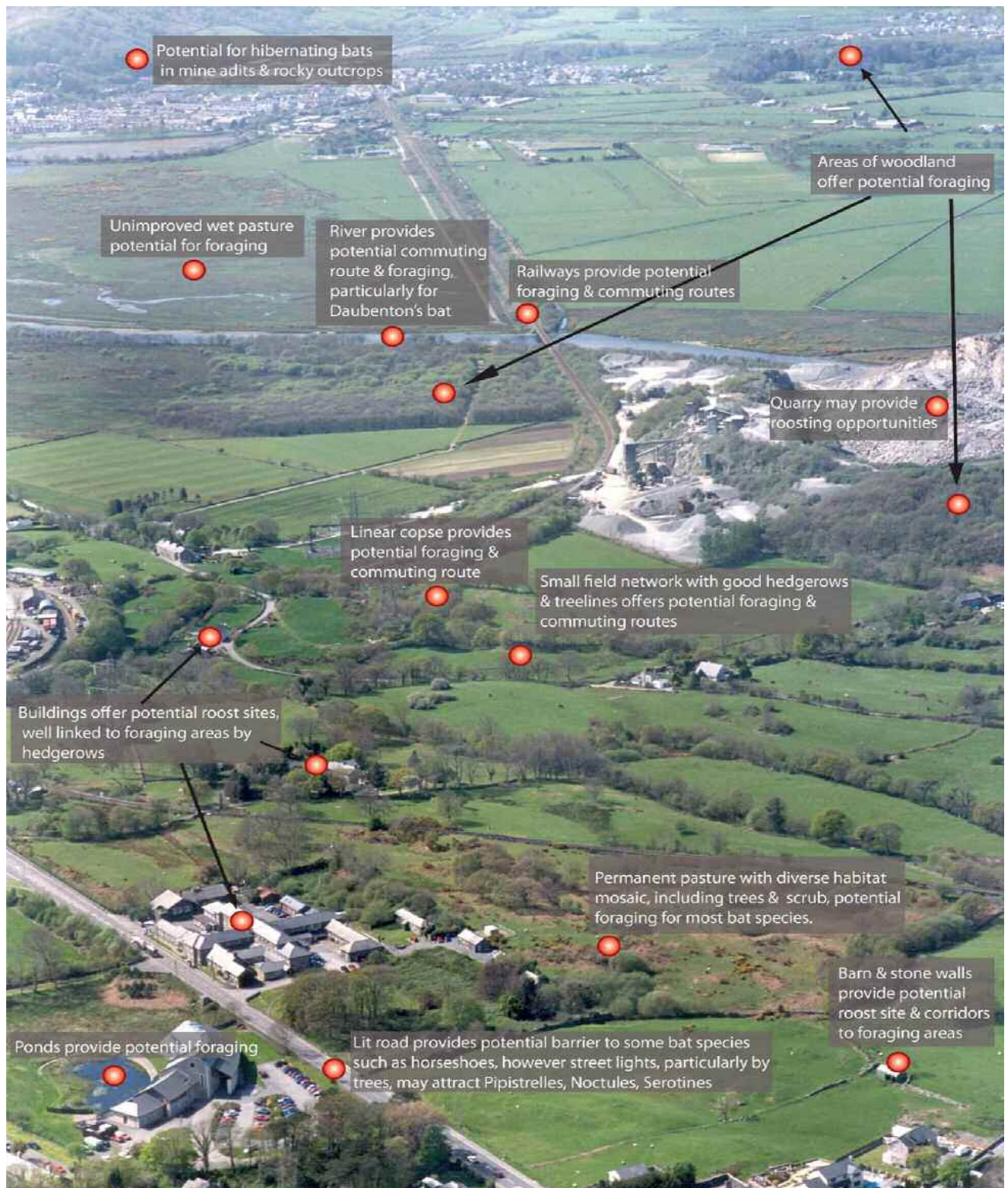


Photo © Transport Wales

**Image 5.1 Landscape, prior to proposed new road being built, showing some important features for bats**

## 5.5 Environmental Impact Assessment: Detailed assessment

The detailed assessment may follow directly from the scoping stage, or may be preceded by a simple assessment if this has identified likely significant impacts on bats. If the former is the case, the first stage of the detailed assessment may involve updating any previous desk study and carrying out a walkover survey. Surveyors should use the results of the scoping and simple assessments and any previous survey information to inform the extent of the detailed field survey. All areas of suitable habitat should be surveyed in detail.

Detailed surveys are required where insufficient information is available from a simple assessment to evaluate the importance of the study area for bats and to enable the impacts of the preferred option to be assessed in terms of significance.

Detailed surveys should aim to:

- gain a general understanding of how bats use the wider landscape around the proposals;
- identify major flight routes, favoured foraging areas and roosts that will be affected; and
- focus on those areas where impacts are likely to occur, for example, known roosts within the vicinity, bat habitat to be lost or degraded (particularly any roosts that might be affected) and any bat flyways that will be severed. It may be necessary to identify the sex of the bats using the route to determine the habitat's priority in relation to breeding success.

Surveyors should use this information and their judgement to target areas of potential importance to ensure sufficient coverage of all features to enable robust conclusions to be drawn. It may be appropriate to start with a broad-scale approach to identify areas of high bat activity and then focus effort on these areas to gain an understanding of the function of the landscape for bats. This will enable an understanding of the conflict between the development and the function of the landscape throughout the year for bats.

Survey effort should be appropriate to the extent of the development and the likely impacts. **Surveys may require at least one full year of survey to consider seasonal differences in behaviour and should be planned well in advance.**

A variety of survey methods are available and the scoping exercise should identify which are to be undertaken. Table 5.2 summarises these and is taken from Bat Surveys; Good Practice Guidelines<sup>9</sup> (Bat Conservation Trust, 2007), which should be referred to for detailed information, along with Bat Workers Manual<sup>10</sup> (JNCC, 2004) and Bat Mitigation Guidelines<sup>11</sup> (English Nature, 2004).

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<sup>9</sup> [www.bats.org.uk/news\\_events/BatSurveys.asp](http://www.bats.org.uk/news_events/BatSurveys.asp)

<sup>10</sup> [www.jncc.gov.uk/page-2861](http://www.jncc.gov.uk/page-2861)

<sup>11</sup> <http://naturalengland.twoten.com/naturalenglandshop/docs/IN13.6>

**Table 5.2. Matrix showing the survey methods that are available for various features used by bats**

Survey method	Building or bridge roost	Tree roost	Underground roost	Swarming site	Foraging area	Commuting route	Migration route
Non-invasive methods							
Internal inspection survey	✓	✓	✓				
External inspection survey	✓	✓					
Emergence/re-entry surveys	✓	✓	✓	✓			
Backtracking	✓	✓					
Manual bat detector surveys					✓	✓	✓
Automated bat detector surveys <sup>1</sup>	✓		✓	✓	✓	✓	✓
Invasive methods							
Catching surveys	✓	✓	✓	✓	✓	✓	✓
Radio-tracking surveys <sup>2</sup>		✓			✓	✓	✓

<sup>1</sup> When the use of static automated bat detectors is considered it is advised to complete a pro-forma to ensure that managing agent, the area teams and the local police are aware that the equipment is being left on site. This will ensure that the devices are not reported to the local police force as being suspicious.

<sup>2</sup> Survey emphasis should be placed on non-invasive techniques that provide better value for money. Radio-tracking is a specialist expensive technique that should only be used in exceptional circumstances. A lot of valuable information on how bats use the landscape can be gathered from interpretation of the landscape, knowledge of bat ecology and observational/bat detector surveys.





Photo © Richard Green

**Image 5.2 A plastic box used for housing an automated bat detector along a hedgerow**



**Image 5.3 Automated bat detector placed within a culvert to record bat activity. Ensure that equipment will not obstruct watercourse culverts. Lesser horseshoe bats are currently using this to fly underneath a dual carriageway on embankment.**

## 6 Licensing

### 6.1 Disturbance licence

A licence to disturb bats and bat roosts for science, education and conservation purposes is required from Natural England in order to enter any known roost or handle any species of bat (refer also to Annex A).

