



# A guide to bat boxes

Bat boxes are man-made roosts designed to provide bats with alternative resting places and are also used to encourage them into areas where there are few existing suitable roost sites. There are various designs of bat box from wooden boxes that you can make yourself, to ready-assembled boxes and even integrated bat boxes that can be built into walls.

Providing bat boxes can increase opportunities for roosting bats, particularly when they are located where there are few existing roosting opportunities. However, where a number of suitable alternative roost sites exist it can take a long time for bat boxes to be used regularly and in some cases they may never be used. Even in these situations bat boxes can have an important additional function in encouraging interest and educating members of the public about bat conservation. Also, correct design and placement of boxes will help ensure better uptake by bats.



© Andrew Dumbleton

## 1. Bat roost preferences

Bat boxes are now available from many outlets, and in a range of shapes and sizes, so some knowledge of bats' preferences will help you choose the best possible box.



© Hugh Clark

Microclimate within a new roost is a very important factor in terms of increasing the chance of successful uptake by bats. In general, bats prefer warm spaces in the summer for rearing young and cooler spaces in the winter for hibernation. The box should be draught proof and made from a thermally stable material such as untreated wood, woodcrete, brick or stone. If possible, it is better to provide several internal chambers so that the bats can move around as their needs change.

Although, it can take bats a long time to make use of artificial roosts, roost location seems to be the most important factor influencing successful uptake.

### 1.1 Orientation and location

Lack of sunlight is the most important known cause of bat box/house failure, and structures for summer roosting should be positioned where they are unshaded for most of the day. Summer maternity roosts (in the northern hemisphere) should have a southerly or westerly aspect. On average we estimate that the roost should receive 6-10 hours of direct sunlight a day. It is always best to provide a number of different options for bats so that they can choose the most appropriate temperature based on their needs. This can be achieved by grouping a number of bat boxes each with a different aspect, for example around the trunk of a tree (see 'putting up bat boxes' below).

## 1.2 Size of the bat box

It is important that the type of bat box should be appropriate to the species. The most frequently used bat boxes are small and only suitable for crevice-dwelling bat species, These are rarely used as maternity roosts, nor used by species such as horseshoe bats which require larger flying areas . Large, carefully designed bat houses or boxes inside buildings can be constructed for maternity roosts and species that require larger flying areas. The design and positioning of access points can be particularly important in these constructions.

## 1.3 Access

Crevice dwelling bats crawl into their roosts via small gaps in the range of 15-20mm high. Roughened surfaces or landing areas allow better access. It is important to locate access points where they are unobstructed but close to sizeable vegetation and flight lines. This allows bats to emerge earlier and forage longer.

## 1.4 Other considerations

Bats are nocturnal creatures and adapted to low light conditions. Most bat species find artificial lighting to be very disturbing. Artificial light sources should not be directed onto bat boxes or flight paths.



© John Altringham

## 2.Types of bat boxes

Bat boxes come in many forms depending on their materials, function and location. In general, they can be divided into the following categories: external bat box, bat house, internal bat loft and integrated bat box. These can either be ready-made products available commercially or home-made.

### 2.1 External bat boxes – wooden

External bat boxes are usually located on trees or outside walls of buildings. The most common types of bat boxes are made from wood. Wooden bat boxes are usually cubic or wedge-shaped, with a grooved ‘bat ladder’ and a narrow entrance slit at the bottom. These will last for approximately ten years and can either be bought ready made, in kit form, or you can make your own from scratch (see ‘making a bat box’ below). They come in a variety of shapes but key requirements are:

- The wood should be rough sawn, for grip and untreated on the inside.
- To protect against moisture, air leaks and wood deterioration, apply one coat of primer to all outer surfaces, including vent openings, landings and entry areas. Follow that with two coats of flat exterior, water-based paint or stain. Do not use oil-based products. Consult Natural England’s guide for safe timber treatment products (TIN092).
- Bat boxes should be painted or stained black or dark in cool climates, using non-toxic coatings.
- Bats do not like draughts. The entrance slit should be no more than 15-20mm wide, and there should be no gaps where the sides and top join. A box that cannot be opened from the top is best, as it will have fewer gaps for draughts, and will lessen the chances of the bats being disturbed. (Bats may unintentionally be injured if the box is opened, for example by damaging their feet and legs. A special license is required in the UK to disturb bats and to handle them – see ‘monitoring bat boxes’ below)
- One of the most successful wooden bat boxes is the Kent bat box. These boxes are not available commercially but are very easy to make yourself (see description below).

