This Advice Note provides details of the effects of roads on bats.

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Nature Conservation Advice in Relation to Bats

Summary: This Advice Note provides details of the effects of roads on bats.
## REGISTRATION OF AMENDMENTS

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<thead>
<tr>
<th>Amend No</th>
<th>Page No</th>
<th>Signature &amp; Date of incorporation of amendments</th>
<th>Amend No</th>
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May 1999
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<th>Amend No</th>
<th>Page No</th>
<th>Signature &amp; Date of incorporation of amendments</th>
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<th>Signature &amp; Date of incorporation of amendments</th>
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</table>

May 1999
PART 3

HA 80/99

THE GOOD ROADS GUIDE
NEW ROADS
NATURE CONSERVATION
MANAGEMENT IN RELATION TO BATS

Contents

Chapter

1. Introduction
2. Key issues
3. Protection status
4. Background biology
5. Bat survey methods for environmental assessment of road schemes
6. When is a bat survey necessary?
7. Licensing considerations and qualifications
8. Possible effects on bats
9. Mitigation measures
10. Contract implementation
11. Maintenance operations
12. Post-construction monitoring
13. Monitoring and review of the advice note

Annex A Review of legislation
Annex B Bat box and artificial bat roost design
Annex C Acknowledgements
Annex D Sources of further information
1. INTRODUCTION

1.1 All bats are strictly protected under UK and European law, having dramatically declined in numbers in the last 50 years due to the loss of roost sites, loss of feeding habitat, use of pesticides and direct persecution. Although rare and declining in numbers, bats are widespread, occurring in rural and urban situations, and thus can be affected by development in virtually any location.

1.2 Both new road schemes and road improvements can affect bats by damaging roosts and feeding areas, or by severing traditional commuting routes. In certain circumstances, road traffic may directly cause bat mortality. Structures such as bridges may contain bat roosts and routine maintenance works affecting these structures can also 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. The information provided in this Advice Note is relevant to smaller bypass schemes, on-line improvements and maintenance operations as well as new road construction.

1.3 This advice note provides details of the effects of roads on bats, and the methods available to mitigate these effects. No particular solution will be appropriate in every instance and advice should be sought from qualified specialists and agreed with the appropriate Statutory Nature Conservation Organisation (SNCO) on a case-by-case basis.

2. KEY ISSUES

2.1 There are at least 14 species of bats resident in the UK. Most are rare or endangered. Bats occupy buildings, bridges, trees and underground structures, and utilise woodland and wetland habitats and linear features for foraging. Since they occur in both urban and rural situations, and since relatively small sites can be of disproportionate importance, bats can potentially be affected by any highways operations.

2.2 Bats and their roost sites are strictly protected under UK and European legislation. Licenses are issued by the SNCO for some activities likely to disturb bats or to damage/destroy bat roosts. Activities relating to the development of land are not licensable and rely on defences in the Act.

2.3 All highways operations should take account of the potential presence of bats by timely survey work and the development of appropriate mitigation.

2.4 The potential effects of new road construction or road improvements include the loss of bat roosts, loss of habitat used by foraging bats, and severance of commuting routes during the construction phase. During the operational phase, effects include road traffic mortality and disturbance. Maintenance operations can potentially affect bat roosts in bridges or trees and can cause disturbance to bats in roosts.

2.5 It is possible to mitigate the effects of highways operations on bats by the provision of artificial roost sites, creation of feeding/commuting habitat and the provision of safe routes to cross the road. Since many bat roosts are seasonally occupied, works should be timed to avoid periods when bats are present wherever possible.

3. PROTECTION STATUS

3.1 Bats and their roosts are afforded protection in Britain through the Wildlife and Countryside Act 1981 (in Northern Ireland, through the Wildlife Order 1985), and the Habitats and Species Directive (92/43/EC), enacted in the UK through the Conservation (Natural Habitats, &c.) Regulations (1994). A brief description of this legislation is given in Annex A to this document. It must be stressed that these descriptions are summaries only. The legislation should always be referred to for the exact wording.
3.2 Although the Crown is not bound by the provisions of the Wildlife and Countryside Act, and work authorised by enabling legislation is therefore not subject to the licensing procedures, Overseeing Departments do have a duty of care to act within the spirit of the legislation as far as possible. This means that the appropriate SNCO should be consulted and allowed a reasonable time to provide advice or agree to a course of action suggested by a consultant before any action is taken which, under normal circumstances, would require their authorisation. In addition, the Crown is bound by the terms of the Habitats and Species Directive (92/43/EC) and is required to act within the provisions of this and other European legislation.

3.3 The SNCOs are: in England, English Nature; in Scotland, Scottish Natural Heritage; in Wales; Countryside Council for Wales; and in Northern Ireland, Department of the Environment for Northern Ireland (Countryside & Wildlife).
4. BACKGROUND BIOLOGY

4.1 Fourteen species of bats are resident in Britain, belonging to two families, the Rhinolophidae and the Vespertilionidae. These species, together with an extinct species, a migrant and a rare vagrant are listed in the box below, along with their status and distribution in Great Britain and Northern Ireland.

<table>
<thead>
<tr>
<th>Common Name</th>
<th>Scientific name</th>
<th>Status</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater horseshoe bat</td>
<td>Rhinolophus ferrumequinum</td>
<td>Native, Endangered</td>
<td>SW England, S Wales</td>
</tr>
<tr>
<td>Lesser horseshoe bat</td>
<td>Rhinolophus hipposideros</td>
<td>Native, Endangered</td>
<td>SW &amp; W England, Wales</td>
</tr>
<tr>
<td>Whiskered bat</td>
<td>Myotis mystacinus</td>
<td>Native, Local</td>
<td>England, Wales, S Scotland, N Ireland</td>
</tr>
<tr>
<td>Brandt’s bat</td>
<td>Myotis brandtii</td>
<td>Native, Local</td>
<td>W &amp; N England</td>
</tr>
<tr>
<td>Natterer’s bat</td>
<td>Myotis nattereri</td>
<td>Native, Fairly common</td>
<td>England, Wales, Scotland, N Ireland</td>
</tr>
<tr>
<td>Bechstein’s bat</td>
<td>Myotis bechsteinii</td>
<td>Native, Very rare</td>
<td>S &amp; W England, Wales</td>
</tr>
<tr>
<td>Greater mouse-eared bat</td>
<td>Myotis myotis</td>
<td>Extinct *</td>
<td>Formerly S England</td>
</tr>
<tr>
<td>Daubentons’ bat</td>
<td>Myotis daubentonii</td>
<td>Native, Fairly common</td>
<td>England, Wales, Scotland, N Ireland</td>
</tr>
<tr>
<td>Particoloured bat</td>
<td>Vespertilio murinus</td>
<td>Vagrant</td>
<td>Occasional records throughout Britain</td>
</tr>
<tr>
<td>Serotine</td>
<td>Eptesicus serotinus</td>
<td>Native, Locally abundant</td>
<td>S &amp; SE England</td>
</tr>
<tr>
<td>Noctule</td>
<td>Nyctalus noctula</td>
<td>Native, Uncommon</td>
<td>England, Wales, SW Scotland</td>
</tr>
<tr>
<td>Leisler’s bat</td>
<td>Nyctalus leisleri</td>
<td>Native, Scarce (more common in Ireland)</td>
<td>S, C &amp; E England, Wales, N Ireland</td>
</tr>
<tr>
<td>Pipistrelle **</td>
<td>Pipistrellus pipistrellus</td>
<td>Native, Common</td>
<td>England, Wales, Scotland, N Ireland</td>
</tr>
<tr>
<td>Nathusius’ pipistrelle</td>
<td>Pipistrellus nathusii</td>
<td>Migrant ***</td>
<td>Occasional records throughout Britain and Northern Ireland</td>
</tr>
<tr>
<td>Barbastelle</td>
<td>Barbastella barbastellus</td>
<td>Native, Rare</td>
<td>England, Wales</td>
</tr>
<tr>
<td>Brown long-eared bat</td>
<td>Plecotus auritus</td>
<td>Native, Common</td>
<td>England, Wales, Scotland, N Ireland</td>
</tr>
<tr>
<td>Grey long-eared bat</td>
<td>Plecotus austriacus</td>
<td>Native, Very rare</td>
<td>S England</td>
</tr>
</tbody>
</table>

* There are no records of Myotis myotis in England prior to 1940, and the last known individual died in 1990. The species was at the very edge of its range in southern Britain and was probably never well-established. May recur as a vagrant.

