VOLUME 10 ENVIRONMENTAL DESIGN AND MANAGEMENT

SECTION 4 NATURE CONSERVATION

PART 2

HA 59/92

MITIGATING AGAINST EFFECTS ON BADGERS

SUMMARY

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

INSTRUCTIONS FOR USE

1. Remove HA 59/92 Amdt 1 from Volume 10, Section 1, Part 5.

2. Insert HA 59/92 Amdt 1, with new title page, into Volume 10, Section 4, Part 2.

3. Archive this sheet as appropriate.

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THE DEPARTMENT FOR REGIONAL DEVELOPMENT*

Mitigating Against Effects on Badgers

* A Government Department in Northern Ireland

Summary: This amendment includes revisions to Chapter 5.3.

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REGISTRATION OF AMENDMENTS

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VOLUME 10 ENVIRONMENTAL DESIGN

SECTION 1 THE GOOD ROADS GUIDE - NEW ROADS

PART 5

HA 59/92

AMENDMENT TO CHAPTER 5.3

MITIGATING AGAINST EFFECTS ON BADGERS

Contents

Chapter

1. INTRODUCTION

1.1 The badger (Meles meles) is one of the most protected species in the UK. Although this protection is mainly concerned with welfare and the prevention of cruelty, road deaths are one of the major causes of badger mortality. New or improved road schemes could adversely affect the long term viability of the species in particular areas, although as yet there is no indication that numbers nationally are at risk.

1.2 The general principles for mitigation described here may also be applied to other mammals, some of which have a higher priority in nature conservation terms, but may not necessarily be afforded the same level of protection. For each of these species different design criteria will need to be applied and advice in each instance should be sought from the appropriate statutory body on the measures to be taken.

1.3 Basic methods of mitigation and general principles can be applied to every situation involving badgers, but the implementation of protection must be specific to individual road schemes and tailored to suit the local conditions.

1.4 Badger mitigation is not solely concerned with the welfare of badgers. Whilst there is no recorded evidence that collision with badgers is a major cause of road traffic accidents, if free to wander across roads they may nevertheless pose considerable risk to road users.

1.5 It should be noted that all references to 'the (relevant) statutory bodies' apply equally to English Nature (EN), the Countryside Council for Wales (CCW), Scottish Natural Heritage (SNH) and the Northern Ireland Environmental Service: Countryside and Wildlife (ES:CW) unless otherwise stated.

2. KEY ISSUES

- Competent assessment work is critical to the success of badger mitigation.
- Taking account of badgers early in the design process will enable alignments which avoid badger setts to be chosen. This will avoid the need for complex sett evacuation and relocation exercises during the construction phase.
- No fencing will be totally badger-proof. Good implementation is essential to success. Any weak spot in fencing will be utilised and negate the efficacy of other measures.
- Fencing must be properly maintained to ensure long term efficacy.
- Badgers do not recognise scheme boundaries.
- Artificial setts and translocation are not easy options. Other solutions should be exhausted before these methods are utilised.
- All badger work should be undertaken or supervised by persons with suitable expertise.
- All badger work should be in place and complete before a new scheme is open to traffic.

3. PROTECTION STATUS

3.1 Badgers and their habitat are afforded protection on the domestic level through the Protection of Badgers Act 1992. They are also included on Schedule 6 of the Wildlife and Countryside Act 1981, and Appendix III of the Bern Convention. There is no separate Badger Act in Northern Ireland, but the badger is included on Schedules 5, 6 and 7 of the Wildlife (Northern Ireland) Order 1985. A brief description of this legislation is given in Annex A to this chapter. It must be stressed that these descriptions are summaries only. The Acts themselves should always be referred to for the exact wording.

3.2 Although the Crown is not bound by the provisions of these Acts, 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 English Nature (or the equivalent statutory body) must be consulted and their agreement sought before any action is taken which, under normal circumstances, would be subject to a licence**. Example letters to be used for this purpose are included in Annex B to this chapter. There may also be instances where referral for licences should be made to the Ministry of Agriculture Fisheries and Food (see 13).

4. GENERAL CHARACTERISTICS

Numbers and Distribution

4.1 Badgers are generally common and widespread throughout the British Isles. Recent surveys estimate that there are around 250,000 adult badgers in mainland Britain and that the population has appeared to remain stable over the past few years, although local variations have occurred. Distribution is not uniform. They are less common in upland areas, East Anglia and Northern England, and least common in central and western Scotland. In some areas there is an abundance of badgers, notably South and South West England and South Wales. The overall mean national density is 1.08 badgers/Km^2 although in some areas far higher densities have been recorded: 20 badgers/km^2 in the Cotswold escarpment.

4.2 In Ireland, comparable numbers occur to those in mainland Britain. Distribution is generally even throughout the Republic and the North, averaging around 3.62 badgers/km^2 with the greatest density found in County Down.

Social Behaviour and Reproduction

4.3 Most badgers live in social groups consisting on average of around 5 to 6 adults. In areas where badgers are rare, pairs or single badgers may be encountered. Most social groups produce only one litter of young per year; some produce none; while larger groups may produce 2 or 3. Badgers therefore do not breed rapidly and a local increase in mortality can adversely affect populations in both the short and longer term.

4.4 Litter size is variable, but the average is 2.9 cubs. It is estimated that on average 175,000 cubs are born in Britain each year, with around 40% surviving to adulthood.

4.5 Equal numbers of male and female cubs are usually produced, but male mortality is generally higher resulting in greater numbers of females in the adult population (see 6). Mating can occur throughout the year, with peak activity during the spring, but due to a process called 'delayed implantation' litters are not produced until the following year. The peak period for birth is February but cubs can be born between December and July. The majority of cubs are born by early April.

5. HABITAT

5.1 Badgers live in underground complexes made up of tunnels and chambers known as setts. Each social group will have its own territory, within which there may be several setts which vary in both status and usage. The different types of sett may be summarised as follows (not all territories will contain an example of each of these sett types).

Main Setts

5.2 Each territory will usually contain one main sett. This will be the largest and most often inhabited structure normally used for breeding. Most main setts are easily identifiable by the presence of several holes (3 - 10 on average) and large spoil heaps. Well established paths will usually be in evidence both to and from the sett and between the different holes. The size of the main sett is extremely variable and it can often be of quite considerable age.

Annexe Setts

5.3 These are always found close to the main sett, usually less than 150m away, and are connected to it by one or more well established and obvious paths. They generally consist of several holes, but are not necessarily in use all of the time, even if the main sett is very active. They will generally be inhabited if the main sett has suffered from subsidence or interference. They may also be utilised by sows during the breeding season if more than one sow within a group is producing a litter.

5.4 Where a group is large, annexe setts may also be occupied by units of the group which have left the main sett, but occupy the same territory. Annexe setts are not found within every territory, but are common in areas of high badger density.

Subsidiary Setts

5.5 These will often have only a few holes and are usually at least 50m from a main sett. There will often be no obvious path connecting to another sett and they are not continuously active.

Outlying Setts

5.6 These are small structures usually having only one or two holes. There is often little spoil outside the holes, no obvious path connecting them with another sett, and they are used only sporadically, mainly as 'resting up' refuges. They will often be inhabited by foxes and/or rabbits when not used by badgers, but can still be recognised as badger setts by the shape of the tunnel which will usually be at least 250mm in diameter and rounded or flattened oval in shape.

Territory

5.7 Badger territory size ranges from about 25 - 150 hectares with an average of around 60 hectares. Size will, to a degree, depend on available food sources and badger density in the region. In areas where badgers are common, smaller territories will be the norm. Territories are often generally distinct with little overlap between neighbouring territories, except in urban situations or where badgers are at low density and markedly less territorial. However, as a general rule it is estimated that territories will seldom extend beyond a 1km radius from the main sett.