A licence is not required in order to make an initial assessment of potential roost sites, or to carry out activity surveys or emergence counts. However, anyone entering a potential roost with the aim of inspecting for bats should hold a disturbance licence as it is reasonable to expect that they will disturb bats at some point.

### 6.2 European Protected Species (EPS) licence

Any highway projects that compromise the protection afforded to bats or roosts under the provisions of the Conservation (Natural Habitats, &c.) (Amendments) Regulations 1994 and subsequent amendments (Conservation (Natural Habitats, &c.) (Amendment) 2007) will require a European Protected Species Licence. Refer to [www.naturalengland.org.uk/conservation/wildlife-management-licensing/habsregs.htm](http://www.naturalengland.org.uk/conservation/wildlife-management-licensing/habsregs.htm) for further information.

In every case, a licence must satisfy three conditions (refer to Annex A) and cannot be granted unless:

- Regulation 44(2)(e) states that licences may be granted to “*preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment.*”
- Regulation 44(3)(a) states that a licence may not be granted unless “*there is no satisfactory alternative*”.
- Regulation 44(3)(b) states that a licence cannot be issued unless the action proposed “*will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range*”.

Applicants are required to submit a licence return report on expiry of the licence. Monitoring the effects of the development on bats is often a key requirement of the licence, and therefore must be carried out.

### 6.3 Qualifications and expertise

Although specific qualifications are not required, it is important that all survey and mitigation work relating to bats is undertaken by suitably experienced ecologists, licensed as appropriate, with the demonstrable skills to undertake habitat assessment, survey techniques and appropriate mitigation, and to distinguish between the different species of bats which may be encountered. Holding a survey licence does not necessarily demonstrate that a surveyor has the appropriate experience to deal with a complex scheme where impacts on bats may be significant.

## 7 Effects of Roads on Bats

### 7.1 Introduction

**There are many aspects of road construction, road improvement and operation which can have potential impacts and effects on bats.** These are described below. As part of any environmental assessment it will be necessary to assess the survey results and information and use this data to assess the relationship between the importance of affected habitats/features and bat populations that use them (adopting a precautionary approach if their presence remains equivocal) as well as the magnitude of any predicted impacts upon them.

Permanent adverse impacts are likely to result in an unacceptable effect on the conservation status of bats. In the first instance it will, therefore, be important to distinguish between permanent and temporary impacts (refer to the Glossary in Annex C for definitions).

Impacts are likely to fall within the four areas below and can be abbreviated as follows: D direct, I indirect, P permanent, T temporary and C cumulative. Temporary impacts may be short-, medium- or long-term.

	Direct (D)	Indirect (I)	Permanent (P)	Temporary (T)	Cumulative (C)
Habitat loss and degradation	✗	✗	✗	✗	✗
Severance of habitat features	✗		✗	✗	✗
Disturbance	✗	✗	✗	✗	✗
Mortality	✗	✗	✗		✗

Assessments should report not only impacts but also the effects on integrity and conservation status of bats.

Whilst many of the issues dealt with below are potentially harmful to existing bat populations, it should be recognised new roads and the management of the existing soft estate also present considerable opportunities to enhance and protect habitats for bats, in particular through habitat creation, enhancement and appropriate management.

### 7.2 Habitat loss and degradation

Habitat loss and degradation are considered to have major potential impacts on bat populations. Any projects can result in the permanent direct loss of bat habitats, such as roosts, foraging areas and landscape features used for commuting. In addition, indirect effects may occur, such as:

- consequential development associated with some new roads may result in further permanent loss of bat habitats and fragmentation of remaining areas;

- adjacent land use may change because of the effect of the new road on field size and management of agricultural land;
- wetland foraging habitats are likely to change if the local hydrology is disrupted by road construction or if polluted by run-off;
- the viability of roosts may be affected by physical/noise/light disturbance (both during construction and operation)
- roosts can be isolated or their microclimate altered by removal of shelter, for example, adjacent vegetation.

Routine maintenance operations on the road network can also result in permanent and direct habitat loss and degradation. Examples are given below.

- The removal of vegetation on the soft estate, particularly woody species, may result in the loss of important foraging areas or even roosts within trees.
- Structure or building repair work, in addition to potentially disturbing or killing roosting bats, may also result in the exclusion of bats or a change in conditions, causing bats to abandon the roost.
- Structure inspections can potentially disturb roosting bats.
- Pollution of wetland foraging habitats, from road run-off or accidental spillage resulting from road accidents, may reduce their invertebrate abundance and value to bats.
- Lighting during night-working that spills onto adjacent foraging habitats or roosts may temporarily deter bats or cause bats to abandon roosts.

Because large numbers of bats congregate at particular roost sites, local populations are potentially very vulnerable; the loss of one roost site may affect the entire population of that species in a given area if it is destroyed whilst bats are using it. On the other hand, some colonies will use a network of roosts, so the loss of one roost may be of less importance provided bats are not using it at the time and alternatives are provided to maintain the integrity of the roost network.

### 7.3 **Severance of habitat features**

Both permanent and temporary severance of habitat features may cause major impacts on bat populations. Bats use linear features to commute from roosts to feeding sites and studies have shown that some species will make large detours to avoid gaps in otherwise continuous corridors (Limpens & Kapteyn, 1991). This is, perhaps, particularly so at dusk and dawn when light levels are higher. Such features include:

- Hedgerows, tree lines, woody vegetation on the soft estate and closed tree canopies over roads
- Walls and fences
- Watercourses, including ditches
- Culverts under roads (that may become blocked due to lack of maintenance)

Severance may disrupt feeding activity and place an energetic burden on commuting bats. It has also been suggested that lit roads form a barrier to movement for some species, particularly horseshoe bats. Furthermore, as bats may travel several kilometres in the course of a night's foraging, severance could affect bats in roosts located some distance from the road scheme in question. The potential significance of the severance of a habitat feature depends on its level of use, the species of bats involved, the availability of alternative habitats

and features and whether the impact is permanent or temporary. Severance could also effectively be caused by bats being killed on the road by traffic, and therefore not reaching their desired habitats, if they are driven to attempt to cross the carriageway by a need to get to areas either side of the road without alternative safe crossings available to them (refer to section 7.5).

Examples of these sorts of severance could be caused by new roads, improvements to existing roads, or removal of habitat features along verges during landscape maintenance works.

#### 7.4 Disturbance

Installation of new temporary or permanent lighting can discourage species such as horseshoe bats, long-eared bats and some *Myotis* bats (Rydell & Racey, 1995). New lights can therefore introduce barriers to commuting, severing foraging areas from roosts, and light near a bat roost may disturb the colony enough to cause bats to abandon the roost.



Photo © Richard Green

**Image 7.1 Lighting of a distributor road under a road bridge can create a potential barrier to bat movement. Dark areas should be provided away from the road in connection with vegetation to allow movement under the bridge.**

Pipistrelles, noctules and serotines will forage for insects attracted to road lights emitting ultra violet radiation. By attracting bats to a road, they could be put in danger of collision with road traffic. Large numbers of bats foraging around road lights may attract predators, with the indirect effect that lighting increases predation of bats. Lighting an area may also draw insects away from other habitats where light sensitive bats would normally feed on them.

*Bats and Lighting in the UK* is available on the Bat Conservation Trust website<sup>12</sup>. This is a working document that raises awareness of the impacts of lighting on bats and mitigation available.

Maintenance projects of structures and buildings also have the potential to disturb roosting bats. Structure inspections or repair work, in addition to potentially disturbing or killing roosting bats either by the method or materials

<sup>12</sup> <http://www.bats.org.uk>



used or by sealing the bats inside, may also result in exclusion of bats or a change in microclimatic conditions. Even changes in roost humidity or temperature alone can cause bats to abandon the roost.