** Recent research into the echolocation calls and genetics of these bats has demonstrated that Pipistrellus pipistrellus actually consists of two distinct species. Both types are found throughout Britain and presently, for the purposes of Environmental Assessment, there is no need to distinguish between the two.

*** At least one record exists of Pipistrellus nathusii breeding in Northern Ireland, and of some breeding individuals in South West England. May be becoming established as a British resident.
4.2 As shown in the box above, many of the species of bat found in Great Britain and Northern Ireland are scarce, rare or endangered. Even those which are relatively common have undergone massive population declines in the last fifty years and all species are of conservation concern.

4.3 Most bats are colonial and roost in groups in trees, buildings, caves, mines and other structures. Large numbers of bats may congregate at a particular roost site and this makes populations very vulnerable, as the loss of one roost site may affect the entire population of that species in a given area. However, under certain circumstances, a roost containing a single bat can also be important. Different roosts are used at different times of year: these can be within the same building or several kilometres apart.

4.4 Bats hibernate to conserve energy during the winter months when their insect food is in short supply. Hibernation roosts are normally in caves, buildings or hollow trees, where a constant low temperature and a high relative humidity can be guaranteed. In spring, bats may move from roost to roost fairly regularly and gather into small groups. (At this time of year bats will often feed only on warmer nights and may remain torpid for several days at a time in bad weather.)

4.5 In June the females of a colony will congregate at a nursery roost to give birth and many species, such as brown long-eared bats, are very faithful to their natal nursery colony. Nursery colonies are often in buildings or trees. Males may visit the nursery colony at intervals throughout the summer, although they tend to spend most of the year singly in traditional roosts of their own. Once the young are weaned, the adult females, followed by the juveniles, will leave the nursery roosts.

4.6 In autumn, mating roosts (often held by a single territorial male) are set up and females visit to mate. Transitory roosts are then used, as the animals feed and gain weight before entering hibernation roosts again. There are no hard and fast rules regarding the roost preferences of different bat species, but the following box provides general guidance.

4.7 All British bats are insectivorous and rely mainly on habitat types which can provide a large biomass of insects, such as woodland and wetland, for feeding. The loss of such habitat types due to large-scale landscape change has led to a significant decline in bat numbers over the last fifty years. Any highway operations affecting these habitats can therefore have an effect on bats. It should be noted, however, that bats regularly roost in urban areas, and some will also cross apparently unfavourable areas to reach distant foraging sites. Thus, with the exception of exposed high ground and intensive arable land, bats can be found almost anywhere.

4.8 Bats commute between roosting sites and feeding areas which may be quite distant, using echolocation as a means of navigation. Greater horseshoe bats, for example, may travel 2-3 km in the course of a night’s activity. Most species of bats tend to follow linear landscape elements such as tree-lines or hedges, and these features can be important in supporting a population of bats in a given area.
Roost preferences of different species of bat in Britain

<table>
<thead>
<tr>
<th>Species</th>
<th>Use of buildings</th>
<th>Use of underground structures*</th>
<th>Use of trees</th>
<th>Use of bat boxes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greater horseshoe bat</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Lesser horseshoe bat</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td>Whiskered/Brandt’s bat</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Natterer’s bat</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Bechstein’s bat</td>
<td>RARELY</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Daubenton’s bat</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Serotine</td>
<td>YES</td>
<td>YES</td>
<td>RARELY</td>
<td>RARELY</td>
</tr>
<tr>
<td>Noctule</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Leisler’s bat</td>
<td>YES</td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Pipistrelle **</td>
<td>YES</td>
<td>RARELY</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Barbastelle</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Brown long-eared bat</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
<tr>
<td>Grey long-eared bat</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>NO</td>
</tr>
</tbody>
</table>

* Includes any site with a similar environment including caves, mines, cellars, ice-houses, grottoes, lime-kilns and tunnels.
** Preferences of P. nathusii are similar.
5. BAT SURVEY METHODS FOR ENVIRONMENTAL ASSESSMENT OF ROAD SCHEMES

5.1 All survey techniques for bats are selective (to a greater or lesser degree) and the most appropriate technique(s) will be determined by the information required and the species likely to be present. The primary aim of most investigations related to highway schemes would normally be to determine where bats are roosting, feeding or hibernating within the immediate vicinity of the road/structure concerned. Most investigations would take place within a standard 2 km corridor centred on the midline of the road. In exceptional circumstances, the investigations may need to be extended up to 5 km beyond the corridor for desk top studies. This would include, for example, schemes where features of value to species such as greater horseshoe bats, which cover large areas when foraging, may be affected.

Survey Methods

Desk Study

5.2 A desk study will normally form the first stage of any investigation into the presence of bats, whether for new road schemes, road improvements or maintenance operations. The statutory consultee for works potentially affecting bats is the SNCO. Appropriate non-statutory consultees would include the local wildlife trust, local records office, county mammal/bat recorder, the local bat group and/or the Bat Conservation Trust. A desk study will provide information on known roosts, usually in buildings or other structures, but the quality/completeness of the information will be variable. It is extremely unlikely that a desk study alone will ever provide information on all of the features of value to bats in a given area.

Field Surveys

Habitat surveys

5.3 Walkover surveys can be used to identify habitat features of value to bats such as potentially suitable roost sites (including buildings), linear features and potentially valuable feeding areas. This should be undertaken as part of the initial ecological appraisal for new roads and road improvements.

Daytime identification of potential roost structures: buildings

5.4 Any buildings identified during the habitat surveys as likely to be suitable for occupation by bats and which may be affected by highways operations should be investigated in more detail for evidence of use by bats. The buildings should be carefully searched by experienced, appropriately-licensed bat workers in order to locate signs of current or past bat roosts, in the form of bats, droppings, staining, feeding remains, and/or remains of bats. Uncovered water tanks should be examined for drowned bats. The outside of the buildings should be searched for access points, and any evidence of their use by bats. In addition, pipistrelles often roost under (for example) hanging tiles, wooden cladding or soffits on the outsides of buildings. Inspections should therefore include an examination of window sills and cobwebs for droppings, as there may be few or no signs within the roof-space itself. Within older barns, areas worthy of careful inspection include hollow mortise joints and the area under the central ridge beam. Inspections may be carried out at any time of year but surveyors should attempt to assess the likely age of any signs present. If significant areas of any part of the buildings, particularly roof spaces, are inaccessible, a bat detector survey may also need to be carried out (see below) to establish if bats emerge from any of the buildings. Bat detector surveys should be restricted to months when bats are active.
Daytime identification of potential roost structures: trees

5.5 All mature and over-mature trees likely to be affected by highways operations should be carefully scrutinised (with binoculars) to assess their likely occupancy by roosting or hibernating bats. It should be borne in mind that there are often no external signs of bat occupancy and, in the first instance, surveys should be carried out to identify potentially suitable roost sites. Surveyors should look for: obvious holes, cavities or splits; dark staining on a tree below a hole; staining around a hole (caused by urine, faeces, or fur rubbing); scratch marks around any hole (caused by bats’ claws); or droppings below a hole. These surveys are best carried out in autumn and winter when the trees are leafless. If surveys must be carried out in summer, it may only be possible to identify trees containing significant amounts of dead wood. However, on hot days, noises (squeaking or “chittering”) made by larger colonies of bats may be audible. These types of surveys do not involve disturbing bats or entry to known roosts and do not therefore require licensed surveyors. However, many of the signs are often difficult to find and interpret, so a surveyor with considerable experience is still required.