## Making a bat box (Kent design)

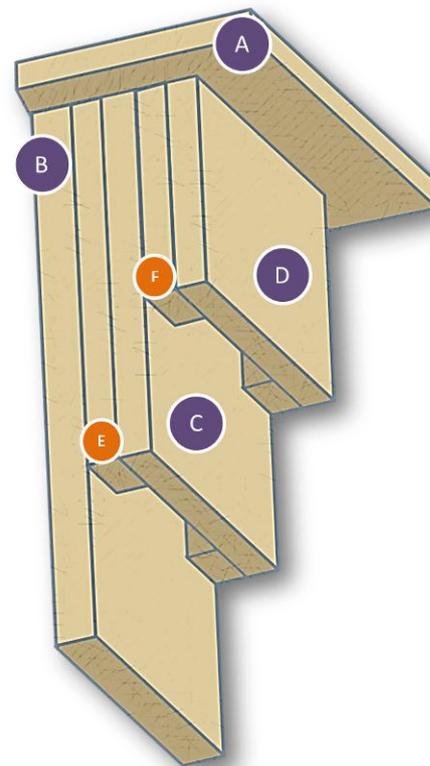
### Design and measurements

Simple to construct, self-cleaning and low maintenance, the Kent bat box is a great extra home for bats to hang out and rest on a hunting night out. These boxes won't be spacious enough to be used as maternity roosts but are a great way to encourage bats in your garden or your green space. The box should be rainproof and draught-free

The only critical measurement is the width of the crevices: between 15-25mm. Other measurements are approximate. Timber should be approximately 20mm thick.

Measurements for one Kent bat box kit would be as follows:

Part	Quantity	Size (mm)
Roof (A)	1	250 x 160 x 20
Back (B)	1	450 x 200 x 20
Centre (C)	1	330 x 200 x 20
Front (D)	1	210 x 200 x 20
Centre Rails (E)	2	330 x 20 x 20
Front Rails (F)	2	210 x 15 x 15
Stand-offs (optional)	2	200 x 20 x 20



### Material and Tools

This kit requires approximately 1.6m of rough wood and 25 screws (8 x 1 ½ inches) to assemble. You can rough it up by scraping with a suitable tool – possibly a saw blade or even a screwdriver but make sure you use untreated wood as some preservative chemicals can kill bats.

Pre-drill the holes to prevent the wood splitting. The hanging screws may either be at the edges of the front panel or in the side centre block (not in the rails!). Fixing may be by use of brackets, durable nylon cord or wires. Alternatively you can assemble your bat box kit with nails although they tend to be less robust than boxes made with screws.

## 2.2 External bat box – woodcrete



© Fiona Lockhurst

An alternative to wood are boxes made of woodcrete (a mixture of wood and concrete). They have the advantage of being more durable so will not need to be replaced. There are two basic types of woodcrete bat box:

- Cylindrical with an access hole in the front and designed to be hung on tree branches with a wire loop; or
- Brick-shaped, usually with narrow roosting crevices inside and an entry slit at the bottom, designed to be fixed to trees or flat surfaces such as walls of buildings.
- If possible, purchase boxes with an entrance slit along the bottom so that accumulated bat waste can drop out the box or be pushed out as bats emerge. Bat boxes with entrance holes in the middle will need to be cleaned regularly by a licensed worker (see 'monitoring bat boxes' below).

## 2.3 Bat houses and barns

It is possible to construct small, complete buildings designed to provide the optimum range of conditions for individual species or an assemblage of species. A 'bat house' refers to a scaled-up elaboration of the free-standing bat box design. In the UK, a 'bat barn' refers to a roofed, stone-built building with a wider floor-space. The main objective when constructing a dedicated bat house or barn is to provide the widest possible range of roosting opportunities and thermal conditions in one self-contained structure.