## 7.5 Mortality

Survey work undertaken on several road schemes (Geoff Billington pers. comm.) shows that some bat species may continue to use severed commuting routes. This is of particular concern for some species, such as horseshoe bats, that habitually fly low above open ground and are, therefore, more likely to collide with road traffic. If bats cannot reach their foraging areas or are killed on the highway, this can lead to a population decline (Brinkmann *et al.*, 2003; Limpens, 2005). Little work has been undertaken in the UK to establish levels of bat injury and mortality caused by collision with road traffic

Bats will also hunt for insects that accumulate above roads and along road verges. Anecdotal observations (Bickmore *et al.* 2003) suggest that air turbulence caused by fast and large road traffic can suck nearby bats into the path of oncoming vehicles. An increase in traffic, due to a new road or improvement project, particularly when close to a nursery roost or swarming site, could cause significant mortality of bats, with inexperienced juvenile bats perhaps at most risk.

Illuminated road signs on new schemes are increasingly being powered by solar panels and micro-turbines. The turbines are often just above hedgerows along which bats forage and commute. As wind turbines have been known to kill bats (Nicholls & Racey, 2007), (by being on flight routes and possibly by attracting them in some way) **they should not be used if any such risks are posed to bats.**

Bats may also be killed by accidental roost destruction. Therefore appropriate surveys must be undertaken to avoid this scenario, especially as it is a criminal offence (refer to Sections 1.2, 5.2 and Annex A).

## 8 Mitigation

### 8.1 Introduction

**If any highway works result in an unavoidable impact on a population of bats, it is necessary to devise an appropriate mitigation strategy in consultation with Natural England.** Should an EPS licence be required from Natural England in order to undertake the works (refer to Section 1.3 & Annex A), any mitigation required as part of the licence should be considered as 'essential' under the Highways Act, which provides powers for its implementation. The mitigation measures should be proportionate to the importance of the populations of bats that would be affected and the scale of the potential impacts upon them. Where it is not possible to achieve *in situ* mitigation, mitigation such as off-site habitat creation and enhancement of existing sub-optimal habitat may have to be considered. In addition, it is also appropriate to maximise the opportunities presented in new projects, in order to achieve the objectives contained within the Overseeing Organisations' BAPs.

In order to be effective, mitigation and compensation measures should be designed on a site and project-specific basis. What works for one scheme will not necessarily work for another scheme and the location of all mitigation should be carefully considered. Before a mitigation strategy is agreed, all options should be considered and discussed with the Overseeing Organisation and Natural England which has produced guidance notes on mitigation for works affecting bats (Bat Mitigation Guidelines<sup>13</sup>). No attempt is made here to discuss all the possible options for mitigation, but the following general principles apply.

Mitigation for the loss of foraging habitat and the loss of roosting sites is well established, although not specific to roads. However, a range of successful mitigation options for habitat severance is not well established. The highways Agency is currently piloting a range of strategies to mitigate for severance, however, there is little data available on the success of these strategies at the time of writing. These include provision of crossing structures for commuting bats or alternative habitats, including roosts and foraging habitat.

Because of the unproven nature of mitigation structures at this time and their considerable expense, any strategy to deal with severance issues should consider:

- a) Is severance a real issue for the species concerned, e.g., noctules are unlikely to be affected as they generally fly at height and in the open?
- b) Is it essential for the conservation status of that colony to continue to safely cross the road, e.g., the best strategy for dealing with severance, in certain situations, may be to acquire land on the same side of the road as the roosts and create suitable foraging habitat?
- c) What is the most cost effective solution available, e.g., bats may be encouraged to use non-specific highway structures by manipulation of linear landscape features (refer to section 8.3.3)

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<sup>13</sup> [http://www.english-nature.org.uk/publications/publication/pub\\_results.asp?C=0&K=bat+mitigation+guidelines&K2=&I=&A=&Submit1=Search](http://www.english-nature.org.uk/publications/publication/pub_results.asp?C=0&K=bat+mitigation+guidelines&K2=&I=&A=&Submit1=Search)

Only when all other options have been discounted should the provision of bespoke crossing structures be considered. The strategy for dealing with severance will need to be agreed with the Highways Agency. Furthermore, it is essential that appropriate monitoring is programmed as part of the mitigation to determine the success of the mitigation and to enable modifications to be undertaken as required.

## **8.2 Minimising the loss or degradation of valuable habitats**

### **8.2.1 *Scoping/simple assessment stage***

Whilst it may be possible to avoid affecting known roosts or potential foraging habitats, such as woodlands, it will often not be possible to avoid crossing linear features, such as hedgerows and watercourses, particularly where these lie perpendicular to a route corridor. However, impacts can be minimised through the careful selection of route options. Consideration should be made to the presence of known important roosts and likely foraging habitats around roosts. A coherent network of roosts, habitats and flyways should be retained to ensure the viability and favourable status of bat populations.

### **8.2.2 *Detailed assessment stage***

If it is not possible to entirely avoid key habitats and features for bats, the options of small-scale variations in alignment, design, timing and minimising the extent of land-take should be carefully reviewed in order to further minimise impacts on any bat populations. For example if a new road impacts on low flying bats, by lifting the vertical alignment then culverts could be inserted within the embankment. Every effort should be made to avoid severance of flyways between known roosts and foraging habitats. If this is unavoidable the alignment should be adjusted where possible to retain and use existing features as potential crossing points, in combination with mitigation techniques. For example, utilise where possible tree lines that have a high and closed canopy, or topography that lends itself to the construction of underpasses or viaducts. This can significantly reduce the need for additional infrastructure, thereby reducing costs and increasing the likelihood of successful mitigation.

### **8.2.3 *Road lighting***

High pressure sodium lamps are commonly used for road lighting. They emit some UV light and are intermediate in their attractiveness to insects and therefore bats. The light is more easily directed than low pressure sodium, which are in the gradual process of being removed or replaced.

Where possible lighting should be avoided. Where it is unavoidable along commuting routes and close to breeding roosts, consideration should focus on the design. Design features available to reduce the potential impact of road lighting include:

- illuminated road studs instead of lighting columns;
- glass lantern covers to filter UV light;
- flat lantern covers result in less light spill than dished covers;
- reduced brightness of lights;
- reduced height of columns;
- increased spacing of lanterns;
- timed lighting to provide dark periods;
- directional lighting, using hoods, cowls, louvres and shields;
- avoid using reflective surfaces under lights; and
- use temporary close boarded fencing to shield light until dense vegetation is established for screening.

### 8.3 Habitat repair, reinstatement, restoration and enhancement

Entwistle *et al.* (2001) details habitat management recommendations for bats. In order to maximise the opportunities that exist to achieve the objectives of the UKBAP, LBAPs and the overseeing organisations' BAPs, habitat reinstatement, restoration and enhancement for bats should be considered for new projects and highway maintenance. Any habitat enhancement undertaken should be appropriate to the site and species present and should be designed on a site-specific basis.

#### 8.3.1 Foraging habitat

Where important habitats will be temporarily affected during construction, they should be restored to a similar or better condition as part of land remediation works as soon as possible. Best landscape design practice should be used to minimise this time, for example consideration should be given to using larger tree and shrub specimens see below. In the example below, the birch and oak on the right have been planted to close the gap over the road with immediate effect to allow bats to continue to cross at this point.



**Image 8.1 Trees have been cleared on the right in order to re-stabilise the embankment. Bats were crossing the road using the canopies at this point.**

Where valuable habitats are to be permanently lost or degraded under the scheme footprint, alternative areas should be identified for habitat re-creation or enhancement. In cases where a road scheme will separate a roost from its associated foraging area consideration should be given to creating new foraging areas on the same side of the road as the roost.

Where habitats cannot be restored or re-created, alternative habitats of value to bats should be created to provide sufficient foraging habitats. Different habitats may be used by bats at different times of the year, linked with seasonal insect abundance. Therefore, habitats with a similar seasonal use should be chosen; or aim to provide a diversity of habitats where this is not possible by planting native trees and shrubs, providing ponds with bank-side vegetation, and providing woodland edge habitats for instance.