Daytime identification of potential roost structures: hibernation roosts

5.6 Potential hibernation sites include caves, mines, cellars, ice-houses, grottoes, lime-kilns and tunnels. Locating such sites within the study area may require a local search for information, and the examination of old maps. Liaison with the local caving group as part of the desk study may be appropriate. If the surveys are carried out in winter, when bats are likely to be present, liaison with the local bat group will be essential in order to ensure bats are not disturbed unnecessarily. Bats may hang in exposed locations (horseshoe bats), squeeze into cracks and crevices (vespertilionid bats), or be situated at ground level (hanging from rocks or within rubble). It can be difficult to detect individuals, and extreme caution should be exercised both when moving within roosts and when attempting to ascertain if a potential hibernaculum is occupied. A specific clause added to a personal licence is required for entry into hibernation roosts (this permits disturbance to bats but not handling).

Daytime identification of potential roost structures: bridges

5.7 This subject is dealt with more fully in Chapter 11.0.

Nocturnal Bat Surveys

Emergence counts

5.8 Emergence counts should be carried out whenever significant areas of any buildings, particularly roof spaces, are inaccessible, or when it is necessary to confirm the use or status of a potential roost (of any description). During good light conditions, bats can be counted individually, and bat detectors can be used to identify species. As visibility decreases, numbers can be counted from ‘bat passes’ on a bat detector. Surveys should not normally be carried out if there is more than light rain, more than moderate wind or if it is unseasonably cold. Observers should be stationed outside potential access points at least fifteen minutes before sunset. Several observers may be required to ascertain the location of access points on an unfamiliar building. At mixed roosts, different species tend to emerge at different times, and observers should ensure that all bats have emerged before ending the period of observation. It is important to log all entrances and exits to get a final emergence count as individuals of some species exit and re-enter a number of times before departing.

5.9 Emergence counts can only be carried out when bats can be expected to be active. The ideal time of year to carry out emergence counts is dependent on whether the roost is in use as a summer (nursery) roost or a transitional roost before or after hibernation. Nursery colonies are at their most stable in the summer, just prior to birth of the young, when a peak in female numbers is reached. The National Bat Monitoring Programme recommends counts in mid- to late June for vespertilionid bats; late July is suggested for horseshoe bats.
Activity surveys

5.10 Depending on the results of habitat surveys and the options for mitigation, bat activity surveys using bat detectors may be required in order to confirm the level of use of a potentially valuable feeding/commuting habitat which may be affected by highways operations. They may be used to record the number of ‘bat passes’ and to identify the species/species group using the area. These surveys tend to under-record those species with weak echolocation calls such as long-eared bats and Bechstein’s bats.

5.11 Bat activity is strongly influenced by weather conditions and by time of night. Peak activity is seen at dusk and at dawn; there is a lull in activity in the early hours of the morning. Surveys should usually therefore concentrate on the two hours after dusk. The most appropriate methodology is usually to walk a set transect and record the number of bat passes in each habitat type encountered. In certain circumstances (for example, where access is restricted), it may be necessary to record bat activity (bat passes) in each of several spots, rather than along transects.

Back-tracking to locate roosts

5.12 In some cases, it may be necessary, to identify the roost that foraging bats are using in order properly to assess any effects of highways operations. ‘Back-tracking’ in this way relies on four assumptions: that the earlier bats are seen, the closer they are to their roosts; that bats fly away from their roost at sunset (thus surveyors should move towards bats to locate roosts); that bats fly towards their roost at sunrise (thus surveyors should move in the same direction as bats to locate roosts); and that bats ‘swarm’ at roost entrances for a period of time before entering their roost. Observers are required to record the direction and type of flight (e.g. commuting/foraging) of all bats seen. The results of observations are pooled in order to identify potential commuting routes and therefore potential roost sites. Surveyors then search for swarming bats along commuting routes in order to locate roosts. The technique can be used for any species, but is biased towards species with loud echolocation calls, and which form large roosts. It can be time-consuming, requires a large number of observers, and is limited to the summer months. There are few occasions where this technique is likely to be necessary and these are likely to be restricted to new road schemes where potentially significant impacts on bats have been identified at an earlier stage.

Species identification: non-invasive methods

5.13 If direct effects on a bat roost or significant effects on foraging/commuting bats are predicted, it will be necessary to identify the species concerned to fully assess the significance of these impacts. Species are normally identified using a combination of bat detectors and visual clues (size, wing profile, roost type, behaviour, flight pattern, geographical location, etc.). Bat remains, including the size, shape and texture of droppings, the presence of mummified corpses or skeletons, or the presence of host-specific parasites may also be used. For some species (e.g. whiskered/Brandt’s bats), identification in the hand may be required (see below).

Species identification: hand-netting, mist-netting and harp-trapping

5.14 Individual bats may be caught by hand during the day at roosts, or in a static hand-net placed outside access points at sunset. At mixed roosts, different species tend to emerge at different times, and observers should ensure that all bats have been sampled. Mist-nets or harp traps for capturing bats in flight in order to confirm identification may be necessary, particularly where rarer species are involved, in order to refine the mitigation proposals.

Radio-tracking

5.15 In exceptional circumstances, it may be necessary to obtain detailed information on the movement of bats between roosts and/or feeding sites using radio-tracking. This procedure requires the capture of individual bats and the attachment of a small transmitter. Each individual’s movements may then be tracked.
6. WHEN IS A BAT SURVEY NECESSARY?

6.1 This chapter sets out the requirements for bat surveys for new road schemes and road improvements at each stage of the Environmental Assessment (as identified in the Design Manual for Roads and Bridges Volume 11). The requirements for bat surveys associated with maintenance operations are dealt with in Chapter 11.0.

Stage 1

6.2 As part of the Stage 1 desk study, organisations such as the appropriate SNCO, the local Wildlife Trust (or similar) and the local bat group should be contacted at an early stage for any information on bats that they might hold. Specifically, a request should be made for details of known roosts affected by route corridor options (up to 5 km away).

6.3 Within the overall map-based habitat assessment, habitat features likely to be of value to bats should be noted, particularly large numbers of mature trees and linear features connecting foraging habitat with known roosts, and these should be considered in route/alignment choice.

Stage 2

6.4 A walkover survey to identify potential roost sites and potentially valuable habitats should be carried out. If the initial desk study or the walkover survey indicate significant roosts, these should be investigated in more detail to inform impact assessment and route choice.

6.5 A more detailed desk study should be carried out if a significant period of time has elapsed since that carried out at Stage 1, or if the need for further information is triggered by the findings of the walkover survey.