### Bat houses

Bat houses have been used with great success in the USA. Bat Conservation International (BCI) has developed criteria on successful design, including:

- Roost chambers must be a minimum of 500mm tall. Taller is better.
- The width (side to side) of roost chambers must be at least 350mm. Greater widths are preferred.
- Roost partitions must be carefully spaced 20mm to 25mm apart (front to back), regardless of the number of chambers. The best crevice size for most UK bats is 20mm.
- Bat houses must include a suitable landing area. Either a 75mm to 150mm landing area must extend below the entrance (by extending the length of the backboard) or partitions must be recessed three to six inches so bats can land on the inside walls of the bottom of the bat house.
- Interior surfaces and landing areas must have adequate texture to provide footholds for bats. Rough-cut wood may suffice or surfaces can be mechanically grooved, roughened or scored horizontally at 6mm to 12mm intervals, approximately 1.5mm deep. Roost surfaces can also be covered with a durable plastic mesh. Plastic mesh must be securely stapled every two inches (up, down and across) so it does not sag, buckle or curl. Mesh must not have sharp edges (trimming may be necessary). Metal mesh, hardware cloth or aluminium window screen is not acceptable, as these can injure bats.
- Screws, staples, nails, mounting hardware or other sharp objects (including splinters) must not protrude into roost chambers. All hardware and metal components must be exterior grade (coated, brass, galvanized, etc.). With few exceptions, all major components must be assembled with screws. Nails, brads or staples alone do not hold well over time. Any exposed metal edges (e.g. roofs) must be smooth.
- Any plywood used must be exterior grade. Boards should come from quality stock such as cedar or pine. Pressure-treated or chemically-treated wood must not be used, as they contain substances that may be harmful to bats.
- Bat houses must be durable and tightly constructed (no unplanned gaps). Caulking or gluing exterior joints (preferably during assembly) is required to prevent drafts. Latex caulk and exterior-grade, water-based paint or stain is recommended.

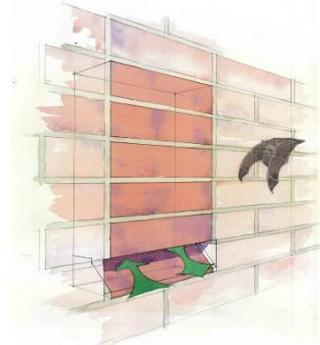
### Bat barns

The building should have a footprint of at least 5x4m and a minimum height of 5m (including a 2m roof-depth). The roof should pitch at around 42° and one side should face south (a more complicated variation might include a cross-gabled roof), the roof should be covered in a dark-coloured material (for example slates). Stone-built walls (incorporating cavity boxes and of course, access gaps) will promote thermal stability in winter and both these and the gable ends of the roof should be clad with tiles or rough-sawn overlapped boarding; further cladding, tiles and even boxes could be mounted to the interior wall surfaces. External lighting is to be avoided.

The future security of the building should be well planned, as it is likely to be a target for vandals and arsonists. Lastly, it should not be overlooked that such a building is likely to require planning permission.

## 2.4 Integrated bat boxes

Integral or integrated bat boxes can be built into the walls or masonry of built structures. The boxes can be embedded such that they do not impair the air-tightness of the building and so are commonly used in new build. Many designs are available including some that have bespoke facades that can match the building façade. The same rules for size and access apply.



Habitat, enhancing home for bat boxes. © Ecosurv

## 3. Putting up bat boxes

### 3.1 How many boxes?



© Daniel Fellman

Ideally, put up two or three boxes facing in different directions to provide a range of temperature conditions. For example, boxes facing from south-east to south-west allow the sun to fall on each box for part of the day. During very hot days a south-facing box may overheat, but the other boxes should have some shade during the day.

Two or three boxes will always be preferable to one, but a single box has a chance of being used, although this depends on the bat species that use the local area. Three boxes per tree can be arranged around the trunk of larger trees. This is especially desirable in larger coniferous plantations.

To increase the chance of it being used, locate the box at a site where bats are known to feed and that is sheltered from strong winds and exposed to the sun for part of the day. Most maternity roosts are located within a short distance to permanent fresh water, preferably a stream, pond, river or lake. Also, bat houses/boxes are more likely to succeed in areas where bats are frequently found in

buildings. Greatest bat-house success has been achieved in areas of diverse habitat, especially where there is a mixture of varied agricultural use and natural vegetation.