Creation of habitats immediately adjacent to a major road may not be appropriate because of the increased risk of bats being killed by traffic. This risk may be

reduced where the road is at a different level to the adjacent habitat, for example in a cutting or on an embankment. Where the risk could be high it may be appropriate to use solid walls or fencing on the road side of the foraging habitat.

Habitat creation away from the road may be difficult to implement and maintain. Land may be compulsory purchased if it can be demonstrated that it is for essential mitigation. Agreements with adjacent landowners (section 253 agreement) are difficult to implement and manage.

### 8.3.2 **Roosts**

Where loss or degradation of roosts cannot be avoided, mitigation, usually in the form of providing replacement roosts, will be required, generally under an EPS licence. The Bat Workers' Manual provides further information on artificial roost creation<sup>14</sup> and the Bat Conservation Trust provides guidance on the use of bat boxes<sup>15</sup>.

The replacement roost should be equal to or of better quality than the roost being lost and appropriate for the requirements of the species concerned.

Microclimate within the new roost is a very important factor in the chances of success. Similar conditions to the existing roost should be aimed for with the option of making modifications should bats not initially take to the new roost.

The long-term maintenance of replacement bat roosts should be secured, either within highways authority responsibilities, or by legal agreement with third parties. Mitigation design should aim to avoid future damage from other factors, such as vandalism.

Where approved by the Highways Agency, the provision of bat roosts or bat boxes can be accommodated in new bridge construction where specific details are incorporated in the design. The formation of bat roosts or installation of bat boxes in existing structures is more difficult and requires special consideration of structural issues, safety, inspection and maintenance. Fixing details would also need to be agreed. Artificial crevices and voids formed retrospectively in brickwork and blockwork require special consideration and detailing to avoid creating locations where future structural deterioration may occur.

The presence of bats on highway structures will limit the periods available for major or routine maintenance and may, in conjunction with other access constraints (network, weather etc), cause severe restrictions to essential works. Therefore other replacement roost opportunities should be sought in preference to using highway structures if at all possible.

Mitigation proposals should be discussed with Natural England. For significant roosts, it is a requirement that roosts should not be demolished before the mitigation plan is implemented and proved to be successful. Bat Mitigation Guidelines (English Nature, 2004) provides further detail of mitigating for roost loss. Bat boxes should be included as a 'feature' on SMIS (Structures Management Information Systems).

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<sup>14</sup> <http://www.jncc.gov.uk/page-2861>

<sup>15</sup> <http://www.bats.org.uk/kids/documents/Batboxes-yourquestionsanswered.pdf>



Photo © Richard Green

**Image 8.2 A 'bat house' with partitioned sections for bats to roost in. It is painted black to absorb heat from the sun and faces south. It is situated adjacent to foraging habitat**



Photo © Richard Green

**Image 8.3 Soprano pipistrelle adults and juveniles roosting in bat house.**





Bat boxes  
built into the  
bridge

Photo © Kate O'Neill



Photo © Kate O'Neill

**Images 8.4a & 8.4b Bat boxes placed into the stone abutments of a new bridge. The bat boxes have been placed over a river corridor which will be enhanced with suitable foraging habitat for a range of bat species**



**Image 8.5. Where it is safe to do so, bat roosts in hollow branches that have to be removed can be relocated to another tree by attaching with heavy duty webbing.**

### **8.3.3 *Flyways/dispersal routes***

A range of mitigation strategies are currently available to mitigate for the severance of bat flyways/dispersal routes. However, some of these are not well established with little information available on their success.

The options for mitigation include the following:

#### **(a) Manipulation of linear landscape features**

Use existing linear features or create new ones to guide bats towards safe crossing points, including realignment away from unsafe crossing points. Fences and stone walls can be relatively easily moved, whilst techniques and machinery exist for translocating hedgerows.





Photos © Cathie Holland for White Young Green

**Images 8.6a & 8.6b Hedge translocation undertaken for a highway scheme. 8.6a shows the recently transplanted hedge material and 8.6b shows the same hedge 16 months later**

When a new road cuts across established flyways and safe road crossings cannot be provided at all of them, the removal of these flyways for a distance from the road should be considered. Some species, such as horseshoe bats, are less likely to immediately alter their traditional commuting routes, whereas others, such as pipistrelles and serotines may be more adaptable.

Lights can be used to direct bats away from severed flyways and towards safe crossing points (Image 8.7), although there has been mixed success with this technique and bats may choose to fly through the lit section or cross at an equally dangerous location rather than using a safe crossing. If used in combination with connecting elements and good foraging habitat, it is more likely to be successful. This approach should be treated as a last resort.



Photo © Richard Green

**Image 8.7 Bollard lighting used to deter lesser horseshoe bats crossing the road at this location and guide them to a safe crossing via a stream underpass. Also note high gate and fence of fine mesh to encourage bats to raise their flight height over road.**

If flyways are removed, temporary solutions can be used during and post construction until permanent replacements are in place or vegetation has matured.



**Image 8.8 Temporary mitigation Cut trees with mesh ribbon to mimic leaves placed in barrels of sand. These are easily moved and so can be cleared from the construction area during the day, being replaced before nightfall along bat flyways crossed by the working area.**



(b) Increase the height that bats fly over roads

Encourage bats to fly higher over roads by using false cuttings, fences, tree planting etc. Bechstein's, Natterer's, lesser horseshoe and long-eared bats will fly through undergrowth vegetation, so for these species consider the use of fences 4-6m high located close to the road but within trees (in order to reduce visual impact and provide shelter from wind). In order to sustain the height of the flyway, trees on the road side of the fence should have their lower branches (below the height of fence) regularly pruned back to the trunk, and all undergrowth should be kept cleared. Lights may also be used at low level to prevent bats dropping to the road. Such measures may be referred to as 'hop-overs'.



Photo © Peter Twisk

**Image 8.9 'Hop over' – bats can be encouraged to fly high over road and traffic by enhanced planting and use of lighting columns; allow tree canopies to touch if possible.**

Where wide roads, for example, dual carriageways and motorways are concerned, there is a danger that bats will not fly at sufficient height over the width of the road. Some species are more likely than others to drop down towards the road surface and risk collision with traffic. Tall vegetation in the central reservation enables some bat species to cross wide roads, acting as a double hop-over. However, culverts may be more successful for low flying species. Where use of vegetation is not possible, fences or walls can be used (although these will have a less pleasing visual effect on the landscape).



Photo © Peter Twisk

**Image 8.10 'Double hop overs' should be considered for wide roads such as dual carriageways; by planting in the central reservation the space between tree canopies is reduced.**

Where a road passes through woodland or has trees along its length on both sides, there may not be a favoured crossing point. In such cases, the use of a fence or wall should be considered to raise bats over the entire length.

The place and height at which the bats are meant to cross must be unlit. Should there be any requirement for lighting, for example, along an adjacent footpath, the lighting should be designed not to shine on the bat flyway.

If a flyway is along a tree-lined footpath or cycleway, for example, that crosses the road and a screen adjacent to the road is not possible, the bats must be brought up to a safe height further from the road. This can be done by removing undergrowth and lower branches up to 25m from the road whilst retaining a dense closed crown layer (refer to Image 8.11).

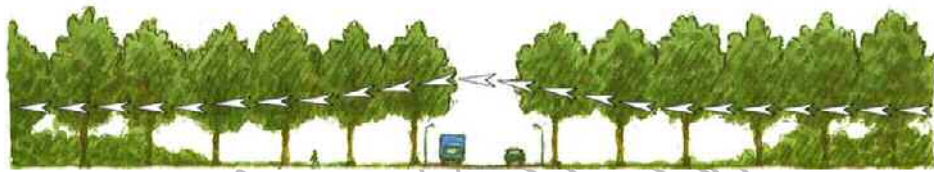


Photo © Peter Twisk

**Image 8.11 Understorey vegetation removed to increase bat flight height in advance of hop-over.**

(c) Provide bat crossing structures

In addition to increasing the height of flyway approaches, structures can be used to maintain bats at height as they cross the road or allow them to cross under the road. Examples include vegetated bridges, wires strung across the road and culverts.