Stage 3

6.6 If it is identified at Stage 2 that a roost will be affected, the detailed effects/impacts of the preferred route should be determined. An assessment of the effects on foraging routes and habitats, as well as direct impacts on roosts, should be included. Techniques to be used may include bat detector surveys to determine the level of bat activity, occasionally mist-netting or harp-trapping to confirm the species affected or, in extreme cases, radio-tracking studies to track bats between sites. The information should be used to refine the mitigation proposals.

6.7 The use by bats of any potential roosts sites identified at Stage 2 which are likely to be affected should be confirmed (see Sections 5.8 and 5.9).

6.8 The impacts on habitats of value should be assessed and recommendations made for mitigation. Where such habitats are close to roosts, activity surveys may be required to determine the level of use by bats before finalising any mitigation.

6.9 Different survey methods should be applied over different areas depending upon the likely impacts of the highways operations.
## Use of different bat survey methods

<table>
<thead>
<tr>
<th>Survey method</th>
<th>Where and when applicable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Desk study</td>
<td>At least 2 km and, under certain circumstances, up to 5 km from the centre line of the route corridor.</td>
</tr>
<tr>
<td>Habitat surveys</td>
<td>All areas directly affected by the landtake of the scheme should be surveyed. The area should be extended if it appears likely that an important linear feature leading to an area of valuable habitat would be affected.</td>
</tr>
<tr>
<td>Identification of potentially suitable roost sites</td>
<td>Where a highways operation involves a landtake, surveys should be undertaken within and adjacent to the landtake to a distance of 500 metres either side, extended as appropriate, to investigate known roosts identified in the desk study if there is the possibility of a significant impact. Within and immediately adjacent to the landtake of the scheme, all potentially suitable roosts sites should be recorded: outside of this area only those structures which show positive signs of past/current occupation by bats or those particularly likely to contain significant numbers of bats should be recorded.</td>
</tr>
<tr>
<td>Surveys to confirm the status of known / potentially suitable roost sites (emergence counts etc.)</td>
<td>Potentially suitable roost sites within the landtake which have been identified by experienced surveyors as those most likely to contain bats should be monitored to confirm their status. Those identified as less likely to contain bats should be felled under supervision (see Sections 9.3 and 9.4). Outside the landtake, those trees which are likely to suffer indirect effects (severance, disturbance) should be monitored.</td>
</tr>
<tr>
<td>Activity surveys</td>
<td>The need for activity surveys would be determined by the results of the habitat surveys and the options for mitigation. These surveys will generally be restricted to areas of habitat directly affected, within or close to the landtake of the scheme, but under certain circumstances, could involve work to determine the importance of feeding sites which might be isolated by a scheme.</td>
</tr>
</tbody>
</table>
7. LICENSING CONSIDERATIONS AND QUALIFICATIONS

7.1 A Bat Roost Visitor (Conservation) Licence from the appropriate SNCO is required in order to enter any known roost or handle any species of vespertilionid bat. Specific clauses are required to be included in the licence in order to carry out additional activities: i.e. to enter vespertilionid hibernation sites and ‘disturb’ bats; to handle hibernating vespertilionid bats; to enter known rhinolophid (horseshoe) roosts; to enter hibernation sites in order to disturb horseshoe bats; or to handle horseshoe bats. The latter are rarely issued except as part of a recognised study. Licences are normally issued for work in specified counties, and are only issued after a period of training which can last up to two years.

7.2 Additional licences are required for photography, for ringing bats, for mist-netting and harp-trapping and for attaching radio transmitters as part of a radio-tracking study.

7.3 A licence is not required in order to examine potential roost sites, nor to carry out activity surveys or emergence counts. It is essential that the surveyor carrying out such non-licensed activities is experienced in both bat ecology and conservation, and in the objective assessment of the impacts of highways operations.

8. POSSIBLE EFFECTS ON BATS

8.1 There are many aspects of road construction and operation which can have potential impacts on bats. These are described below in terms of the potential impacts on nature conservation outlined in the Design Manual for Roads and Bridges Volume 11. In many cases, it will not be possible to determine the precise significance of these impacts in the absence of relevant research, but wherever possible the precautionary principle should be applied.

Direct loss of habitat through land-take

8.2 Most new road schemes or improvements require a limited landtake (compared to, for example, housing, business or leisure developments). They therefore tend not to have significant impacts (for example, the removal of suitable feeding habitat or roost sites) as these can be avoided by early identification of sensitive sites and good engineering design. However, under certain circumstances, for example, where a linear feature runs parallel and close to the road, there may be significant effects. Bats show strong preferences for particular habitat types, mainly woodland, wetland and corridor habitats, and are sensitive to the loss of these features (even where very small patches of habitat, such as small ponds, are lost).

8.3 The loss of a single roost site can have implications for the bat population over a wide area. It is not only the loss of large nursery roosts with obvious congregations of bats which is important. A traditional mating roost or lek may consist of a single tree, (which at the time of a summer bat survey could be occupied by a single bat) but its loss could have serious implications for that population.

Severance of habitat features

8.4 Bats use linear features to commute from roosts to feeding sites and activity studies have shown that some species will make large detours to avoid gaps in otherwise continuous corridors. Severance of such features may disrupt feeding activity and place an energetic burden on commuting bats. Horseshoe bats, in particular, rarely travel far from cover and could become isolated from feeding sites if their traditional commuting routes are severed. It has also been suggested that lit motorways form a barrier to movement by horseshoe bats. Since bats may travel several kilometres in the course of a night’s foraging, severance could affect bats in roosts some distance from the road scheme in question. The potential significance of severance of a habitat feature depends entirely on its level of use, the species of bats involved and the availability of alternative habitats and features. This can only be determined by detailed activity surveys.
**Road traffic related mortality**

8.5 Bats are occasionally found dead on roadside verges, having apparently been swept into the path of traffic. A limited amount of work on this has been undertaken in Germany but no systematic records of bat road casualties are maintained in the UK. The numbers concerned are likely to be relatively small, and in general it would be expected that narrow country lanes (particularly with high hedges) would cause more bat mortality (per vehicle movement) than major roads, since a bat is more likely to be attracted there and less likely to be able to escape from the path of traffic.

8.6 There are particular implications for the construction of new roads close to nursery colonies where young bats would be in danger while their flight was weak.

**Disruption to local hydrology**

8.7 Road schemes which cause draw-down or other disruptions to the local hydrology, could potentially destroy or degrade wetland feeding areas for bats.

8.8 During the Environmental Assessment process, there should be consideration of any interactions between hydrological and ecological effects, and the impact of any hydrological changes on bat foraging areas should be identified.

**Polluted run-off**

8.9 Pollution into local watercourses could again potentially destroy or degrade the value of wetland feeding areas for bats.

**Effects of road lighting**

8.10 Roads illuminated by some types of street lights are frequently used as feeding sites by several species of bats. White (mercury vapour) street lamps apparently attract more insects, and therefore more bats, than orange, low-pressure sodium lamps, since they emit ultra-violet light. High-pressure sodium lamps include some mercury vapour and emit some UV, and are thus intermediate in their attractiveness to bats. Street lights generating ultra-violet light attract insects and hence provide a valuable and predictable food source for aerial-hawking species, such as pipistrelles. Furthermore, lit roads can constitute linear landscape elements which bats may use to navigate in open areas.

8.11 Types of bat which glean insects in cluttered environments (such as Myotis species) do not benefit from road lighting. (Most of the very rare and endangered species in Europe fall into this category). It has also been observed that lit roads form a barrier to the movement of horseshoe bats under some circumstances.