5.8 Each territory will usually comprise a number of different habitat types which will provide different food sources at different times of the year. The preferred diet is earthworms and the most productive foraging habitat is short grassland. Because of the seasonal variations in territorial marking, **the timing of badger surveys to establish territorial boundaries is crucial to the accurate and reliable delineation of these boundaries, and so to the determination of the likely effect of a road development** (see DMRB 11.3.4, Chapter 7).

5.9 Each territory will be criss-crossed with a series of pathways which link different setts together, provide access to foraging areas, and can mark the boundaries of the territory. There may also be a boundary path running round the perimeter of the territory. Where a territory is undisturbed over several generations, these paths will be constantly maintained. Even where a territory has been disturbed, it is generally accepted that badgers will try to utilise these pathways despite any obstacles that have been introduced or other dangers that may be present. When startled or threatened, a badger will follow a path to the nearest available refuge, even if this means a longer journey than a direct cross-country route.

5.10 Historically, badger paths may have developed from pre-existing linear features within territories, eg hedgerows, and it is therefore not unusual for boundary

paths to run alongside roads. Indeed the roadside can provide valuable foraging areas.

Dungpits

5.11 These are specially dug holes about 150mm by 150mm by 150mm deep in which badgers leave their rather loose droppings. Each pit is used more than once and is not backfilled with soil but left open as an odorous noticeboard generally to indicate to badgers from a neighbouring social group that they have reached a territorial boundary. Dung pits are often clustered together to form a 'latrine'. Although these are found most frequently on the territorial boundaries, they also occur near good feeding sites and close to setts.

6. MORTALITY

6.1 Adult badgers have no natural predators in Britain. Although the UK badger population can be described as 'approximately' stable, there is evidence that in certain areas numbers have declined through a combination of habitat change and loss, illegal persecution and road traffic mortality (see 8). Current estimates are that around 50,000 badgers are killed each year on the UK road network. In addition, for every lactating sow killed there may be further mortalities of dependent cubs underground. Similar casualty rates have also been estimated across Europe, and it is likely from comparison with data from other European states that road traffic mortality may be important at both the local and metapopulation level in determining badger population viabilities in areas where badgers are at moderate to low density.

6.2 Seasonal patterns of road mortality have also been identified, with peaks in casualties occurring as a result of variations in badger activity, during spring, mid-summer and autumn. The most obvious peak - during spring - is due to a general increase in activity and range expansion by sexually active males.

6.3 The majority of badger road casualties obviously occur on the older road network. Unprotected new roads (especially widened existing roads) which sever badger territories can however be devastating to a social group. **By implementing sound mitigation measures on new and improved roads, these should be safer for badgers than the majority of the existing network.**

7. BADGER SURVEYS

7.1 Where a new or improved trunk road or motorway is likely to affect badgers, survey work should be undertaken in accordance with the advice given in **DMRB Volume 11: Environmental Assessment**. It is essential that the Stage 2 and 3 assessments (see DMRB Volume 11, Section 2, Part 1, Chapter 2; and Section 3, Part 4, Chapter 7) are undertaken by people with sufficient relevant expertise in badger issues. The local Wildlife Trust or Badger Group will often be able to provide up to date data on badger territories, sett locations and badger road casualties. Alternatively, the Mammal Society have records of most identified badger setts. Useful contact addresses are given at Annex F.

7.2 The land-take of most new roads is unlikely to constitute a significant proportion of any one badger group's territory. The most important potential impacts involve fragmentation of their territories and direct loss of setts. Surveys as part of the environmental assessment process should therefore focus on these issues, highlighting in particular where setts may be affected and where badgers are likely to cross the new road.

7.3 A corridor of approximately 500m (ie 250m either side of the centreline of the road) is usually sufficient, widened to 1km as necessary to locate nearby setts or other features of importance. The status and activity of each sett within the corridor should be assessed along with the most well-used badger paths which cross the route line.

7.4 It is occasionally necessary to widen the survey area considerably in order to properly determine the status of setts (by locating other neighbouring setts). This should be done at a later stage, when it has been confirmed that the sett in question would be affected by construction. It may also be necessary to undertake a bait-marking exercise at this stage, and also to determine the status and 'ownership' of setts that would be directly affected. A more extensive bait-marking survey, to delineate territory boundaries, is rarely necessary for a road development.

7.5 The technique of bait-marking involves feeding badgers with bait laced with plastic pellets which are indigestible but harmless, and relies on the badgers' characteristic behaviour in marking their territory boundaries with dung-pits. Bait-marking to determine territory boundaries is usually only effective between mid February and late April, and mid September and early October; the times when badgers increase their marking activity. Badgers also use dung-pits close to their setts, and these are used more regularly. Setts may be difficult to detect in the summer months due to vegetation cover. Surveys are therefore best carried out during early spring or autumn.

7.6 The line of the new road, other areas such as contractors' compounds, etc and, in particular, those setts that would be affected during construction, should be re-surveyed immediately prior to construction to update the original survey and adjust the proposed mitigation as necessary.

7.7 Specialist badger reports produced as part of the environmental assessment should not be made publicly available in a form that would allow sett locations to be identified. Requests for such information should not be met, except where the request originates from a person or organisation with a legitimate interest in badgers.

8. POSSIBLE EFFECTS ON BADGERS

8.1 The construction and use of roads can affect badgers in several ways. A sett may lie in the way of construction, the road may cause severance of the badger territory, or construction work may cause disturbance to badgers in the vicinity of the works. **In all cases mitigation strategies should be developed that are specific to the individual circumstances and preferably developed by a recognised badger consultant.**

Severance

8.2 Where the line of a new or improved road crosses some part of a badger territory, it is inevitable that badgers will attempt to cross the surface of the road. In these circumstances it is essential that the badgers are deterred from crossing at uncontrolled points and are steered towards suitable crossing points (see 9).

8.3 Allowing severance by using fencing solely as an exclusion method serves no useful purpose either from an animal welfare or conservation viewpoint. Disruption of a badger territory - even the loss of a small proportion - may cause disproportional disruption to the group directly affected.

8.4 Badgers are aggressive animals and males in particular will tend to fight with badgers from other groups (especially other males) which enter their territory. Genetic variance is achieved by cuckoldry (males mating with females from adjacent groups) and natural dispersion. There is no evidence that forcing a social group to integrate with adjacent groups through the deliberate severance of part of their territory can be beneficial in this way.

8.5 In some cases, where on-line widening is the preferred option, the existing road may already form the boundary of a badger territory. It is therefore unlikely that badgers will attempt to cross the improved road but they may attempt to gain access to the verge. However, the embankments of many roads are marked by aggregations of dung pits which often give the appearance of territorial boundaries. In practice though, the same group of badgers will often use both sides of the road.

Sett Loss

8.6 By identifying badger setts at the earliest stages of scheme design, an alignment can be chosen to avoid direct sett loss. However, where other constraints also have to be considered, road construction may unavoidably involve the direct loss of one or more of the different sett types described above. The mitigation strategy to be adopted will vary in each individual circumstance, depending on such factors as type and number of setts to be lost, size of the territory affected, and size of the clan. **In all cases where the sett is occupied or shows signs of current use, the methodology for evacuation and mitigation must be agreed with English Nature (or equivalent).**

Other Effects

8.7 Whilst not directly affecting a sett, the process of construction of the road can nevertheless cause disruption to badgers, as can maintenance operations once the road is open to traffic (see 11 and 12, respectively).