In determining design of structure, the following points should be considered:

- Cost effectiveness, e.g., combining with other compatible uses, such as pedestrian/accommodation bridges and watercourse/wildlife culverts may help to justify costs.
- Structures should ideally be positioned along the line of existing flyways and connect with adjacent landscape features used by commuting bats, e.g., hedgerows/tree lines.
- Shorter span structures are likely to be more successful;
- Structures should not be lit.
- Required design life.
- Structures may require approval from the Highways Agency, encompassing safety requirements.
- Visual impact should be minimised.
- Design should be informed by current best practice information.



Photo © Peter Twisk

**Image 8.12 A green (or vegetated) bridge may be the best option but to be successful needs to link in with established flight-lines on both sides of the highway.**



Photo © BCT

**Image 8.13 A green (or vegetated) bridge over a dual carriageway; lighting columns have been placed under the bridge and along the road to deter bats from going under the green bridge**

Where it is not possible to use existing or proposed bridges by adaption then consideration can be given to the use of purpose built crossing structures, noting the uncertainty of their effectiveness.

#### **Wire/mesh structures**

Such structures may provide a solution; however, it is not yet clear how effective they are, particularly over larger spans (refer to Images 8.14-7.16). In the short-term it may be that bats try to remain faithful to their traditional routes and such structures could reduce the risk of road collisions, whilst in the longer term bats



may habituate to the changed landscape and adjust their behaviour. Therefore, it may be that such structures do have a role to play during the construction period and for a short period following completion of the project. It may be that bats find mesh structures more attractive than wire structures because they offer greater protection from wind and predation. However, more research is needed to demonstrate the effectiveness of wire/mesh structures.

At the time of writing the number of examples on the network is very limited but it is hoped that the monitoring of these and several proposed structures will confirm their overall value. Prior to pursuing these structures, all other options should be examined and advice sought from the Highways Agency.



**Image 8.14 Wire structure. Success is only likely to be possible if they are erected in conjunction with existing roadside trees. This example could be improved by bridging the gap to adjacent vegetation.**

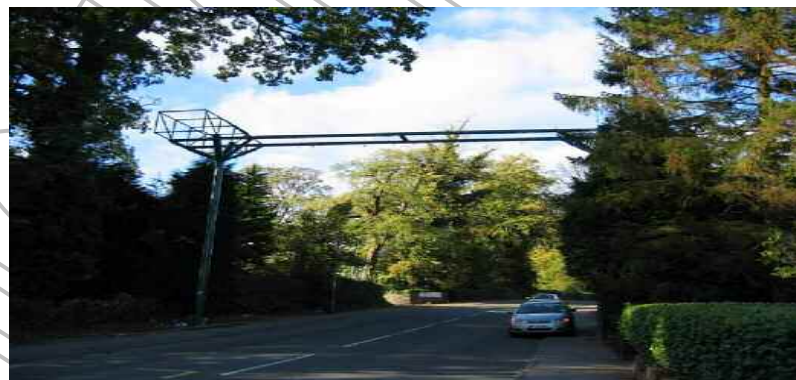


Photo © Richard Green

**Image 8.15 A more substantial structure, consisting of mesh between metal tubes (see Image 8.16). If used in lit areas, the structure should be positioned above street lighting.**



Photo © Richard Green

**Image 8.16 Mesh arrangement on structure in Image 8.15**



**Image 8.17 Temporary structure using wire and camouflage netting constructed over a cutting during construction of a new dual carriageway to reconnect an important bat flyway.**

### **Signage gantries**

Where signage gantries are required for a scheme, their position should be considered for their potential use by bats to cross the road. For example, can they be placed on a severed flyway? In mainland Europe there is evidence that gantries are used as crossing points by pipistrelle and serotine bats. In practice however, there is little flexibility in terms of location.

### **Underpasses/Culverts**

In addition to bridges, underpasses can be provided for bats to cross under roads. Lesser horseshoe bats are known to use a culvert with a diameter of 1.2m over 90m in length under a dual carriageway road (R Green pers. comm.), however, the largest practical size of culvert should be used to increase the chances of use; 2.5m diameter should be considered as a minimum for species such as lesser horseshoes and Natterer's bat that are known to use smaller underpasses. Research in the Netherlands has shown that serotines require a viaduct with a minimum height of 6 to 7 metres and a minimum width of 5 to 7 metres. However, species requiring larger underpasses are generally more likely to cross over the road at height more readily. An integrated approach to the whole landscape along the road should, therefore, be considered.



Photo © Kate O'Neill

**Images 8.18 Willow barriers used as temporary mitigation to lead bats to an underpass constructed for bats. Willow barriers create an immediate corridor while the permanent landscaping matures.**



Photo © Richard Green

**Image 8.19 Following tree removal prior to road widening, a temporary netted fence is used to maintain a flyway for lesser horseshoe bats, guiding them to an underpass**





Photo © Richard Green

**Image 8.20 Netting used to guide bats from a smaller culvert under an existing road to a new road culvert during construction. Overhead netting was used to attempt to train the bats to fly through the culvert rather than over the road.**



Photo © Richard Green

**Image 8.21 A 2.5m diameter culvert being installed on a new road on an existing flyway. The culvert conveys a small watercourse that will increase its attractiveness to bats.**

Wider roads generally need larger diameter underpasses, but some species are known to use smaller culverts where they have been in place for some time. Bats should be guided to the underpass using earthworks, vegetation and/or fencing, etc. Landscaping should be designed and maintained to reduce the height at which bats fly as they approach the underpass (to avoid them flying over the road). Underpasses tend to work best when combined with a watercourse crossing, particularly with larger structures, such as clear-span bridges or viaducts. Watercourses with bank-side trees and shrubs leading to the crossing are favoured but even fringing reeds offer an extra dimension for bats to follow.

Underpasses designed specifically for bats should not be lit. Where tunnels or bridges are to be built for other purposes and have to be lit, for example, pedestrian access, they should be designed to provide a dark area for bats, ideally along part of the structure, e.g., a wall, ceiling or parapet. Refer to section 7.2.3 for further guidance on lighting.

Table 8.1 (overleaf) provides guidance on underpass sizes and overpass heights favoured by bat species, based on work undertaken in Europe.

Interim Advice

**Table 8.1 Summary of suitable features to facilitate the movement of bats (species are grouped) (adapted from Limpens et al., 2005)**

		Passing over					Passing under							
		High over landscape	Hop-over at crown height	Hop-over vegetation	Hop-over vegetation+ wall	Over or along viaduct	Culverts (h x w = 1 x 2 m)	Bridge over water (h ≤ 1 m)	Tunnels (h x w = 4 x 4 m)	Bridge over water (h ≥ 2 m)	Tunnels (h x w = 6 x 6 m)	Under viaduct (h > 6 m)	Bridge over water (h > 6 m)	
A	Lesser horseshoe bat				✓	✓	✓	✓	✓	✓	✓	✓	✓	From small to large, species that hunt close to or in vegetation, and formal structures. Flying on the route made easy by vegetation.
	Natterer's bat				✓	✓	✓	✓	✓	✓	✓	✓	✓	
	Bechstein's bat				✓	✓		✓	✓	✓	✓	✓	✓	
	Brown long-eared bat				✓	✓		✓	✓	✓	✓	✓	✓	
	Grey long-eared bat				✓	✓		✓	✓	✓	✓	✓	✓	
	Greater horseshoe bat				✓	✓			✓	✓	✓	✓	✓	
	Greater mouse-eared bat			✓	✓	✓				✓	✓	✓	✓	Large species that hunts close to the vegetation, follows structures, but also crosses open areas.
B	Whiskered bat			✓	✓	✓			✓	✓	✓	✓	✓	From small to large, species that hunt along border structures, and follow structures.
	Brandt's bat			✓	✓	✓			✓	✓	✓	✓	✓	
	Barbastelle			✓	✓	✓			✓	✓	✓	✓	✓	
	Daubenton's bat			✓	✓		✓	✓	✓	✓	✓	✓	✓	Species that hunts above water, and follows structures.
C	Soprano pipistrelle		✓	✓	✓	✓			✓	✓	✓	✓	✓	From small to large, species that hunt along structures out into the half-open surroundings, and follow structures.
	Common pipistrelle		✓	✓	✓	✓			✓	✓	✓	✓	✓	
	Nathusius's pipistrelle		✓	✓	✓	✓			✓	✓	✓	✓	✓	
	Serotine	✓	✓	✓	✓	✓					✓	✓	✓	From small to large, species that hunt in half-open to open surroundings, and sometimes follow structures.
	Noctule	✓	✓	✓	✓	✓					✓	✓	✓	

Key: h x w = height x width

Species are grouped according to their preferred hunting area; from close to the vegetation, via half-open to open hunting areas. Species within each group are ordered from small to large.