**Disturbance during construction**

8.12 Disturbance caused both by road construction and operation may have impacts on bats if very close to existing bat roosts. The activity of foraging bats may be disrupted if construction operations continue into the hours of darkness.

**Collateral habitat creation**

8.13 Habitats and features such as linear landscape plantings, or the creation of wetland features such as balancing ponds, whilst not provided as mitigation specifically for bats, would be expected to be of benefit as these features mature. Certain elements can also be incorporated to maximise the value of these features.
9. MITIGATION MEASURES

Safe working periods at roosts

<table>
<thead>
<tr>
<th>Month</th>
<th>Roosts known to be used for hibernation only</th>
<th>Roosts known to be used by nursery colonies only</th>
<th>Potential roosts: use unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>January</td>
<td></td>
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<td>February</td>
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<tr>
<td>December</td>
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</tbody>
</table>

Note that the information in the box above is given as a guide, and timings in any given year will depend on geographical location, and local weather patterns. During cold spring weather, for example, bats may remain in torpor until weather conditions improve. Advice should still be sought on a case-by-case basis.
Timing of works affecting roosts in buildings and other structures which would be directly affected by highways operations

9.1 Where it is essential for buildings with identified roosts to be removed then, once appropriate mitigation has been designed and implemented, demolition should proceed outside of the times when bats are in occupation (see box). If necessary, “exclusion” of the colony can be attempted by blocking access points after the bats have dispersed naturally and well before they are likely to return. The timings of such operations should be determined by the type of roost and in practice it can be difficult to block all access points to large structures.

9.2 Where potential roost sites have been identified, these should be surveyed prior to demolition. If bats are discovered, recommendations for the appropriate mitigation would depend on the numbers and species of bats present, and the time of year. In all cases, advice should be sought from an appropriately-qualified consultant and the course of action agreed with the SNCO. If any uncertainty remains regarding occupation by bats, tiles should be removed by hand from a section of each roof space, and cellars should be carefully exposed, and then left for 24 hours (longer in cold weather). This should be sufficient to encourage any concealed bats to disperse. If bats are discovered once demolition has begun, work on that structure should stop immediately, and SNCO’s advice should be sought.

Tree roosts

9.3 Where trees with potentially suitable conditions for roosting bats (but which appear to show no positive signs of past/current occupation) have been identified which would have to be felled, these should be felled under the supervision of an experienced, appropriately-licensed bat worker and, if possible, outside of the times when hibernating bats or bats with dependent young could be present. Ideally, this would mean felling such trees in either spring or autumn (see Box) though there may be a conflict of interest with regard to occupation by nesting birds, which means that autumn would be the optimum period.

9.4 In certain circumstances, it may be necessary to fell trees containing potentially suitable conditions for roosting bats during periods of the year outside those specified in Section 9.3 or to fell trees which show signs of current or recent occupation by bats. In these cases, the trees should be monitored using the procedure for emergence counts, as specified in Sections 5.8 and 5.9. Felling should be carried out by an experienced contractor, and limbs should be removed in sections, keeping (if at all possible) hollow sections intact. Limbs should be slowly lowered to the ground, inspected carefully, and left lying for at least 24 hours (48 hours in cold weather) for any concealed bats to escape. Many cracks and fissures are kept open only by the weight of the limb itself, and will tend to close once the limb is severed. In such cases, wedges should be used to ensure the fissures stay open before separating the limb from the tree.

Provision of bat boxes and other artificial roosts

9.5 While, for linear developments, it is usually most appropriate to avoid direct impacts on bat roosts by good engineering design, there may be some situations where this is unavoidable (for example, junction improvements or other developments where there is no choice of alignment). Where an existing roost would unavoidably be lost, consideration should be given to the provision of artificial roosts. In most cases, this is likely to involve the provision of a number of bat boxes. Bat boxes have been used widely in Britain since the 1970s and eleven of our bat species have been recorded as roosting in them. Bat boxes are normally used in the summer or autumn months. They are widely used as mating roosts, and six species have used bat boxes as nursery roosts (pipistrelle, brown long-eared, noctule, Leisler’s, Natterer’s and Daubenton’s bats). The provision of bat boxes can also be used to improve the habitat for roosting bats. Brief details of the construction and siting of standard bat boxes are given in Annex B.

9.6 New designs of bat boxes for use in different circumstances are continually being developed, and the Bat Conversation Trust or an appropriately-qualified environmental consultant will be able to provide further information. Alternative bat box designs include versions made of cement and sawdust, or of clay, which last longer than the standard wooden box. Various block or planking structures are easily constructed to attach to buildings or bridges (see Annex B). In some circumstances, it may be appropriate to adapt existing structures, such as pill-boxes (Annex B) or parts of cellars.
9.7 If a hibernaculum would be lost, it may be appropriate to construct a replacement or to adapt an existing structure. The conditions within the existing structure should be carefully monitored (see Chapter 12) before its destruction in order that its conditions may be replicated in the new structure. New and existing bat hibernacula (or potential hibernacula) can be improved by grilling entrances (particularly if these have been exposed by the road construction) or by altering air flow/ventilation.

9.8 The most important features for an effective hibernation site are:
- Location and access (to ensure bats will find it during summer or autumn)
- High humidity (close to 100%)
- Stable winter temperatures (within the range 2-7°C, depending upon the species)
- Suitable crevices for bats to hide in/surfaces to hang from
- Protection from predators (including people)

Artificial roosts in bridges

9.9 If the construction of a new bridge could potentially result in the loss of an existing bat roost, the roost should be avoided if possible. If it could not be avoided, an alternative roost structure should be constructed as close to the original as possible. It may be appropriate to install artificial roost sites into the bridge, particularly if the bridge is over water or over an access track or minor road. It is not usually appropriate to install bat roosts in bridges over roads where bats may be encouraged into the path of on-coming traffic. In any case, bat roosts should be incorporated into the non-structural elements of the bridge. Figure 9.1 illustrates suitable locations for artificial roost structures in typical masonry and concrete bridges.

Bat bridges and underpasses

9.10 Safe crossing-points may be required to allow bats to fly over or under new or improved roads in order to avoid road traffic mortality or to allow bats to continue to use traditional flight paths. Bats will use existing crossing-points (such as culverts, side road and cattle underpasses, access tracks and pedestrian crossings) to cross roads. Where no suitable structures exist, new crossing-points may need to be provided or existing structures adapted. Bats will be more likely to use such crossing-points if linear planting ‘corridors’ are used to ‘lead’ bats towards crossing-point entrances such that there is no break in cover. Certain species of bat are known to undertake quite long detours in order to follow such linear features when commuting between roosts and feeding sites.

9.11 In exceptional circumstances, for example, where the traffic from a new road would be directly in the path of bats entering and leaving their roost, it may be possible at an early design stage for the road, to alter the vertical alignment to raise or lower the road such that the bats’ existing flight path coincided with an underpass.

9.12 Purpose-built bat tunnels may also be considered in circumstances where it can be demonstrated that bats need to cross the road (for example between their roost site and a valuable foraging area) and cannot do so by any existing structure. The form of this tunnel/culvert can vary but should be greater than one metre in diameter. If possible, allowing water to flow through the culvert will increase its value for bats. As for existing crossing points, it would also be advantageous to use linear landscape planting elements to lead bats to the crossing.