9. MITIGATION MEASURES

Fencing, Tunnels, Underpasses and Overbridges

9.1 The only proven method for deterring badgers from crossing a road is the use of badger fencing, although it must be stressed that no fencing suitable for highway use can truly be described as badger proof. **Fencing will only be effective as a deterrent if it is used to direct badgers to a suitable crossing point**. In the past, a variety of fencing specifications have been used on road schemes often with little success: 'chicken wire' and lightweight stock netting can easily be dug under and can be physically broken by badgers, and rectangular mesh stockproof fencing can be climbed by badgers, which they will do if there is no suitable crossing point near.

9.2 Experience has shown that the most effective specification is for chain link or welded mesh fencing attached to wooden post and rail fences using heavy duty staples. As a minimum standard, this should be at least 1m high above ground with a lower section of 600mm buried below ground; 300mm down into the soil and a further 300mm turned away from the fence in the direction from which badgers will approach. Where the fencing is to be placed on undulating ground, or where it is not possible to provide crossing points close to pre-existing pathways, it may be necessary to provide fencing buried to depths of up to 500mm with an equal length turned outwards (see Annex C).

9.3 Any gap or potential weak spot in the fencing may negate the entire package of protective measures. For this reason it is of particular importance that where the fencing crosses difficult features - for example undulating ground or streams - it is installed under the supervision of a suitably experienced person. Gaps must be avoided where the fencing abuts other features such as hedgebanks, footbridges, gates or stiles.

9.4 Similarly, problems have arisen in the past on trunk road schemes where it has not been possible to provide the full required length of fencing because landowners have been unwilling to allow badger netting to be included as part of accommodation works, or have failed to properly maintain this aspect of the accommodation works. Where this has happened the remaining lengths of badger fencing have proved inadequate. If it has been decided that badger fencing (or other specialised wildlife fencing) should be provided, then ownership of the badger fencing, and the maintenance responsibility, should remain with the highway authority promoting the scheme.

9.5 On trunk roads, the fenceline will normally mark the land ownership boundary. If netting is attached and turned out under the ground, it will obviously encroach onto adjacent land. Many landowners may be willing to allow this encroachment, and it is worth seeking their approval to this course of action. Where permission is not given, the fenceline should be installed within the highway boundary a sufficient distance to allow the turned netting to remain on highway land. Adjacent landowners should be informed that the fenceline does not mark the extent of land ownership.

9.6 Underpasses suitable for badgers have been developed over a number of years, and if correctly sited on or near to an existing badger path, are proven to be effective. Studies have also shown that badgers are fairly adaptable and will readily utilise a variety of different crossing structures including overbridges, culverts, agricultural bridges, and underpasses, provided that they are forced/encouraged to do so through the use of appropriate fencing. However, crossings that are heavily used by pedestrians are unlikely to be used because of human scent.

9.7 Where specialised tunnels are to be used, these should be constructed of Class M 600mm diameter concrete pipes - widened at the entrances if possible. Where headwalls are required, the precise design will not alter the effectiveness of the tunnel. Crossings will be more readily used if the approaches are 'softened' through the use of appropriate planting. Badgers may also be encouraged to use new tunnels by laying syrup or peanuts at the tunnel entrance or by laying scent trails using bedding or dung produced by the relevant social group.

9.8 In some (if not most) cases, crossings will be needed for more than one species. It is sensible to adopt an integrated approach under these circumstances. For example, it is possible to combine the needs of badgers and amphibians. A culvert can be adapted to provide a dry run and in certain circumstances the provision of a Class H 1050mm diameter concrete pipe may be appropriate. The use of plastic pipes is not recommended although in some cases plastic culverts over natural ground may be an effective alternative to concrete pipes.

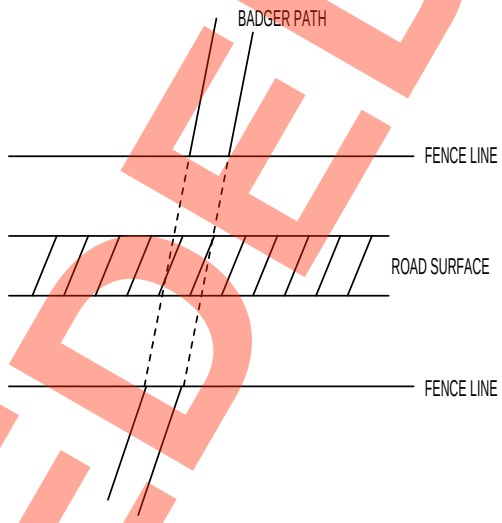
9.9 In the past, the provision of underpasses under roads in cuttings has been rejected as an expensive and difficult solution. Where the length of road in cutting is relatively short, and a suitable crossing point can be provided at the end of the cutting, rejection of an underpass under the cutting may not be critical. However, where extensive lengths of cutting are encountered (and a badger would need to make a detour in excess of 500m to cross the road), the resulting severance could be severely detrimental to the long term survival of the social group concerned. Viable options are now available which involve siting the tunnel at the highest point of the cutting and the best design to allow through passage of air. To avoid problems of interference with highway drainage systems, advice should always be sought from a drainage engineer on the design of the badger tunnel. In all cases a design solution should be adopted that will prevent the tunnel from becoming waterlogged.

9.10 Diagrammatic specifications for tunnels, fencing, etc are given in Annex C. Illustrative examples of good and bad practice are given in Annex D.

Siting and Arrangement of Measures

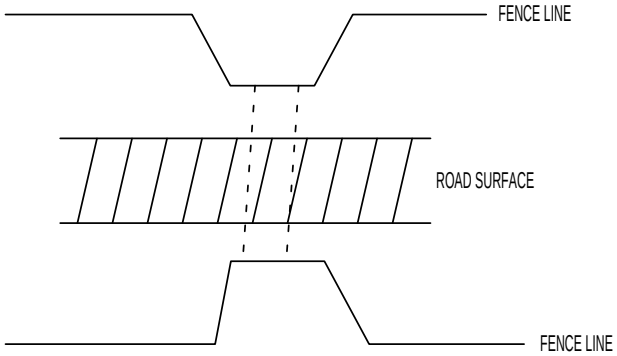
9.11 Siting of badger crossings is crucial to their success. It is obviously preferable if a crossing can be sited on or as near as possible to the site of the original badger path. Where several badger paths cross the line of a new road, it may not be possible to provide a crossing point for each path. The number provided will, to an extent, depend upon the size of the territory, amount and nature of the territory severed, and the size of the resident social group. As a general rule, it is recommended that at least two crossings are provided per social group. Where it is necessary to site these away from an existing path, every effort should be made to minimise the length of detour required, preferably to no more than 250m (see Figures 9.4 and 9.5).

9.12 Badger fencing is required at either side of the crossing point (preferably to a distance of 500m each side) and on **both sides of the road**. If used asymmetrically, badger fencing can have a negative effect in forcing badgers on the wrong side of the fencing back onto the carriageway. Substantially shorter lengths of badger fencing at each side of tunnel entrances may be acceptable if the tunnel is located on the exact line of the pre-existing badger path, and the fencing is arranged in the manner described in Figures 9.1 and 9.2 (see also Annex D).



Tunnel entrances lie flush to fenceline. May be missed by badgers.

Figure 9.1

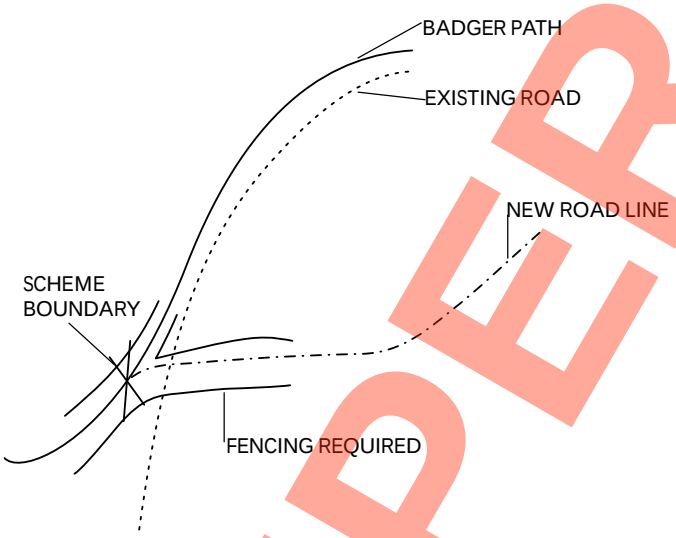


Tunnel entrances in recess along fenceline. Badgers are guided to them.