Species in group A fly through vegetation and must be brought up to height by means of a hop-over with a 'closed screen'. Species in groups B and C can be brought up to height using vegetation, and species in group C will follow the crown layer on their own.

#### 8.4 **Avoiding disturbance, damage or mortality**

Any works affecting roosts should be planned to avoid times when bats are present or are most sensitive to disturbance (refer to Table 8.2 below). Compounds, storage areas, temporary haul routes etc. should be sited away from known bat roosts and night working should be avoided close to any occupied bat roost.

**Table 8.2 The best time to undertake work affecting different types of roost**

Roost type	Best time to undertake work
Nursery and summer roosts	October to April
Hibernation roosts	May to September
Roosts occupied year round or use unknown	March/April or September/October
(Mating/swarming sites)	(December-March and May-July except where the site is also a nursery or hibernation site)

*Be aware that there is overlap between these periods. Some species may have a maternity roost and hibernation roost in the same structure. The structure may also be important for mating.*

If necessary, exclusion of the colony can be attempted (under EPS licence) by using one-way access structures that allow bats out of the roost but not back in. Details of these are provided in Mitchell-Jones (2004). The timing of these operations must be determined by the type of roost. In practice it can be difficult to block all access points to large structures. An alternative option is to make the roost unsuitable for use by bats (again under licence), ideally before they start using the roost. This may involve exposing the roost to the elements, particularly light, and making the microclimate unfavourable by cutting back vegetation, opening doors or hatches to let wind through or illuminating any internal voids in order to discourage bats (refer to Images 7.23a and b). As a last resort, any bats still present in a roost immediately prior to works should be caught and relocated under licence. This can be done by hand, hand-net, mist-net or harp-trap. Refer to Mitchell-Jones (2004) for details. Recommended approaches for different habitat types are given below.



Both photos © H Limpens

**Images 8.22a & 8.22b** show alteration of roost entrance where demolition of a building containing a roost could not be avoided. Such work should not be done during nursery or hibernation periods if bats are using the building for these purposes. After checking that the bats had left, demolition commenced with carefully dismantling the wall where the bats had been.

#### 8.4.1 Traffic calming

Although slower traffic speeds (below 40mph) are likely to reduce the number of road casualties, traffic calming is unlikely to be an effective means of mitigating the potential effects of bat road traffic accidents on its own. Bats suffer fatal injuries even at relatively slow speeds, and more appropriate mitigation would be to develop 'safe crossing points' or avoid the need to cross.

## **9 Monitoring**

### **9.1 Introduction**

Monitoring is vital to provide valuable data on the success or failure of mitigation measures and to provide data on the use of highways and the soft estate by bat species. Without ongoing monitoring it will be impossible to determine what is working and what is achievable for future highway projects, any monitoring strategy should be agreed with the Highways Agency. The extent of monitoring should be appropriate to the mitigation provided.

It is essential that monitoring is included within contract requirements.

### **9.2 Monitoring during and post-construction**

Monitoring may be necessary during and after construction to consider whether mitigation measures are performing successfully. Adjustments should be made to mitigation measures where needed throughout the construction period, for example, temporary flyways over haul routes.

Detailed post-construction monitoring is not considered appropriate for all schemes but should be undertaken where the potential impacts on bats are considered significant, as defined by the implementation of significant mitigation measures which are part of any licence submission, particularly when the success of mitigation measures is uncertain. The methods used for monitoring during and post-construction should be based on the standardised survey techniques outlined in Chapter 4, and will depend on the mitigation originally implemented. This may include monitoring the rates of colonisation of newly created roosts, the foraging or commuting activity over newly created or modified habitats or routes, and the presence of bats in existing roosts that may have been affected by works. Data should be incorporated into relevant environmental databases.



## Annex A: Legislation and Policy

### A Legislation and Policy

All UK bats have legal protection, as do their roosts even if the bats are not present at the time. The following section refers to European and National legislation and policy specific to bats. A summary of the legislation has been provided, however, it must be stressed that these descriptions are summaries only; the original legislation should always be referred to for the exact wording. If necessary, legal advice should be sought.

#### A.1 UK legislation protecting bats

##### A.1.1 ***Wildlife and Countryside Act 1981 and amendments; and the Countryside and Rights of Way Act 2000***

All bat species in England are protected under the Wildlife and Countryside Act 1981 (WCA) (as amended) through inclusion in Schedule 5. The WCA transposes into UK law the Convention on the Conservation of European Wildlife and Natural Habitats (commonly referred to as the 'Bern Convention'). All species of bats are listed on Schedule 5 of the WCA, and are therefore subject to the provisions of Section 9, which make it an offence to:

- Intentionally kill, injure or take a bat [Section 9(1)]
- Possess or control any live or dead specimen or anything derived from a bat [S 9(2)]
- Intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection by a bat [S 9(4)(a)]
- Intentionally or recklessly disturb a bat while it is occupying a structure or place which it uses for that purpose [S 9(4)(b)]

However, it should be noted that European protected species are planned to be removed from Schedule 5 of the Wildlife and Countryside Act (1981).

The WCA has been amended by the Countryside and Rights of Way (CROW) Act 2000, which adds an extra offence ('or recklessly' to S9(4)(a) and (b)), makes species offences arrestable, increases the time limits for some prosecutions and increases penalties.

The Natural Environment and Rural Communities Act 2006 places a duty on Government Departments to have regard for the conservation of biodiversity and maintain lists of species and habitats which are of principal importance for the purpose of conserving biodiversity, in accordance with the Convention on Biological Diversity. These lists include several bat species.

##### A.1.2 ***Other legislation***

Once captured, bats may become subject to the Protection of Animals Act 1911, which prohibits cruelty and mistreatment. Releasing a bat in such a way as to cause undue suffering may be an offence under the Abandonment of Animals Act 1960. There are various statutory provisions relating to the transport of animals, designed to ensure their welfare. However, these are unlikely to be applicable to bats as they are rarely taken into captivity.

## **A.2 European legislation (and UK translations) and policy of relevance to bats**

### **A.2.1 *The Habitats and Species Directive 92/43/EEC; and the Conservation (Natural Habitats, &c.) Regulations 1994***

In England and Wales the Conservation (Natural Habitats &c.) Regulations 1994 (as amended) (the Habitats Regulations) transpose into UK law Council Directive 92/43/EEC of 21st May 1992 on the Conservation of Natural Habitats and of Wild Fauna and Flora (often referred to as the 'Habitats [and Species] Directive'). All bats are listed on Annex IV of the Directive (animal and plant species of community interest in need of strict protection). Greater and lesser horseshoe, Bechstein's and barbastelle bats are also listed in Annex II (animal and plant species of community interest whose conservation requires the designation of special areas of conservation). Inclusion on Annex IV ('European protected species') means that member states are required to put in place a system of strict protection as outlined in Article 12; this is done through inclusion on Schedule 2 of the Regulations.

European protected animal species and their breeding sites or resting places are protected under Regulation 39. It is an offence for anyone to deliberately:

- disturb, capture, injure or kill a bat;
- damage or destroy a breeding or resting place
- have in one's possession or control, a live or dead European bat species.

