

Hand-augering to locate European badger *Meles meles* tunnels and chambers as part of emergency mitigation along water pipe installation works near Stanway, Essex, England

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SUMMARY

European badgers *Meles meles* and their setts are legally protected in the UK. If setts are to be damaged or destroyed as part of development, humane exclusion of badgers is usually required in advance of works. Exclusion can be achieved by erecting one-way gates over sett entrances which allow badgers to exit but not regain entry. Natural England (the governmental conservation advisory body in England) recommends that exclusion is maintained for 21 days before construction work begins to ensure that the sett has been vacated. In this study, a large diameter (400 mm) water main was installed through a badger sett without exclusion of animals due to discovery of the sett only after construction work had commenced. The sett location and the presence of numerous European rabbit *Oryctolagus cuniculus* burrows interspersed with sett entrances would have made exclusion difficult. As an emergency mitigation measure, a 1.4 m deep, 40 cm wide trench was excavated 6 m from the sett entrances (located mostly in a lapsed field boundary using a combination of hand-augering (to detect badger tunnels and chambers; these were then excavated by hand), followed by mechanical excavation. Subsequent to this, work to excavate the trench, lay the pipe through the sett and back-fill the trench took one week. Despite the disturbance caused by this approach, badgers were not excluded from the entire sett and the risk of killing badgers which may have been present below ground was significantly reduced; no badger or other large mammal activity was evident during the mitigation works.

All works were carried out under Natural England licence and under the supervision of an ecologist and a Natural England Wildlife Management Adviser.

BACKGROUND

In the UK, a requirement of extended Phase 1 habitat survey prior to development is to identify precise areas in the survey area with the potential to support legally protected species (IEEM 1995). This includes European badger *Meles meles* which receives protection under the Protection of Badgers Act (1992), which makes it illegal to deliberately kill badgers or disturb their setts. With regards to badgers, the purpose of the survey is to identify setts prior to any development works (e.g. road-building, pipe-laying) so that appropriate mitigation measures can be undertaken to avoid badger deaths and to minimise disturbance. Lack of current sett use,

sett size and type (main, annex, subsidiary and outlier), and their location (sometimes concealed in dense vegetation), may lead to badger setts not being discovered during these surveys.

Failure to identify active setts during Phase 1 surveys means that there is no opportunity to undertake mitigation measures prior to development. This may be compounded by the fact that licences are not normally issued for works to be undertaken between 1 December and 30 June as badgers may have dependent cubs below ground during this period and disturbance may force the sow (female) to abandon them.

In this present study, an extended Phase 1 survey was undertaken along the alignment of a proposed 400 mm diameter water main in July 2009 to identify ecological constraints to development. No badger setts were detected in a 3 m-wide lapsed field boundary, adjacent to the working corridor due to concealment by dense vegetation. It was intended to lay the pipe close to the field boundary and at a distance of about 6 m from the majority of sett entrances that were arranged linearly within the boundary. The sett was located 40 m from a major road (A12) and 300 m from two other busy roads.

In February 2010, work started on the laying of a water main within a 15-20 m wide working strip extending from the field boundary into the field. During top soil stripping by mechanical excavator, a badger emerged from a collapsed tunnel. All work in the area immediately ceased. The following day, an ecologist inspected the tunnel and a search carried out within the boundary confirmed the presence of a badger sett. Sett entrances were distributed linearly within the boundary and over a distance of approximately 15 m. Soil stripping had taken the tops off badger tunnels and caused tunnel collapse in several locations (Fig. 1). No more top soil was removed from the working corridor. The sett was determined to be an active breeding sett with six main entrances. A rabbit warren was also present with rabbit holes interspersed with sett entrances. Following the ecologists site visit, the incident was reported to Natural England (NE; the governmental conservation advisory body in England) and emergency mitigation discussed with an aim to avoid delays to the construction programme whilst ensuring the welfare of the badgers.