Habitat creation / enhancement

9.13 Habitat creation and enhancement schemes for bats should endeavour to preserve or enhance the availability of features which generate large volumes of insect food such as woodland and water margins, or linear corridor habitats, as lack of continuity of the landscape, or the loss, fragmentation or degradation of habitat patches may pose a threat to bat populations. Where habitats of value to bats have been lost as a result of highways operations, these should be replaced on a like-for-like basis.

9.14 Consideration should be given to the creation of new wetland or woodland features or the creation of new links between isolated patches of potentially valuable bat habitats. Normal pollution control measures such as petrol interceptors, silt traps and balancing ponds will also help to enhance the surrounding habitats for bats.
Street lighting

9.15 Reductions in street lighting at specific points could be considered if traditional commuting routes of species such as greater horseshoe bats (which may perceive lit roads as a barrier) are severed. It may be necessary to modify/omit lighting from sections of road close to breeding roosts, if at all possible.

Traffic calming

9.16 Although slower traffic speeds are inherently likely to reduce the number of all types of road casualty, this is unlikely to be an effective means of mitigating the potential effects of bat road traffic accidents. The small size of bats means that they would suffer fatal injuries even at relatively slow speeds and more appropriate mitigation would be to develop 'safe crossing points' as described above.

Working practices

9.17 Compounds, storage areas, to temporary haul routes etc. should be sited away from known bat roosts. Night working should be avoided close to any occupied bat roost. Works which must take place close to any seasonally-occupied roost should take place when bats are absent, if possible.
Figure 9.1. Suitable locations for artificial roost structures in typical masonry and concrete bridges. Naturally-occurring bat roosts are more commonly found in the span of the bridge, but artificial roosts should be incorporated into non-structural elements of both masonry and concrete bridges.
10. CONTRACT IMPLEMENTATION

10.1 It is essential that Project Managers are satisfied that measures have been put in place to ensure compliance with the Wildlife and Countryside Act (1981) before any work affecting bats is carried out. Contractors should be made aware of the presence of bats and of their responsibilities under the Act.

10.2 Since bats can very quickly occupy a new structure (such that a concrete bridge can become occupied between construction and treatment with protective water-repellent coatings (Silane or similar)) it is essential that advice from an experienced, appropriately-licensed person is available throughout the construction period.

10.3 All Environmental Clerks of Works should be made aware of bats. If they are not personally licensed to carry out bat work, an appropriately-licensed, experienced bat worker/consultant should be available throughout construction.

11. MAINTENANCE OPERATIONS

Bats in Bridges

11.1 Bridges may be occupied by many species of roosting bats at all times of the year. Bat roosts are more likely to be found in the bridge span, but may be found in any crevice or gap including the abutment, the span/abutment interface, spandrel, spandrel/abutment interface, pier, parapet, corbel, drainage pipes or holes, box void, widening joint or expansion joint.

11.2 It is important to be aware of the possibility of finding bat roosts during regular bridge inspections. If a roost is found, then prior knowledge of its presence will make it easier to plan future works, and avoid delays. Any bridge works (including strength testing, re-pointing by hand, pressure pointing, shot-blasting to remove old paintwork, removal of vegetation, strengthening with concrete infill, staying, structural repairs, ‘Silane’ treatment (or equivalent) and demolition can potentially affect bats. Routine inspections will not normally disturb bats but those carrying out inspections of structures should be made aware of the presence of known bat roosts.

11.3 Before the commencement of bridge works which may affect bats, advice should be sought from an appropriately-qualified consultant and the course of action agreed with the SNCO. The SNCO (together with the local Bat Group if appropriate) may be able to provide advice on any bat roosts which are already known to exist in any structure.

11.4 If no bat roosts have previously been recorded in the bridge, but potential roost sites are present, a survey should be carried out by an appropriately-licensed, experienced person. Although bats are most commonly encountered in masonry bridges, they can occur even in newly-constructed concrete box girder bridges. Bridges should be surveyed using powerful torches and binoculars, and deep crevices should be inspected using a fibrescope.

11.5 If bats are present, or there is evidence of past occupation by bats, and the crevices occupied are likely to be affected by the proposed works, advice should be sought from an appropriately-qualified consultant and the course of action agreed with the SNCO.

11.6 Where a roost in a bridge is known to be occupied seasonally, works should be programmed at a time of year when the bats are absent. Thus works affecting a nursery roost would take place in winter. If a roost is occupied all year round, or works during its season of use are unavoidable, bats can tolerate some disturbance or can be temporarily excluded during the operations, subject to agreement by the appropriate SNCO. Ideally, such operations should be confined to mid-April to mid-May or late September to mid-November.

11.7 If works are close to, but not directly affecting a bat roost, the disturbance may cause them to abandon their roost, at least temporarily. In some cases, they may become habituated to the noise, or they may simply have no alternative roosts. In these cases, bats may seek refuge deeper in the bridge or enter torpor. The bridge should be checked daily and if any bats are found in the area being worked on, advice should be sought from an appropriately-qualified consultant and the course of action agreed with the SNCO. While it is illegal for an unlicensed person to remove bats from their roost, they may legally remove a bat in danger out of harm's way.
11.8 Where works during the season when bats are in occupation are unavoidable, bats can be excluded from crevices in a bridge using a polythene funnel placed over their normal exit point (see Figure 11.1). **This type of exclusion should not be attempted at nursery roosts between June and July when dependent baby bats may be trapped inside the roost and should always be undertaken by an experienced, appropriately-licensed bat worker.** The mortar used in re-pointing works usually sets within two hours, thus the area around the bat roost should be given priority to ensure that mortar in this area is set before the bats return the following evening.

11.9 If it is structurally safe to retain cracks occupied by roosting bats within a bridge structure, these should be stuffed with paper during re-pointing works. The entrance to the roost crevice can then be reduced in size (to prevent ingress of water) by mortaring up to a plastic pipe. The pipe and paper can then be removed and the surface roughened to allow bats to grip. Advice should be sought from the SNCO/consultant regarding the size of opening to be left which would continue to allow bats access but would not become blocked by accumulated droppings. Figure 11.2 demonstrates this process. **This procedure should not be attempted when bats are in occupation and should always be undertaken by an experienced, appropriately-licensed bat worker.**

11.10 Where appropriate, bridges can be made more suitable for roosting bats by the addition of artificial roost sites. This can be valuable mitigation for the loss of bat roost crevices during maintenance works, but should be approached with care. Such roosts should be incorporated into non-structural parts of the bridge. It is generally not appropriate to encourage bats onto bridges over roads, where bats may fly into the path of on-coming traffic. Creating bat roost sites where the road is on a bridge, particularly over water, is more valuable. Artificial roost sites which can be added to existing bridges are illustrated in Annex B.

11.11 In certain circumstances, it may be necessary to ensure, for reasons of safety, that bats do not occupy a particular bridge. The chances of occupation by bats will be reduced by filling every visible crevice (bats can enter a crevice as small as 12mm wide). For masonry bridges, this could be effected by regular re-pointing. For concrete structures, this would be more difficult, as bats can and do roost in essential expansion joints. In rare cases, it may be necessary to ‘bat-proof’ expansion joints by fixing a tough but flexible mesh over the joint. No chemical repellents are either licensed for use on, or known to be effective in, repelling bats.

### Roadside trees

11.12 Roadside trees can become a hazard if they become diseased or unstable. However, these over-mature trees which contain holes or fissures are potentially valuable for roosting bats. Tree surgery on particularly dangerous roadside trees could potentially cause direct mortality of bats or result in the loss of roost sites.