There is a threshold above which a person will be considered to commit the offence of deliberate disturbance of a European protected bat species. An offence will be committed if bats are deliberately disturbed in a way as to be likely significantly to affect (a) the ability of any significant groups of animals of that species to survive, breed, or rear or nurture their young, or (b) the local distribution or abundance of that species.

### **A.2.2 *Convention on the Conservation of Migratory Species of Wild Animals 1979 (Bonn Convention)***

All bat species are listed in Appendix II of the Bonn Convention, to which the UK is a signatory. This requires Member States to strictly protect these animals, conserve or restore the places where they live, mitigate obstacles to migration and control other factors that might endanger them.

### **A.2.2 *Convention on the Conservation of European Wildlife and Habitats 1979 (Bern Convention)***

All bat species except the common pipistrelle are listed in Appendix II of the Bern Convention. This requires Members to take appropriate and necessary legislative and administrative measures to ensure the special protection of the wild fauna species specified. The common pipistrelle is listed in Appendix III, which requires that any exploitation of the species is regulated to keep the population out of danger.

### **A.2.3 *Eurobats***

An Agreement on the Conservation of Populations of European Bats (Eurobats) has been concluded under the auspices of the Bonn Convention. Its main provisions are to: restrict the killing or capture of bats; protect key bat habitats; co-ordinate relevant research; and increase public awareness of bat conservation. All parties to the Eurobats Agreement (of which the UK is one)

submit annual reports to the Eurobats secretariat on their activities. The Eurobats secretariat produces annual national reports on its activities.

### **A.3 Exceptions and licensing**

There are several exceptions (defences) to the provisions listed in sections A.1 & A.2 above.

The incidental result of a lawful operation defence has been removed from legislation whether the damage occurs by accident or not (Conservation (Natural Habitats, &c.) (Amendment) Regulations 2007). An offence will only be committed if the deliberate disturbance is likely to significantly affect a significant group of animals of that species' ability to survive, breed, or rear or nurture its young or is likely to significantly affect the local distribution or abundance of that species.

#### **A.3.1 Protected species licensing**

- **Scientific, education and conservation licences**  
Licences permit otherwise unlawful activities, and can only be granted for certain purposes. Natural England issue licences to individuals for scientific, educational and conservation purposes under the Conservation (Natural Habitats &c.) Regulations 1994 (as amended). Surveys for bats which involve otherwise unlawful acts (such as intentional disturbance or taking) may be authorised for scientific and educational purposes; this includes surveys of potential development sites.
- **Development licences**  
Development or maintenance-related activities that affect bats are likely to require a European Protected Species (EPS) Licence. These are issued by Natural England under the Conservation (Natural Habitats &c.) Regulations 1994 (as amended). Three tests must be satisfied before a development licence (to permit otherwise prohibited acts) can be issued:
  - Regulation 44(2)(e) states that licences may be granted to *"preserve public health or public safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequences of primary importance for the environment."*
  - Regulation 44(3)(a) states that a licence may not be granted unless *"there is no satisfactory alternative"*.
  - Regulation 44(3)(b) states that a licence cannot be issued unless the action proposed *"will not be detrimental to the maintenance of the population of the species concerned at a favourable conservation status in their natural range"*.

'Favourable conservation status' is defined in the Habitats Directive (Article 1(i)). Conservation status is defined as *"the sum of the influences acting on the species concerned that may affect the long term distribution and abundance of its population within the territory."* It is assessed as favourable when: *"population dynamics data on the species concerned indicate that it is maintaining itself on a long term basis as a viable component of its natural habitat, and the natural range of the species is neither being reduced nor is likely to be reduced for the*

*foreseeable future, and there is, or will probably continue to be, a sufficiently large habitat to maintain its populations on a long term basis."*

In order to obtain a licence to allow the destruction of bat roosts etc, in advance of any otherwise legitimate development which may impact on the favourable conservation status of bats, it must be demonstrated by the applicant that all reasonable steps have been taken to minimise the impact (to satisfy R. 44(3)(a)) and any remaining damage will be adequately compensated for (to satisfy R. 44(3)(b)). **There should be no net loss in local bat population status, taking into account factors such as population size, viability and connectivity.** Hence, when it is unavoidable that a development will affect a bat population, the mitigation should aim to maintain a population of equivalent status in the area.

Note, that even though there is apparent overlap between the WCA and the Habitats Regulations, they run concurrently. EPS licences issued to permit capture, breeding site destruction, etc. are issued under the Conservation (Natural Habitats &c.) Regulations 1994 (as amended). It should also be noted that a licence only allows what is permitted within its terms and conditions; it does not legitimise all actions related to bats at a given site.

#### **A.3.2 When is a European Protected Species licence required?**

This is a decision to be made by the consultant or client. A licence simply permits an action that is otherwise unlawful. To ensure that no illegal activities are undertaken, it is recommended that a licence is applied for if, on the basis of survey information and specialist knowledge, it is considered that:

- the site in question is demonstrably a breeding site or resting place for bats
- the proposed activity is reasonably likely to result in an offence.

No licence is required if the proposed activity is unlikely to result in an offence. Further advice is provided in Mitchell-Jones (2004) to assist the consultant in arriving at a decision on this matter, though it must be recognised that determining whether a particular site is used as a breeding or resting place can be problematic for such mobile animals as bats. Note that if the proposed activity can be timed, organised and carried out so as to avoid committing offences then no licence is required.

Examples of works that are likely to need a licence because they may result in the destruction of a breeding or resting place and/or disturbance of bats include:

- demolition of buildings or structures known to be used by bats;
- alteration or maintenance works that will affect areas where bats are known to roost; and
- removal of trees known to be used by bats.

#### **A.4 National policy guidance**

##### **A.4.1 National planning guidance**

The statutory planning process requires that full account is taken of nature conservation, and as species protected by law and identified as a priority for conservation, bats are relevant when interpreting planning guidance throughout the UK. Together with its associated ODPM Circular 06/2005 and Guide to Good Practice, Planning Policy Statement 9 (PPS9): Biodiversity and Geological Conservation sets out planning policies and guidance on protection of biodiversity and geological conservation through the planning system in England.

Published in August 2005, this replaces PPG Note 9 on nature conservation (published October 1994).

Planning Policy Statement 9 (PPS9) sets out the planning policy on the protection of biodiversity and geological conservation through the planning system in England. It states that local authorities should aim to maintain, enhance, restore or add to biodiversity and geological interest, with the principal aim of planning decisions being to prevent harm to biodiversity and geological conservation interests.

The Highways Agency seeks to take reasonable steps, consistent with the proper exercise of its functions, to comply with the principles laid down in PPS9. However, this advice applies to the planning system and it does not recognise the limitations imposed on public bodies, by other enacting pieces of legislation such as the Highways Act. It is recognised, however, that there are occasions when work will be undertaken outside of the provisions of the Highways Act and in these circumstances the provisions of PPS9 will apply.

#### **A.4.2 Biodiversity Action Plans**

Several bat species are identified as species of principal importance for biodiversity under the UK Biodiversity Action Plan (UKBAP), which is the UK Government's response to the Convention on Biological Diversity and is the definitive list referred to by CRoW 2000 Section 74 and subsequently by NERC 2006 Sections 41 and 42.

Currently, barbastelle, Bechstein's, noctule, soprano pipistrelle, brown long eared bat, greater horseshoe and lesser horseshoe bats are listed as Priority Species within the UK BAPs, which aim to prevent any further declines in population numbers and to maintain the present geographical distribution of these species.

A generic SAP for bats is included in the Highways Agency BAP (HABAP). Highway verges have also been identified in some local authority BAPs as making a significant contribution to local biodiversity.

The objectives of the HABAP with respect to bats are as follows:

- to avoid impact of new road schemes or improvements on bats;
- to mitigate unavoidable impacts on bats, their roosts or their habitats;
- to raise awareness of bat issues among HA staff, Managing Agents and consultants;
- to maintain detailed records of known bat roosts on and close to the network; and
- to safeguard and enhance known bat populations on and close to the network.

Bats are also listed as Priority Species in numerous regional and local BAPs within their UK range.