Bat boxes should be located close to a linear feature such as a tree line or hedgerow. Some bat species use these features for navigation between their roosting site and feeding grounds and to avoid flying in open and exposed areas. Ensure that branches or other items will not impede the bats' approach to the box – clear away underneath the box so the bats can land easily before crawling up into the box.

### 3.2 On trees

Most species will use higher positioned boxes (around 5m high), although long-eared bats may use a box 1.5m above the ground. If you are locating boxes in public areas, consider the risk of vandalism and of the box being accessible to cats. Place the box as high as it is safe to do. Consideration should be given to tree growth and boxes may need rehangng over time. Use headless or domed nails not

fully hammered home to allow the tree to push the box off without splitting, or strap the box to the tree. Iron nails can be used on trees with no commercial value. Copper nails can be used on conifers, but aluminium alloy nails are less likely to damage saws and chipping machinery.

### 3.3 On buildings

Placing the boxes high up by the eaves on a building will reduce the likelihood of the bats falling prey to cats or humans. As with trees, the aspect of the box should capture sun for part of the day.

Gazebos, garden walls and sheds have been suggested as sites for bat boxes. However, the main danger is that the boxes are not high enough above the ground and are too visible to predators.

### 3.4 On poles

Bat Conservation International (BCI) found that boxes on poles were more successful than bat boxes on buildings which were more successful than boxes on trees. However, they concluded that this is probably a function of the structure's ability to receive more sunlight.



© Sue Burchett

Single-chambered bat houses do not work well installed on poles. Since larger bat houses are more thermally stable, use only multi-chambered bat houses at least 350 mm wide and 600 mm tall on posts. All bat houses should be mounted at least 3 m above ground, and 5m to 7 m is better. Metal predator guards may be helpful, especially on wooden posts. Be sure to use a schedule-40 galvanized steel pole with the inside diameter 2" or greater or a 4"x6" treated wooden post.

## 4. Monitoring bat boxes

Making and putting up bat boxes is a great conservation action but what is even more useful is to know whether they are being used, when and by which species. Here are few tips on monitoring bat boxes.



© Daniel Fellman

Five pipistrelles in a Kent bat box

### 4.1 How long before bats will use the box?

Sometimes it may take several years for the bats to find the box. Be patient! It is highly unlikely bats will shift their roost from a well-used site to a newly positioned box and there may be plenty of other suitable roosting sites in the area. However other times bats will use the box within a few months.

### 4.2 How will I know if the box has been successful?

To check if the box is being used, look out for droppings, urine staining, listen for 'chattering' and watch the box for an hour either side of sunset to observe any bats leaving to feed.

### 4.3 Licensing

You can undertake the checks above without needing a licence. However, if the box needs to be opened to check it then there must be a suitably licensed bat worker present. Anyone wishing to undertake bat box checks should obtain training in bat handling and identification before applying for a licence.

All bats and their roosts are protected by law and it is an offence deliberately to disturb, handle or kill bats. The relevant legislation in England & Wales is the Wildlife and Countryside Act 1981 and Conservation of Habitats & Species Regulations 2010. In Scotland it is the Conservation (Natural Habitats, etc.) Regulations 1994 and in Northern Ireland the Conservation (Natural Habitats, etc.) Regulations (Northern Ireland) 1995.

## 5.A bed without breakfast?

Bats often use features such as hedgerows, tree lines and waterways as commuting pathways between roosts and foraging areas. This type of habitat also provides shelter, allowing insects to gather and therefore support foraging bats. The highest densities of bats occur where insects are most plentiful. Make sure you maintain or create good foraging habitats for bats by planting a wide range of plants such as flowers that vary not only in colour and fragrance, but also in shape for example. See BCT's 'Encouraging Bats' and 'Landscaping for Bats for more information (available from [www.bats.org.uk/publications](http://www.bats.org.uk/publications)).



### See also

- **B.3.b** - Building a Ken bat box instructions
- **B.3.d** - Monitoring bat boxes at Priory Country Park
- More resources in the 'Gardening for bats' (**B.4**) folder of the Resources Pack DVD

Photos and illustrations by the Bat Conservation Trust unless otherwise stated.