11.13 If, on the advice of a highway manager or arboriculturist, tree surgery is required on a mature or over-mature tree which contains conditions potentially suitable for roosting bats, advice should be sought from the local bat group or appropriately-qualified consultant, and the work should be approved by the local SNCO. Mature roadside vegetation may form part of a continuous linear feature, and the severance of such features should be avoided. If trees need to be removed, these should be replaced, and the understorey retained, in order to retain as much as possible of the linear nature of the feature.

11.14 If a roost in a roadside tree is occupied seasonally, works should take place while the bats are seasonally absent. If the roost is occupied year-round, or if works during the occupied season are unavoidable, it may be possible to temporarily exclude the bats.
11.15 If tree works are planned which may disturb bats, but where the bat roost itself would not be directly affected, it may be appropriate to temporarily exclude bats by blocking the roost entrance using crumpled paper at night after the bats have flown out. Note: this approach is only possible at times of year when bats are active. The tree works should be undertaken the next day and the blocking material removed immediately. (This approach should be agreed with the appropriate SNCO). **This should not be attempted at nursery roosts between June and July when dependent baby bats may be trapped inside the roost and should always be undertaken by an experienced, appropriately-licensed bat worker.**

11.16 If the roost site is within part of the tree which needs to be removed for safety reasons, the tree surgery should be supervised by an experienced, appropriately-licensed bat worker. Details of the procedures for work on potential bat roosts are given in Chapter 9.0.

11.17 Mitigation for loss of roost sites in roadside trees can include the provision of bat boxes (see Chapter 9.0). Alternatively, a cut limb which constitutes a bat roost can be securely strapped into the crown of the tree to preserve the original roost structure. Whole dead trees, modified where safety issues require this, can also be retained *in situ* to preserve the original roost structure.

11.18 Any information relating to bats in roadside trees should be included in the Inventory and checked every five years as part of the Detailed Inspection.

**Minor works**

11.19 Occasionally minor works, including signage, visibility, cable-laying etc., may affect bat roosts or habitats. The principles described above are equally relevant in these circumstances.
Figure 11.1. Working with bats in bridges: excluding bats from cavities prior to works.

Figure 11.2. Working with bats in bridges: retaining bat roosting cavities in non-structural elements of bridges prior to works.
12. POST-CONSTRUCTION MONITORING

Bat boxes

12.1 Some bat boxes will become occupied by nesting birds, and those occupied by bats may harbour various ectoparasites. It is therefore important to clean out bat boxes annually outside of the breeding season. This annual cleaning should be undertaken by an experienced, appropriately-licensed bat worker. If bat boxes have not been occupied within three years of erection, they should be moved to alternative sites nearby.

Artificial bat roosts

12.2 Where existing bat roosts have had to be altered, it may be necessary to ensure that certain physical parameters have not changed beyond acceptable limits. Factors such as temperature and relative humidity can be measured using thermistor probes and data loggers. Small adjustments to structures, such as the addition of insulation or the modification of ventilation etc., can then be made to adjust the physical conditions as necessary.

Habitat management

12.3 The management and maintenance of habitat features of value to bats should form part of the routine management of roadside vegetation. The following aspects are of particular importance to bats:

- the maintenance of intact linear features and the re-planting of gaps; and
- maintenance of good water quality by routine inspection and maintenance of pollution control measures.

13. MONITORING AND REVIEW OF THE ADVICE NOTE

13.1 At the time of writing very little information on the effects of highways operations on bats had been collected and detailed mitigation for bats had been developed in only a handful of schemes. This guidance is based on a limited number of road schemes, and largely on our existing knowledge of bat ecology and experience with other types of development. Once the advice is implemented, more information will be generated as the effects of schemes and the success of mitigation is monitored. The contents of this Advice Note should be reviewed at five-year intervals in the light of new developments and amended as necessary.
ANNEX A REVIEW OF LEGISLATION AND GUIDANCE

A1 The legislation relating to the protection of bats in Britain is contained mainly within the Wildlife and Countryside Act (1981) and the Habitats and Species Directive (92/43/EC), enacted in the UK through the Conservation (Natural Habitats, &c.) Regulations (1994). All legislation relevant to the conservation of bats in the context of the design and management of highways is summarised below. (Please note that this is not a complete resume of all of the provisions of this legislation, but only as it may relate to highways. Thus, for example, regulations regarding photographing bats have been omitted.)


A2 Bats and their roosts are protected under the Wildlife and Countryside Act (1981). Under the provisions of Sections 9 and 16 of this Act it is an offence to intentionally kill or injure any wild bat. It is also an offence to handle any wild bat unless an appropriate licence is held.

A3 It is an offence to intentionally destroy, damage or to obstruct access to any ‘shelter’ (roost) used by a bat, or to disturb a bat using such a place. It should be noted that to ‘disturb’ a bat can include simply to enter its roost and that an appropriate licence should be held to enter a known bat roost. The roost itself is protected by law, even if bats are seasonally absent.

A4 The relevant Statutory Nature Conservation Organisation must be notified of any proposed operation which could cause damage or disturbance to a bat roost, and allowed a reasonable time to provide advice. In the context of a highway construction scheme, this means that, when approached as a statutory consultee, the SNCO should be provided with any information regarding bats collected during the Environmental Assessment. Bat surveys, where there is potential for bats to be disturbed, should be undertaken by an experienced, appropriately-licensed bat worker. In the context of bridge maintenance operations, the SNCO should be contacted well in advance of any proposed operations which are likely to affect bats. If a structure becomes occupied by bats at any time during highway construction or maintenance, work should be suspended immediately and advice sought from an appropriately-qualified consultant and agreed with the SNCO. Activities relating to the development of land are not licensable and rely on defences in the Act, that is, that any disturbance or mortality caused is the ‘incidental result of an otherwise lawful action which could not reasonably have been avoided’. To use this defence, the appropriate SNCO must have been consulted, and allowed a reasonable period in which to provide advice.

The Habitats and Species Directive 92/43/EEC

A5 The Council Directive 92/43/EEC of 21st May 1992 on the Conservation of Natural Habitats and of Wild Flora and Fauna exists to promote the maintenance of biodiversity in Europe. The Annexes of this Directive list habitats and species of importance in a Europe-wide context, and all bats are included. The strict protection afforded to these species is already enshrined in the Wildlife and Countryside Act (see A2 above).

A6 A further aim of the Habitats Directive is to create a network of protected sites across the European Union known as Natura 2000. This will consist of Special Areas of Conservation (for habitats and species identified under the Habitats Directive) and Special Protection Areas (designated under the Birds Directive). Four species of bat occurring in Britain are covered by Natura 2000 provisions (greater horseshoe bat, lesser horseshoe bat, Bechstein’s bat and barbastelle) and several candidate SAC (cSAC) sites for the conservation of these bats have been put forward by the UK.

A7 In the context of Highways schemes, the presence of greater horseshoe, lesser horseshoe, Bechstein’s or barbastelle bats should be treated as of Europe-wide significance, and project managers should be aware of the importance of cSAC sites.

The Bonn Convention

A8 The Convention on the Migratory Species of Wild Animals protects species which migrate between signatory states. Within this convention, the UK became a signatory to the agreement on the Conservation of Bats in Europe which, among other provisions, aims to protect key bat habitats. This agreement came into force in 1994.

A9 The major implication for highways schemes is the need for awareness of possible impacts of road construction and maintenance on, for example, foraging habitats used by bats as well as roost sites which may be affected by proposals and linear features used by bats travelling between the two.