Figure 9.2

9.13 Fencing perpendicular to the crossing point will inevitably be ineffective unless the crossing is sited exactly on the badger path. The fencing must be used to guide badgers to the crossing, which means that it should provide an angled approach or form a recess leading up to the crossing. The exact angle of approach is not critical, but where a recess is formed this should not be so deep and narrow that badgers can pass it by without realising it is there. Similarly, it is useless to provide a tunnel if this emerges into a field at some distance from the fenceline, as the badgers will simply not associate it with a means of crossing the road. (See photographs at Annex D.)

9.14 It must be remembered that badgers do not recognise scheme boundaries, and that in some cases it may be necessary to provide fencing which extends beyond the scheme limits, particularly where an existing badger path is close to the extremties of a scheme. Fencing the entire length of the scheme may prove totally ineffective if the badgers can access the carriageway by moving a short distance onto an adjacent stretch of road (see Figure 9.3).



scheme limit ineffective as badgers will simply walk around the end of the fenceline. Fencing must continue along line of existing road to prevent this.

Figure 9.3

Badger Gates

9.15 Badger gates have been used in a variety of ways as part of badger mitigation strategies. Their use is not always successful. There is no evidence that one-way badger gates can be used in lengths of fencing to provide escape routes for badgers caught on the wrong side of the fence. Badgers will either not know that the gate exists or through persistence by badgers or decay of the gate they can soon become two-way gates thus producing a 'weak spot' in the badger fencing, allowing access onto the road.

Gates at Tunnel Entrances

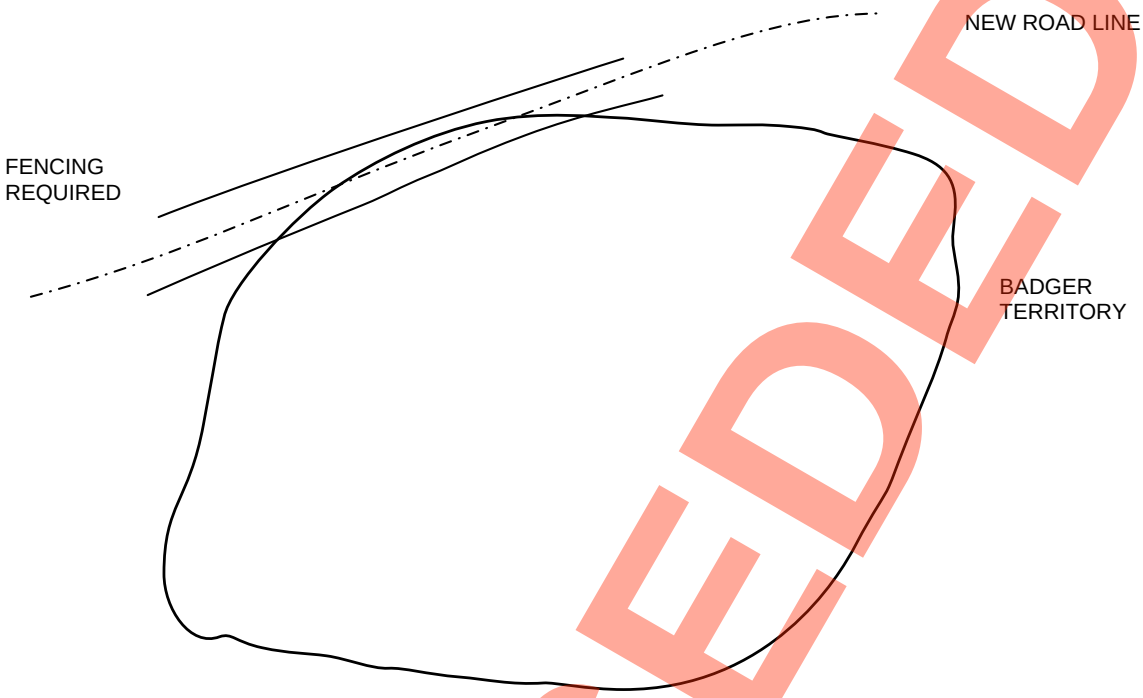
9.16 It can be difficult to persuade badgers to use tunnels, and gates at tunnel entrances may act as a further disincentive, so they should be omitted wherever possible. Badger gates are not something that badgers recognise as a facility designed just for them and are rarely useful except where badgers are being excluded from setts. Faced with an apparently solid wooden obstacle, they will often try to penetrate the wire mesh of the fence on either side rather than utilise the gate itself. A design with a mesh window (see drawing at Annex C) is the preferred option where a gate is considered essential. It is worth noting that livestock does not normally penetrate stockproof fencing by using natural badger routeways. It may be better, therefore, to try to replicate typical badger runs at the tunnel entrances instead of using gates.

Access Gates in Badger Fencing

9.17 Where it is necessary to provide an access gate in a length of badger fencing, care should be taken to ensure that a weak spot is not created. It is obviously not possible to bury and turn netting attached to the gate, and to prevent badgers from digging under at this point, a 4 inch concrete sill should be provided between the gate posts. Chain link fencing should be attached to each side of the gate to ensure no gap exists at ground level (see illustrations at Annex D). Similar principles apply to any feature along the line of fencing which may create a 'weak spot', eg inspection chambers for drainage, stiles, etc.

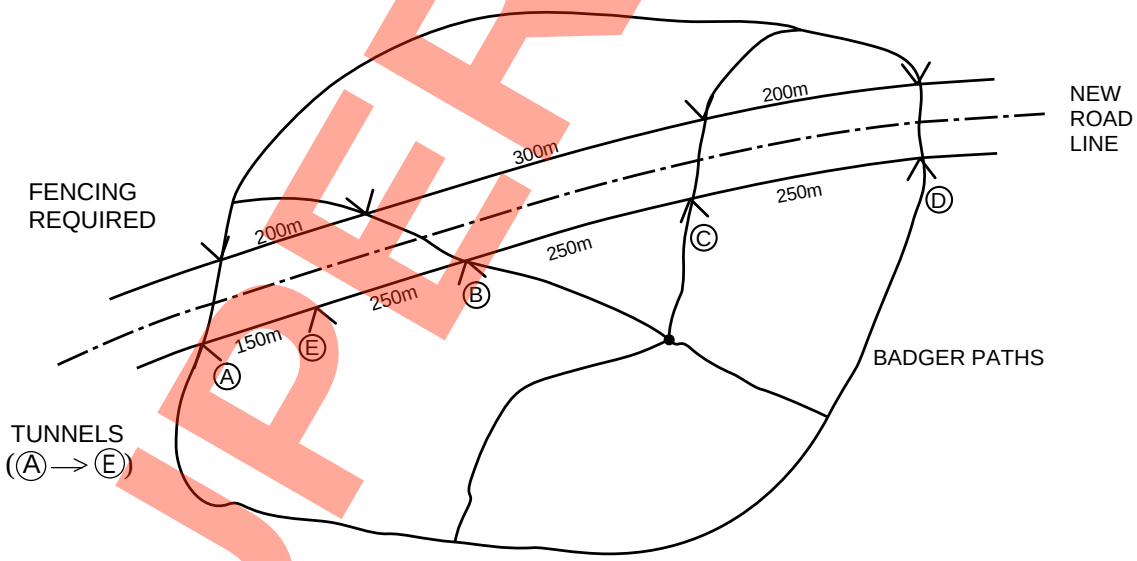
Reflectors

9.18 Wildlife reflectors have been widely used throughout the UK, Europe and the United States of America as a means of preventing road accidents involving deer. To date, their use as a deterrent for badgers remains unproven. As a result, they should not be relied upon as an alternative to the provision of fencing and tunnels.