Initial consideration was given to realigning the water main 30 m from the boundary and repairing the sett under a Conservation Licence, even though the incident had occurred in February (i.e. within the non-licensable period). However, landowner consent to move the pipe was not forthcoming as the land had received outline planning permission for further development. These delays eventually ruled out emergency repair works, as it would have fallen within the period when dependent cubs may have been below ground. A decision was made to retain the existing alignment but to delay pipe installation in the vicinity of an 80 m stretch centred on the sett location until 1 July 2010.

Normally, development work that would directly affect a sett is only permitted following a period of badger exclusion, usually in excess of 21 days, to ensure that all animals had vacated the sett. However, in this case, several factors suggest that this procedure would be inappropriate, including: the sett was already badly damaged; the proximity of main roads may have resulted in badger fatalities and road user safety should access to the main sett be restricted (i.e. badgers may stray onto the road); and badgers may have gained access via rabbit burrows close to existing sett entrances. Evidence from subsequent sett monitoring during the consultation period with NE suggested that the sett was not in regular use despite being identified as a breeding sett in February. Furthermore, since construction activities had continued elsewhere, the only section requiring installation by 1 July was the 80 m stretch centred on the sett. The site engineer and contractors suggested that to install this remaining section (i.e. soil-stripping, trenching, pipe installation and infilling) would take one week.



Figure 1. Exposed badger tunnels revealed following top soil stripping and their alignment exposed as a result of hand digging back to the boundary hedgerow.

Following consultation with Natural England, it was considered that a “live dig” through the sett (i.e. excavating through part of the sett system approximately 6 m from the main entrances) could be undertaken provided appropriate measures were put in place to ensure that badgers, which may have been present, were not harmed. This included the use of hand-augering to detect badger tunnels and chambers, and using one-way badger gates, before mechanical excavation recommenced.

ACTION

Study site: This work was undertaken north of the village of Stanway (Ordnance Survey grid ref. TL 950241), approximately 5 km west of Colchester, Essex (southeast England). The sett lies at the edge of a large arable field, surrounded by three roads, the A12, A1124 and B1408. Private residences are the main land use in the immediate area, although new commercial buildings are being constructed adjacent to the A1124.

Mitigation process: A Development Licence was obtained from Natural England for works associated with the “live dig” to commence on 1 July. Following receipt of the licence, one-way gates were fitted over the tunnels which had been exposed by the soil stripping and which lay at the edge of the field. This was to allow badgers to exit blind ended tunnels (i.e. not linked underground to other tunnels) and ensure that they would not be trapped when top-soil was replaced. The gates were required to be in place for 21 days to reasonably ensure that badgers had exited and would thus not be trapped following top soil reinstatement. Vegetation and sticks (‘soft blocks’) were placed in all sett entrances within the boundary and at the entrances of damaged tunnels within the works corridor so that any badger activity could be detected. These were monitored every day during trench excavation and pipe-laying, and on every third day following top soil reinstatement until all gates were removed.

To avoid the risk of injuring or killing any badgers still present underground, a hand auger (10 cm diameter x 1 m long; Fig. 2) was used to locate underground tunnels and chambers along the line of the proposed water main. Augering was done at 0.5 m intervals along the alignment of the main to 30 cm depth on the 1 and 2 July 2010. Of the 80 m section of main to be laid, augering was carried along 35 m; the ground opposite the

sett and 10 m either side of the outermost sett entrance. Any tunnels encountered were excavated by hand, working back towards the boundary in which the entrances were located. Badger gates were fitted where these tunnels emerged from the boundary (Fig. 3). Including tunnel entrances exposed by top-soil stripping, a total of six gates were fitted to tunnels emerging from under the hedge boundary on 1 and 2 July 2010. Galvanised steel mesh was placed around these tunnels and along the edge of the soil-stripped corridor to prevent badgers from digging around the gates and regaining entry to the sett.



Figure 2. Hand-augering to locate tunnels and chambers along the line of the water main. The exposed badger tunnels can be seen emerging from the base of the hedge, one has been fitted with a badger gate (left-hand edge centre of photograph).