The Bern Convention

A10 The Convention on the Conservation of European Wildlife and Natural Habitats came into force in 1982 and was the first international convention covering all aspects of protection of the natural heritage. All bats (except the pipistrelle) are on Appendix II of the Convention and afforded special protection. The protection afforded to these species is already enshrined in the Wildlife and Countryside Act (see 3.1 above).
Planning Policy Guidance No 9

A11 PPG 9 has implications for local authority road schemes and ancillary development such as MSAs/MMAs which are governed by the Town and Country Planning Act (1990). PPG 9 embodies the Government’s commitment to conserving biodiversity and states that "the presence of a protected (under the Wildlife and Countryside Act) species is a material consideration in considering a development proposal". Although the concept of 'material consideration' does not apply to Highway schemes, Planning Policy Guidance can be seen as providing good practice guidance. Since the "presence" of bats is not defined, this can be interpreted as including both roost sites and features of value to foraging bats.

Biodiversity: The UK Action Plan

A12 The Convention on Biological Diversity was signed by the UK following the 1992 Earth Summit in Rio de Janeiro. In 1994, the Government produced the UK Action Plan, a national strategy for the conservation of biodiversity. Individual ‘Species Action Plans’ have been drawn up for many of the most-threatened species, and more are planned by the year 2000. The Government has identified six ‘priority species’ and these are: the greater horseshoe bat, the greater mouse-eared bat and the pipistrelle for which Action Plans already exist; and the lesser horseshoe bat, Bechstein’s bat and the barbastelle, for which Action Plans are in the process of being drawn up. Any highway schemes potentially affecting priority species should ensure that mitigation proposed is compatible with the existing Action Plans. (Note that the greater mouse-eared bat is now extinct in Britain).
ANNEX B BAT BOX AND ARTIFICIAL BAT ROOST DESIGN

Figure B1. Standard bat box and Wedge design bat box. Boxes should be of rough-sawn, untreated timber. They should be draught-free, secure and weather-proof. All designs in 25mm planking. All figures in millimetres.

STANDARD BOX DESIGN

- Rubber hinge at top gives extra weather-proofing
- Sawcuts on back board (10mm apart x 1mm deep (if wood is not already rough)
- Roof levers off from the front, slots back into groove

WEDGE DESIGN

- Entrance gaps 15-18mm in both standard and wedge boxes
- With bottom-opening panel
- Use 37mm galvanised nails for swivel and lock

May 1999
Figure B2. Alternative bat boxes: front view and cross-section

Front view

Cross-section
Figure B3. Roosting cavities behind facings to structures and planking roosts

Roosting cavities behind facings to structures

20-25mm high gap in brickwork, 1-2 bricks wide. Use either narrow brick or mortar to create appropriate width.

20-25mm vertical gap, using 3/4 brick.

Planking roost (to be fixed to structures)

Facing bricks

20 x 20mm batten

20-25mm gap between bricks

Cavity formed in concrete behind

Rough planking section
20-25mm from concrete surface
Figure B4(i). Constructing a typical hibernation roost from an existing structure. This is shown for a standard pillbox but the principles apply to the modification of any similar small structure. The standard hexagonal pillbox, most common in the south-east of England, can be quickly, cheaply and easily converted to a winter hibernaculum and occasional summer roost for bats.

The choice of structure for conversion needs some thought. One of the many threats to a hibernating bat is excessive disturbance. Structures near to houses, roads or footpaths should be a lower priority than remote structures on private land. Unconverted structures may already be in use as night roosts or feeding roosts in summer, although not normally as day roosts. This means a converted box may be readily adopted, even in its first year. Any conversion where disturbance is possible needs the protection of a stout gate.

1. The first requirement is to stabilise the interior temperature and humidity, and limit light levels. Cut 10cm medium-density concrete blocks in half and, from the inside, cement one into each of the firing slits at its narrowest point.

2. Three-quarters of a similar block is then cemented into the outside, widest part of each firing slit. Leave a gap of 20 x 2cm at the bottom cement layer. There should be a hollow between the inner and outer blocks with bat access to the outside.

3. The entrance of the structure should be half-closed from the roof downwards. Two small brick pillars, half-way in and on either side of the passage entrance will support a lintel as a base for a block wall up to the roof. The access space left should be about 1m high.
The major part of the conversion having been completed, it is necessary to create cracks and holes for bats to hide in, out of the reach of rats and foxes.

4. Wooden boards can be nailed to walls, leaving 15-20mm narrow gaps between wall and board.

5. The roof should not be forgotten as a site for boards and tiles; the more crevices created, the greater the likelihood that bats will occupy the structure.

6. If a gate is required, this should be fitted where the entrance passage is half-closed by the new block wall. (If a gate is needed, use 25cm blocks to create the wall to give added strength). The door must be steel, with horizontal bars 15cm apart so that bats can fly through.
Figure B5(i). Artificial roosts in bridges: details of bat roosting cavity for concrete bridge
Figure B5(ii). Artificial roosts in bridges: bat roosting crevice built into mass concrete bridge abutment

Vertical crevice
50 mm wide x 200 mm high x 250 mm deep

Concrete

Facing stone

Outside face
Figure B5(iii). Large artificial roost in a concrete bridge abutment offering a range of temperature regimes (and therefore suitable for use at different times of the year).
Figure B5(iv). Artificial roosts in bridges: creation of an artificial cavity in concrete infill for use by bats (but not for incorporation into masonry arches)
ANNEX C  ACKNOWLEDGEMENTS

Cresswell Associates are grateful to the following individuals and organisations for providing us with information useful in drafting this advice: John Altringham, Eric Bennett (Devon Bat Group), Geoff Billington, David Bullock (National Trust), Jim Buzbee, Frank Carlyle, Richard Crompton, John Drewett (Yorkshire Bat Group), Laurent Duvergé (Vincent Wildlife Trust), Gregg Erickson, Daniel Eva (Cornwall Bat Group), Malte Fuhrman, Angela Graham (South Lancashire Bat Group), Gloucestershire Bat Group, John Goldsmith (Norfolk Bat Group), David Hosken, Tony Hutson (Bat Conservation Trust), Institute of Environmental Assessment, Eric Jansen, Brian Keeley, Jim Kennedy (Bat Conservation International), Tony Lane (East Yorkshire Bat Group), Ian Macdonald (SNH), Mark Perkins, Ian Rabjohns (Gwent Bat Group), Paul Racey (University of Aberdeen), Blake Sasse, Henry Schofield, Chris Shaw (Devon Bat Group), Peter Smith (Brecknock Bat Group), Tony Taylor (Derbyshire Bat Group), Ben Verboom, Dean Waters, Ted Weller, Edward Wells (Somerset Bat Group), Rombout de Wijs, Anne Youngman (SNH).

ANNEX D  SOURCES OF FURTHER INFORMATION

The Secretariat to the European Bats Agreement produces a newsletter entitled “Eurobat Chat”. It is available from:

Eric Blencowe,
Eurobats Secretariat,
Mallwitzstrasse 1-3,
D-53177 Bonn, Germany.
Tel: 00 49 228 9543 551
Fax: 00 49 228 9543 550

Standard bat boxes can be obtained from:

Bat Groups of Britain
10 Bedford Cottages
Great Brington
Northampton
NN7 4JE
Tel: 01604 770632

The Bat Conservation Trust can supply advice and a range of leaflets on bat issues. They will also be able to provide contact details of local bat groups (who may hold information on bat roosts within their county) and suppliers of bat boxes.

Bat Conservation Trust,
15 Cloisters Business Park
8 Battersea Park Road
Battersea
London
SW8 4BG
Tel: 0171 627 2629
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