Road runs along/just clips badger territory.
Fencing is still required but crossing points are not essential.

Figure 9.4



Ideally tunnels should be provided at every well used badger path that is severed by the road (points A, B, C and D).

Where this is not possible, at least two crossing points should be provided at locations that do not require excessive detours by badgers (points C and E, for example).

Figure 9.5

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10. SETT DESTRUCTION AND BADGER RELOCATION

10.1 Although it is preferable to choose a route alignment which avoids direct loss of a sett, instances will occur where a badger sett lies on the route of a proposed road scheme. Unless a sett can be proved to have collapsed or fallen into disrepair through natural causes, or that it has remained unoccupied by badgers for a period of twelve months, it should be assumed that it is in current use (see Annex A).

10.2 **In all cases where a sett needs to be destroyed, advice should be sought from English Nature (or equivalent), and the methodology for eviction prior to the works must be agreed with them (see 3.2).**

10.3 Badger use of some of the setts within their territory is usually seasonal (see 5), and where the assessment work has been completed some time before the proposed works it will be necessary to update the survey work to establish occupation of a sett. This will ensure that badgers who have taken up residence in a previously disused sett are not harmed and also avoid abortive costs where a previously occupied sett has fallen into disuse. It may also be necessary, where a main sett is affected, to determine the size and extent of the sett. There is no proven methodology at present for doing this, although some success has been reported using soil resistivity techniques developed for archaeological investigations. New ground probing radar techniques have also been used with some success by ADAS.

10.4 Before any exclusion work takes place, it is important that sufficient alternative shelter is available to badgers within their existing territory. For example, if a main sett is to be destroyed there needs to be one or more suitable annexe setts or large subsidiaries available that are sufficiently remote from the road scheme. Consideration should be given to possible seasonal effects, eg waterlogging, before it is assumed that such alternatives are viable.

10.5 Where no sufficient alternative shelter is available, it may be necessary to construct an artificial sett in a suitable safe location (see 10.12). If this is necessary, the artificial sett should be constructed, wherever possible, a minimum of six months prior to exclusion from the main sett to allow badgers time to become aware of its existence.

10.6 Occupation of any alternative sett can be encouraged by providing suitable bedding at the entrances and supplementary feeding at the site.

10.7 The exclusion methods to be used will in each instance be particular to the circumstances of the sett. Exclusion is best achieved by a combination of electric fencing and badger gates, with the fence erected carefully around the sett to ensure no gaps and the badger gates positioned on every well-used path leading to and from the sett area. The gates should be kept open, then allowed to swing freely, then set in a one-way position to effect exclusion. Activity at the sett should be carefully monitored and an appropriate period must have elapsed during which no badgers emerge from the sett (this will vary with the season and site-specific considerations) before it is considered empty. Under certain circumstances, eg where the topography is particularly problematic or human interference is likely, gates over the entrance holes themselves or a permanent exclusion fence may be the only options. However, in each case the basic process of exclusion is the same.

10.8 The use of chemical repellents of any description is no longer an approved method of exclusion and may be illegal under the Control of Pesticides Regulations 1986. **Any proposals to solely utilise these methods should be rejected.** Renardine may be used as a repellent to reduce the use of sett entrances, but only as a back-up to reinforce the effectiveness of other exclusion methods.

10.9 Once it is known that all badgers have been excluded from a sett and the appropriate time period has elapsed, a sett may be destroyed. A suitable expert (ie an individual to whom a licence would be issued) must be present for this operation. Great care must be taken when destroying a sett in case any badgers have remained undetected.

10.10 There are limits to what may be safely achieved, particularly on steeply sloping ground or where a sett is constructed on several levels. In extensive setts it is rarely possible to destroy the deepest parts, but by making the top layer (to a depth of around 2 metres) too loose to support a tunnel system, if re-excavated by badgers in the short term, then, once all entrances have been dealt with, the sett can be declared effectively destroyed.

10.11 While sett destruction can only be carried out between 1 July and 1 December (in exceptional circumstances, English Nature or equivalent may relax this rule), every effort should be made to begin engineering work as soon as possible thereafter to prevent badgers attempting to re-occupy the sett.

Artificial Setts

10.12 Building artificial setts is not an easy solution to be adopted every time a badger sett needs to be destroyed. Landowners may be unwilling to allow construction of an artificial sett on their land and it will usually be difficult to justify the Compulsory Purchase of one particular plot of land for this purpose. Their use should therefore be the exception rather than the rule. Artificial setts should also not be considered to be permanent features. It is far more likely that their use will be temporary and that the badgers will find a suitable site within the territory where they will excavate their own sett. Exceptional situations, where artificial setts have continued to be used as main setts several years after their provision, have however been recorded.

10.13 Therefore in most, **but not every**, situation simple artificial setts are to be preferred to more expensive and complex structures, which may only have a very limited use. Advice on artificial setts is available in the publication 'The Guide to Artificial Badger Setts' available from the National Federation of Badger Groups (see Annex E and F).

Translocation

10.14 For many species affected by road development, translocation can often be used as an effective method of mitigation. With badgers however, translocation is an extremely expensive and time consuming operation with only a limited chance of success. Badger translocation should therefore only be considered as a last resort where no alternative setts are available and it is not possible to provide an artificial sett.

10.15 Advice from, and the agreement of, English Nature or equivalent must be sought before any translocation is attempted. Clearance from MAFF must also be sought to ensure that there is no risk of spreading Bovine TB.

11. DISRUPTION DURING CONSTRUCTION

11.1 The physical presence of a road and its use can have long-lasting effects on local badger populations. But the construction or improvement of the road itself can also have substantial effects on badgers if no mitigation measures are taken. Noise, dust, lighting for night working, equipment or spoil blocking sett entrances and/or pathways, excavation work, and the presence of large numbers of human beings can all have an impact.

11.2 Wherever possible, site compounds should be located away from badger setts or badger paths. Where a scheme has been constructed in stages, each subject to separate contracts, it is essential that contractors are made aware of mitigation measures installed on the previous contracts so that disruption/damage to them can be avoided. For example, it is senseless to install tunnels on one section of road if, during construction of the next section, access to this tunnel is blocked by fencing or stored materials. Under these circumstances it is likely that the badgers will be dissuaded from using the tunnel in the longer term.

11.3 For similar reasons, the siting of on-site and off-site borrow pits, surplus soil tips, and other storage areas should be carefully considered so as to avoid prime foraging areas. Many road verges can be important foraging areas - particularly so where a social group has a small territory.

11.4 Badger survey work, when undertaken by a competent person, should identify all setts likely to be affected by construction. But, on occasions, an active sett may be discovered during the course of construction. If a suspected badger sett is discovered, advice should be sought immediately from a suitably experienced person on whether it is indeed a badger sett, and if so, whether it is occupied.

11.5 If a sett is found to be occupied, English Nature or equivalent should be informed and asked to agree to a 'Sett Evacuation Plan' as a matter of priority (see 3.2). **If this happens between 1 December and 30 June it may be necessary to wait until 1 July before undertaking this course of action**. In the meantime, the Contractors should be issued with a variation to the contract to preclude any activity which would cause damage or disturbance to the sett. It would usually be necessary to erect suitable fencing around excluded areas to emphasise the importance of this. (Plastic tape should not be used since the noise made in windy conditions can be disturbing to badgers). It should be made clear to contractors that, following the issue of an instruction to avoid damage to a sett, any action contravening this instruction would be illegal and that the incident will be reported to the Police.