Following hand-augering, mechanical excavation was undertaken to the depth reached by the auger. The process of tunnel detection by augering followed by mechanical excavation was repeated (Fig. 3). Tunnels that bisected the trench line and travelled further into the field were also excavated by hand to determine whether they were occupied at their terminal ends. This technique was also applied to the working area not previously soil-stripped. A 5 m buffer from the trench to the boundary was left with top soil in place as no badger tunnels were found more than 5 m from sett entrances in the previously stripped area. This was to minimise the risk of encountering tunnels radiating from the sett, minimising overall sett damage and ensuring that as much of the sett as possible was available to badgers in the event that they wished to reoccupy it soon after works had been completed.

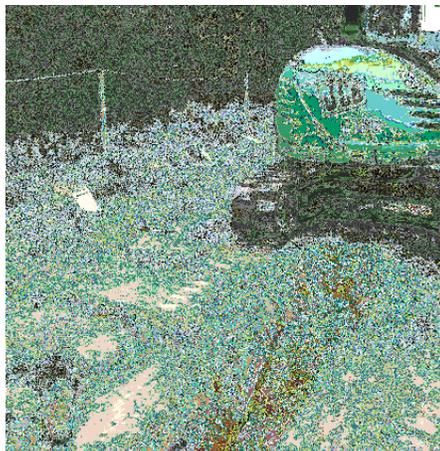


Figure 3. Excavation of pipe installation trench close to the badger sett. Note the gates over sett entrances along hedge base and steel mesh around these tunnels and along the edge of the soil-stripped corridor to prevent badgers from digging around gates and regaining sett entry.

CONSEQUENCES

Some badger tunnels were initially identified on the surface of the soil stripped area due to evidence of slumping and collapse. However, the hand auger technique was effective at locating previously undetected badger tunnels down to 60 cm depth. Below this depth, ground conditions (compacted sand and gravel) made augering impossible. It was considered highly unlikely that badgers would have been able to excavated into the sand and gravel, particularly as mechanical excavation (continued until the trench was 140 cm deep) of this stratum proved difficult. Auger boring indicated soil type at greater depths which was useful in determining the likelihood of encountering deeper tunnels.

Over the two days spent augering (1-2 July over the 35 m strip), no new tunnels or chambers were found below those which were damaged. No chambers or tunnels were found in the area where no top soil stripping had taken place. Subsequent to badger tunnel and chamber location by hand augering and excavation by hand, no badgers were encountered during trenching. No badger or other large vertebrate animal activity occurred at the sett during works as indicated by the soft blocks.

Trenching was completed on the 7 July 2010. The pipe was then installed and the trench back-filled by the 9 July. On the 4 August, gates were removed from the sett entrances at

the base of the hedge and top soil reinstated. Top soil reinstatement took less than 4 hours.

Conclusions and discussions: Hand-augering was effective in identifying tunnels and other voids below ground in advance of trenching by mechanical excavator. Should this method be applied elsewhere in the future, consideration should be given to the type of auger used to overcome constraints associated with soil conditions. However, it is important that sufficient care is taken such that the operator knows when tunnels or voids are encountered. It is considered that this method, combined with use of one-way gates and wire mesh to prevent re-entry into blind-ended tunnels, substantially reduced the risk of killing or injuring badgers which may have remained below ground. No further badgers were observed during the progress of the mitigation or pipe-laying work. Additionally, the level of disturbance in this current approach is considered to be less than that caused by total exclusion of badgers from a sett for 21 days (as per NE recommendations). The sett did not appear to be regularly used at the time of the works and badgers could occupy part of the sett (those tunnel systems beneath the boundary hedgerow which did not extend out into the field).

The approach outlined in this study may provide a solution when emergency works are required in the vicinity of a badger sett, where the option to shut a sett completely may lead to greater levels of disturbance to badgers, or where badger exclusion is difficult to achieve. However, this approach should not be viewed as an alternative to the established pre-planned mitigation protocol when badger setts are identified (as best as possible) along the works corridor prior to work commencement.

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