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## C. Glossary

**Aphodius** – Group of beetles belonging to the family Scarabidae. Primarily feed on decaying organic matter, particularly manure. Includes dung beetles.

**Autecology** - The branch of ecology that deals with the biological relationship between an individual organism or an individual species and its environment

**Bat flyway** – A regularly used route used by bats, usually associated with a linear landscape feature.

**Biodiversity** - A term used to describe the diversity of all living things, including genetic, species and ecosystem diversity.

**Biodiversity Action Plan (BAP)** - A strategic document that outlines how the most urgent priorities for wildlife conservation (both species and communities of organisms) can be promoted.

**Construction** - All new projects.

**Compensation** - Creation or enhancement of habitats in order to compensate for losses resulting from a development.

**Countryside and Rights of Way Act 2000** - The Act creates a new statutory right of access to open country and registered common land; modernises the rights of way system; gives greater protection to Sites of Special Scientific Interest (SSSIs), provides better management arrangements for Areas of Outstanding Natural Beauty (AONBs); strengthens wildlife enforcement legislation; and requires Government Departments to have regard for biodiversity and conservation.

**CPO** - Compulsory Purchase Order.

**Culvert** - A closed channel used for the conveyance of surface drainage water or other watercourse under a road or motorway.

**Designated site** - An area that is particularly good for wildlife or geology may have a 'designation' placed on it. This can be statutory or non-statutory and can offer varying degrees of protection.

**Design Manual for Roads & Bridges (DMRB)** - A Highways Agency document providing guidance on aspects of road design, construction and maintenance

**Desk-study** - Desk-based information gathering exercise, involving contacting SNCOs, biological record holding centres and other specialist groups.

**Detailed assessment** - An activity to gain an in-depth appreciation of the beneficial and adverse consequences of the project. Such assessments are likely to require detailed field surveys and/or qualified modelling techniques, capable of being defended at public inquiry.

**Direct impact** - an impact on an environmental receptor / resource that has no intermediary impacts.

**Ecological Clerk of Works (ECow)** - A site based ecologist who oversees all works on site which may have an ecological impact.

**Ecological watching brief** - Details the need for supervision of works where absence of a species cannot be confirmed, and work is proceeding on a precautionary basis. This may involve an Ecological Clerk of Works.

**Enhancement** - a measure that benefits the baseline condition following the completion of a project as compared with a do-nothing scenario.

**Environmental assessment** - An analysis of the impact of a planned action to the environment to determine the significance of that action and whether a full Environmental Impact Assessment is needed.

**Habitat** - An area in which an organism naturally lives, grows and reproduces; the area that provides an organism with adequate food, water, shelter and living space.

**Habitat enhancement** - Action taken to improve existing habitats which may be sub-optimal in their present state, in order to increase the value for nature conservation.

**Habitat fragmentation** - The partitioning of larger habitats into smaller more isolated parcels, usually as a result of development. Fragmentation of habitat can negatively affect the abundance and diversity of plants and animals in an area.

**Habitat severance** – The separation of habitats by removal of suitable habitat linkages for organisms to migrate between habitats.

**Highways Agency Biodiversity Action Plan (HABAP)** - The Highways Agency Biodiversity Action Plan (HABAP) prescribes the Highways Agency's role in the conservation and enhancement of biodiversity in England. It is part of a long-term strategy for the conservation of habitats and species on the motorway and trunk road verges of England.

**Improvements** - All improvements of existing roads and other capital works

**Indirect impact** - Secondary impact, defined as the potential effects of additional changes that are likely to occur later in time or at a different place as a result of the implementation of a particular action.

**Invertebrate** - An animal without a backbone, such as snails, worms, and insects.

**IUCN** – The World Conservation Union.

**IUCN Red List** - The IUCN Red List of Threatened species is internationally recognised as the list that categorises the status of globally threatened animal and plant species. It provides taxonomic, conservation status and distribution information on species that have been evaluated using the IUCN Red List categories.

**Lepidoptera** – Taxonomic family of butterflies and moths.

**Local Biodiversity Action Plan (LBAP)** - Local Biodiversity Action Plans aim to identify local priorities and to determine the contribution they can make to the delivery of the national Species and Habitat Action Plan targets. Often, but not always, LBAPs conform to county boundaries.

**Mitigation** - measures intended to avoid, reduce and, where possible, remedy significant adverse environmental effects.

**National Biodiversity Network Database** - An online database which allows you to view distribution maps and download UK wildlife data. [www.searchnbn.net](http://www.searchnbn.net)

**Natural Environment and Rural Communities Act 2006** – The enabling legislation for the creation of Natural England, which also reinforces the duty of public authorities to have regard to the conservation of biodiversity.

**Operation** - management and maintenance operations of existing roads

**Operational phase** - the functioning of a project on completion of construction.

**Permanent impact** - an impact that is irreversible.

**Population** A group of organisms, all of the same species, which occupy a particular area. Also, the total number of individuals of a species within an ecosystem, or of any group of similar individuals.

**Precautionary principle** - The idea that if the consequences of an action are unknown, but are judged to have some potential for major or irreversible negative consequences, then it is better to avoid that action or take appropriate actions to minimise the likely impacts.

**Priority species** - There are 382 Priority Species in the UK. These are species that are globally threatened and/or species which are declining rapidly in the UK, by more than 50% in the last 25 years (see species action plan).

**Protected species** - Species that are safeguarded under UK or European legislation.

**Rapid assessment** - An activity based on the assessment of data and information beyond that which is readily available. Such additional information is typically gained through exploratory consultations with statutory bodies, simple analysis, reconnaissance surveys or investigations of new data sources.

**Route option design** - A range of alternative routes for a road development should be considered, as early on in the design process as possible. There is a need to balance a range of requirements, including the need to minimise environmental impacts.

**Runoff** - The part of precipitation and snowmelt that reaches streams by flowing over or through the ground. Surface runoff flows away without penetrating the soils. Groundwater runoff enters streams through by seeping through soils.

**Scoping Assessment** - An activity involving the exploration of available data and information. It requires the use of impact identification techniques that are based upon generalised relationships and thresholds.

**Sites of Special Scientific Interest (SSSIs)** - An area of land or water notified by a statutory nature conservation organisation under the Wildlife and Countryside Act 1981 as being of national importance for nature or geological conservation.

**Soft estate** - The soft estate is defined as the land within the highway boundaries that is not part of the carriageway.

**Special Area of Conservation (SAC)** - A site designated by the UK Government under EC Directive 92/43 on the conservation of natural habitats and of wild fauna and flora.

**Species Action Plan (SAP)** - The UK BAP highlights 382 Priority Species, for which Species Action Plans (SAPs) have been drawn up. They provide information on the threats facing each species and actions to achieve the action plan targets.

**Statutory designated sites** - Sites with statutory designations have strong legal protection against damage from development, agriculture or other causes. Statutory designations do not confer any public right of access. Their protection is overseen by the relevant SNCO.

**Statutory Nature Conservation Organisation (SNCO)** - SNCOs are Government funded bodies whose purpose is to promote the conservation of wildlife and natural features. The main duties and powers are been given by various Acts of Parliament. SNCOs include; English Nature (England), Countryside Council for Wales (Wales), Scottish Natural Heritage (Scotland), Environment and Heritage Service (Northern Ireland).

**Temporary impact** - an impact that will last for a limited time only.

**UK BAP** - 'Biodiversity: the UK Action Plan' was launched in 1994 which outlined the UK Biodiversity Action Plan for dealing with biodiversity conservation, in response to the 1992 Rio Convention. This is now known as the UK BAP.

**Wildlife & Countryside Act 1981** - This is the principle mechanism for the legislative protection of wildlife in Great Britain. It does not extend to Northern Ireland, the Channel Islands or the Isle of Man. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the European Union Directives on the Conservation of Wild Birds (79/409/EEC) and Natural Habitats and Wild Fauna and Flora (92/43/EEC) are implemented in Great Britain. Similar legislation is enacted to fulfil these obligations elsewhere in the United Kingdom.