11.6 To ensure that accidents do not occur to setts, it is important that there is a transfer of information between construction personnel at all levels.

12. BADGERS AND MAINTENANCE OPERATIONS

12.1 Under the terms of the Badgers Act 1992, English Nature consider that:

- all work (above and below ground) within 10m of a sett entrance, whether involving the use of machinery or of hand-held tools requires a licence;

- all work between 10m and 20m from a sett entrance will require a licence if heavy machinery or earth moving equipment is to be used, or if the work involves anything other than the movement of light occasional traffic within that zone;

- beyond 20m, work which involves pile driving, rock boring, dynamic compaction, or the use of explosives will be licensable. In some cases this will include operations in excess of 100m from the sett entrance.

12.2 All sett entrances, whether there is evidence of use or not, are included in the determination of these distances.

12.3 Where maintenance or management operations on the highway meet any of these criteria, advice should be sought from English Nature on the working practices to be utilised.

12.4 Where an operation is required for emergency safety reasons it may not be possible to seek English Nature's view before commencing work. In these circumstances, every effort should be made to avoid direct or prolonged interference with a sett.

Maintenance of Fencing

12.5 For badger protection to remain effective, it is essential that fencing is properly maintained. Regular checks should be made, especially during the first two years when badgers will be adjusting to new pathways and crossing points, to ensure that the fencing has not been vandalised or damaged to the extent that badgers can gain access to the carriageway. Where badger casualties are noticed in previously unaffected areas, a thorough check should be made of the fencing in the vicinity.

Maintenance of Tunnels

12.6 Periodic checks should be made of tunnel entrances, especially in the first two years, to ensure they are not blocked by debris (or deliberately blocked), and that the entrances do not become waterlogged.

13. EXISTING ROADS

Badgers as pests

13.1 In rare circumstances badgers may be the cause of structural damage to roads as a result of undermining. In these circumstances MAFF, who are the licensing authority, should be informed before any remedial action is taken.

13.2 The presence of a badger sett on a road verge should not, of itself, be assumed to present a risk of undermining. Several badger setts may be found alongside existing trunk roads and motorways which do not cause any potential problems. If remedial action is required, agreement with MAFF should be sought as to the methods employed (see 3.2).

14. CONTRACT IMPLEMENTATION

14.1 Ideally, badger mitigation measures should be installed by experienced contractors familiar with this work. It is essential that badger mitigation is properly implemented since any weakness will be exploited by badgers rendering the whole assembly of measures worthless. Where specialist contractors are not used, contract supervision by a person with experience of badger work is vital.

14.2 Some of the common faults in the implementation of badger mitigation are: fencing not buried to sufficient depth, fencing not provided to an adequate height, gaps left in fencing, or areas earmarked for fencing not fenced, tunnel entrances blocked either by badger fencing or other stockproof fencing applied afterwards. It is imperative that the mitigation is checked for all of these faults before the road is open to traffic. It may be necessary to stipulate in contracts that the Certificate of Completion will not be issued until badger measures are in place in a satisfactory manner.

14.3 Similarly, other features implemented on the scheme should also be checked to ensure that they do not interfere with the badger measures. Where tunnels exit into blocks of tree planting which are enclosed by rabbit fencing to prevent damage to the trees, badger gates should be included in the rabbit fencing (see 9.17). Care should be taken to ensure that each badger tunnel entrance is strategically placed (see 9.11) and that the passage through the badger gates is obvious. Placing these on an existing badger path, or at a point where a field boundary crosses the rabbit proof fencing, will help badgers to locate the gates and use them as a way through the fencing.

The Golden Rule

14.4 ALL BADGER MITIGATION MUST BE IN PLACE AND COMPLETED BEFORE THE ROAD IS OPENED TO TRAFFIC.

15. ACKNOWLEDGEMENTS

15.1 The following photographs and drawings have been used by permission:

Badger Gate Drawing Annex C -
courtesy of Dr Penny Cresswell-Lewns, the Badger Consultancy.

Photographs in Annex D3, D4, D5(a), D6(a), and D7 -
courtesy of Paul Skinner, the Chalkhills Badger Group.

Photographs in Annex D5(b), D6(b), and D8 -
courtesy of Michelle Vaughan.

16. ENQUIRIES

Approval of this document for publication is given by the undersigned:

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All technical enquiries or comments on this document should be sent in writing as appropriate to the above.

ANNEX A

SUMMARY OF LEGISLATION

Protection of Badgers Act 1992:

A1 Under this Act it is illegal to:

- wilfully kill, injure or take any badger or attempt to do any of these things;
- cruelly ill-treat badgers, dig for any badger or use badger tongs in the course of killing or taking badgers or attempting to do so;
- have in your possession any dead badger or any part of one or an object derived from one, if that badger was taken in contravention of the Act in operation at the time of death;
- have in your possession or control a living, healthy badger or to sell one or offer one for sale; or
- intentionally or recklessly damage, destroy or obstruct access to any part of a badger sett, to cause a dog to enter a sett or to disturb a badger while it is occupying a sett.

Wildlife and Countryside Act 1981:

A2 **Schedule 6**: Badgers are included in Schedule 6 which lists the animals that are protected under Section 11 of the Act. Section 11 outlaws certain methods of taking or killing animals where this is necessary.

Bern convention - Appendix 3:

A3 This requires signatory states to:

- regulate the exploitation of badgers; and
- ban certain means of capturing or killing badgers.

Wildlife (Northern Ireland) Order 1985:

A4 **Schedule 5**: The badger cannot be intentionally killed, injured or taken. No person can possess or control a live or dead badger or part derived from one. The sett cannot be destroyed, damaged or have the access by badgers obstructed. It is also an offence to damage or destroy anything which conceals or protects a badger sett or to disturb a badger while it is occupying one.

A5 **Schedule 6**: It is an offence to place any of the items listed in the schedule where they are calculated, ie likely, to cause bodily injury to a badger.

A6 **Schedule 7**: It is an offence to sell, offer or expose for sale, or publish an advertisement regarding the sale of, a badger either dead or alive.

ANNEX B

SPECIMEN LETTERS TO ENGLISH NATURE

I. Destruction of a Sett

B1 As you may know the [Insert name of authority eg Secretary of State for Transport] has developed proposals for a trunk road improvement/construction scheme between **[Insert name of scheme or specific reference]**. This work is essential because **[Describe reasons for the improvement/construction]**.

B2 The badger survey that was undertaken as part of the environmental assessment of this scheme has shown that implementation of this project will lead to the destruction of a badger sett at **[Insert location of sett]**. In order to effectively mitigate any disruption that will be caused by these necessary works, we will be employing **[Insert name of consultant/contractor]** to carry out any necessary work. The methodology that we propose to use is outlined in the attached annex **[to be prepared by consultant]**. Subject to any views you may have, this work is programmed to start on **[Add date]**.

B3 We should be grateful for your agreement that it would be acceptable to proceed on this basis, and we would appreciate any comments on the methodology or any additional advice that you can offer us.

II. Maintenance Work

B4 I am writing to inform you that the **[Insert authority]** will be carrying out essential maintenance work along the [Insert name of road or other appropriate description]. We are aware that there is a badger sett situated some x metres from the road and consequently the works may cause some disruption to badgers.

B5 The work involved will **[Describe works]** and will involve the use of **[Describe any machinery that will be used]**.

Either:

In order to minimise the disruption caused, we propose to **[Describe mitigation]**. We should be grateful for your agreement that it would be acceptable to proceed on this basis, and we would appreciate any comments on the methodology or any additional advice that you can offer us.

Or:

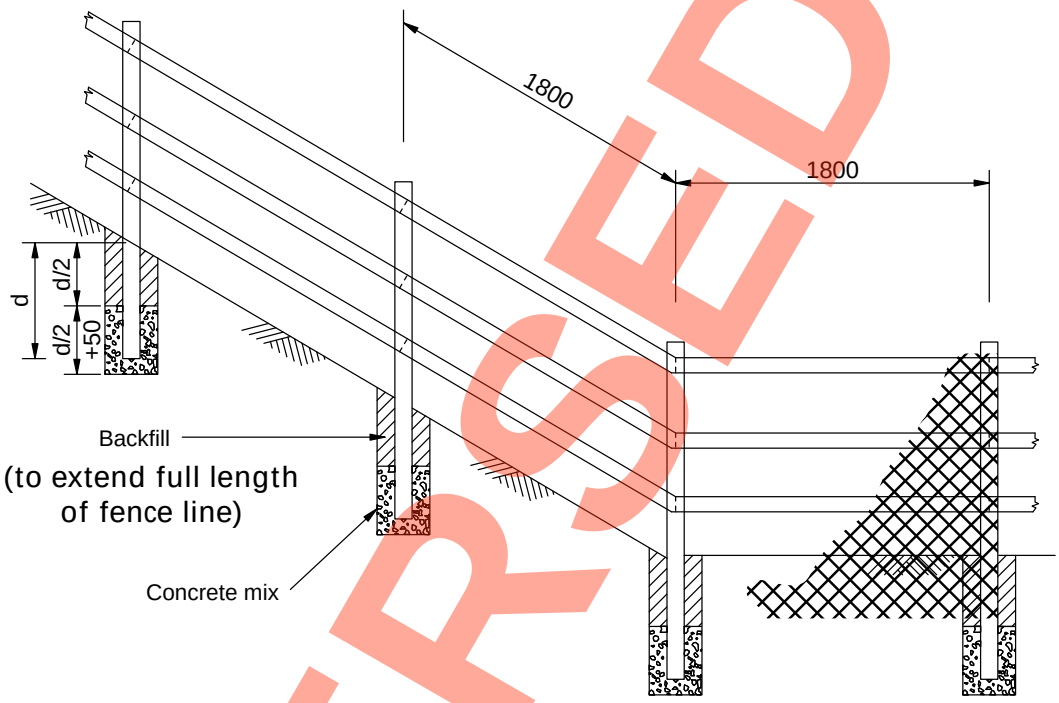
We should be grateful for your advice on the measures to be taken to minimise the disruption to badgers. The work is programmed to start on **[Add date]** and a reply by **[Insert date]** would be appreciated so that we can inform our contractors of any measures you suggest.

ANNEX C

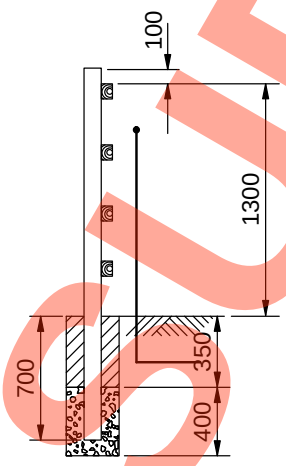
DRAWINGS

C1: Fencing

WOODEN POST AND 3 RAIL FENCE



3 RAIL FENCE



Chain link netting (preferably plastic coated) stapled to timber fencing.

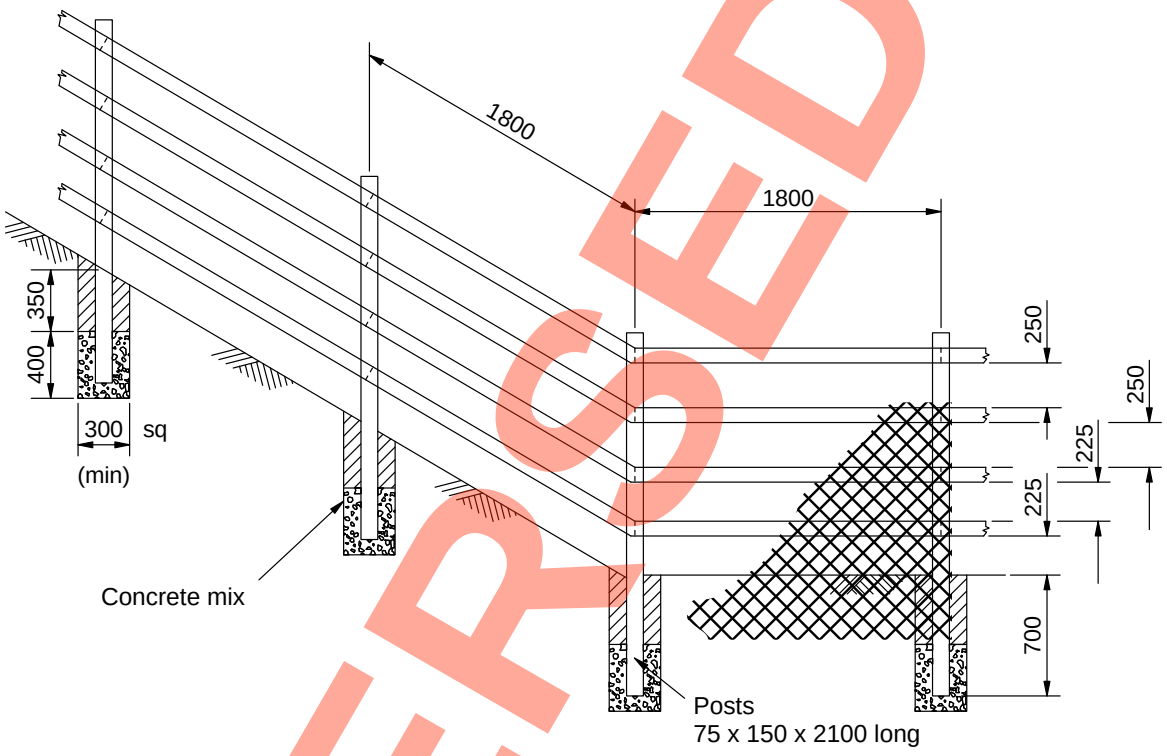
Lower 300mm - 500mm of chain link dug into the ground and turned away from the road.

Hole diameter should be in the range 20 - 40mm ideally, but no greater than 50mm under any circumstances.

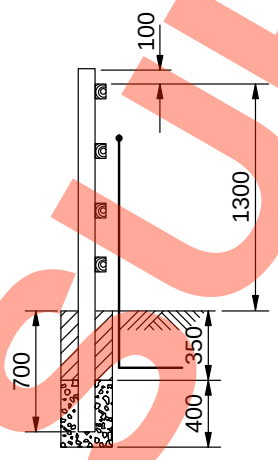
All Dimensions are in millimetres

C2: Fencing

WOODEN POST AND 4 (OR 5) RAIL FENCE



4 RAIL FENCE



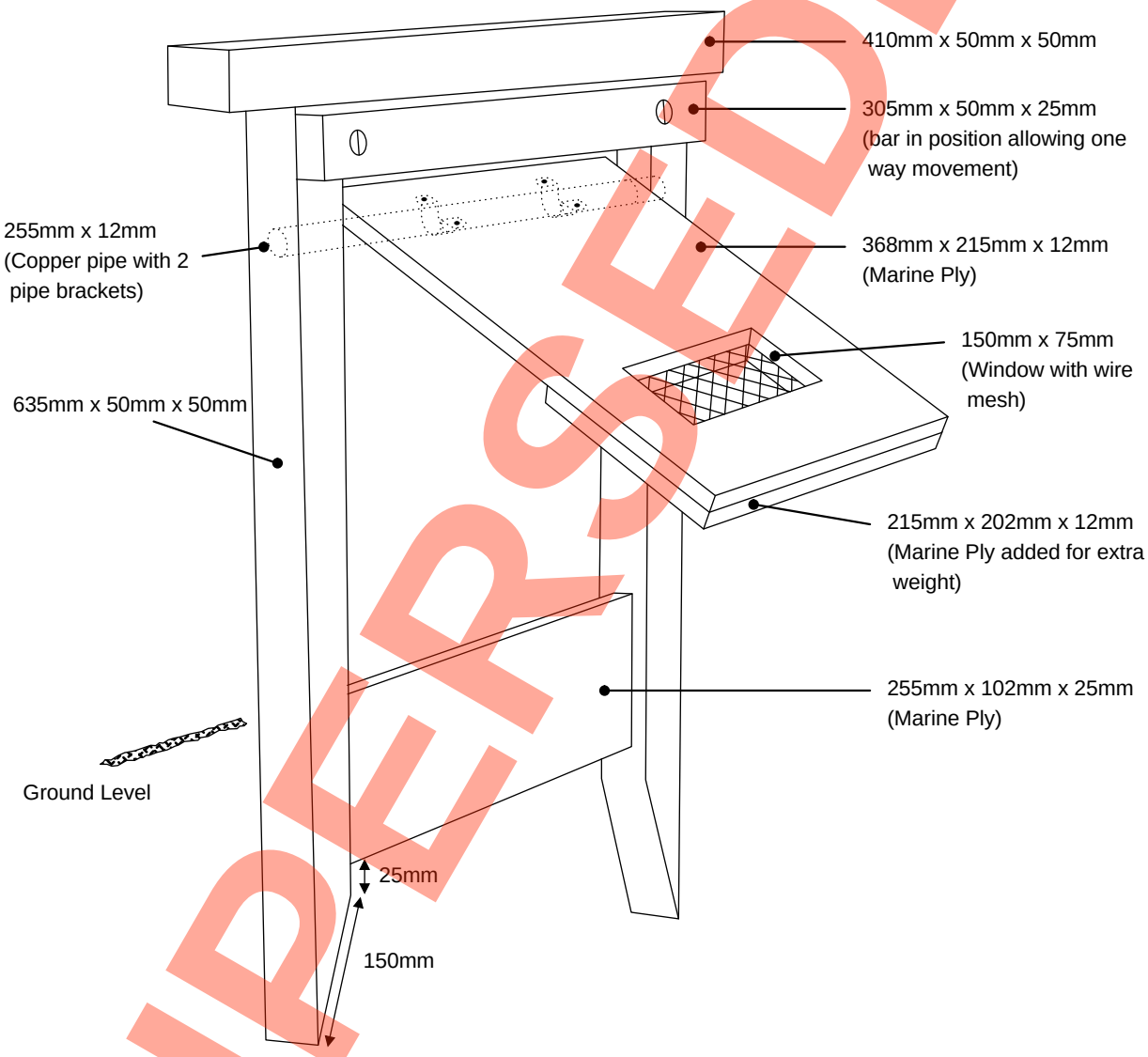
Welded mesh stapled to timber fencing.

Lower 300mm - 500mm of chain link dug into the ground and turned away from the road.

For chain link or welded mesh, 2.5mm guage is recommended.

All Dimensions are in millimetres

C3: Badger Gate



ANNEX D

ILLUSTRATIONS

D1: Siting

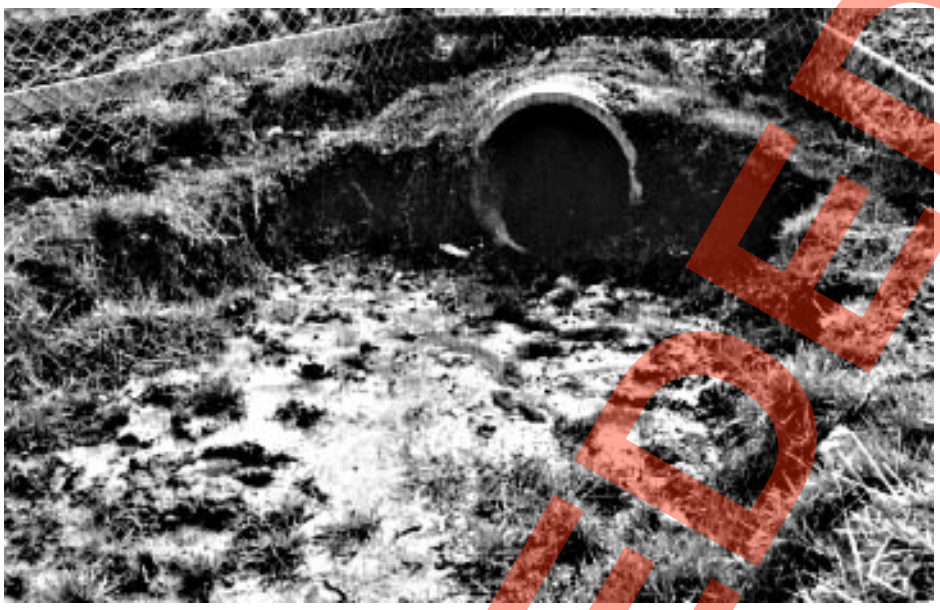
Bad practice

Tunnel entrance is flush to fencing. Badgers may simply walk past without knowing tunnel exists.

Good Practice

Tunnel entrance is located in recess in the fencing. Badgers are guided to the entrance.

D2: Siting



Bad Practice

Waterlogged ground at tunnel entrance will deter badgers.

Bad Practice

Tunnel is set away from fence and below it. Badgers are unlikely to find entrance. Even if they do, they are unlikely to associate it with a means of crossing the road.

D3: Implementation

Bad practice

Fencing is not continuous.
Note: inappropriate square netting has also been used.

Bad practice

Gap has been left between fenceline and railings on pedestrian footbridge.

D4: Implementation

Bad Practice

Gate has been set too high. Even if badgers realise gate is an access point, they would have to jump to get through.

Bad practice

Lack of hard base allows badgers to dig under gate. This is now a two-way access point.

D5: Implementation

Bad Practice

Netting has not been buried to sufficient depth to prevent underdigging by badgers.

Bad practice

Netting has not been buried to sufficient depth to prevent underdigging by badgers.

D6: Implementation

Bad Practice

Gap below access gate in exclusion fencing allows badgers easily to pass through.

Good Practice

Concrete plinth under gate prevents badger access.

D7: Value for Money

Bad Practice

Duplication of 'specialist' fencing increases cost. A combined fence would have been more appropriate. Note: double fenceline also causes visual clutter.

Bad Practice

Contractors' compound has been sited across exit from badger tunnel. This negates the entire purpose (and expenditure incurred) of providing the tunnel.

D8: Coping with Highway Features

Good practice

Simple ledge under river bridges can provide safe crossing point.

Good practice

Stile has been thoughtfully designed to allow badger fencing to be used.

ANNEX E

REFERENCES

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The Natural History of the Badger by Ernest Neal - Helm Mammal Series (updated version with Chris Cleesman now published)

Provisions for badgers against Traffic 1990 - Verenging Dast Boom

The Badger: Report to the Standing Committee of the Convention on the Conservation of European Wildlife and Natural Habitats - Council of Europe T-PVS (93)18

Home Office Circular No 100/1991

Investigation of badger setts using soil resistivity measurements by J Butler, T J Roper and A J Clark - J Zool (1994) 232 409-418

Species Conservation Handbook - English Nature

Badgers: Guidelines for Developers - English Nature

The Guide to Artificial Badger Setts - National Federation of Badger Groups

ANNEX F

USEFUL ADDRESSES

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