Collision Cause

Jochen Langbein and **Rory Putman**

examine a range of measures designed to reduce deer-related road traffic accidents

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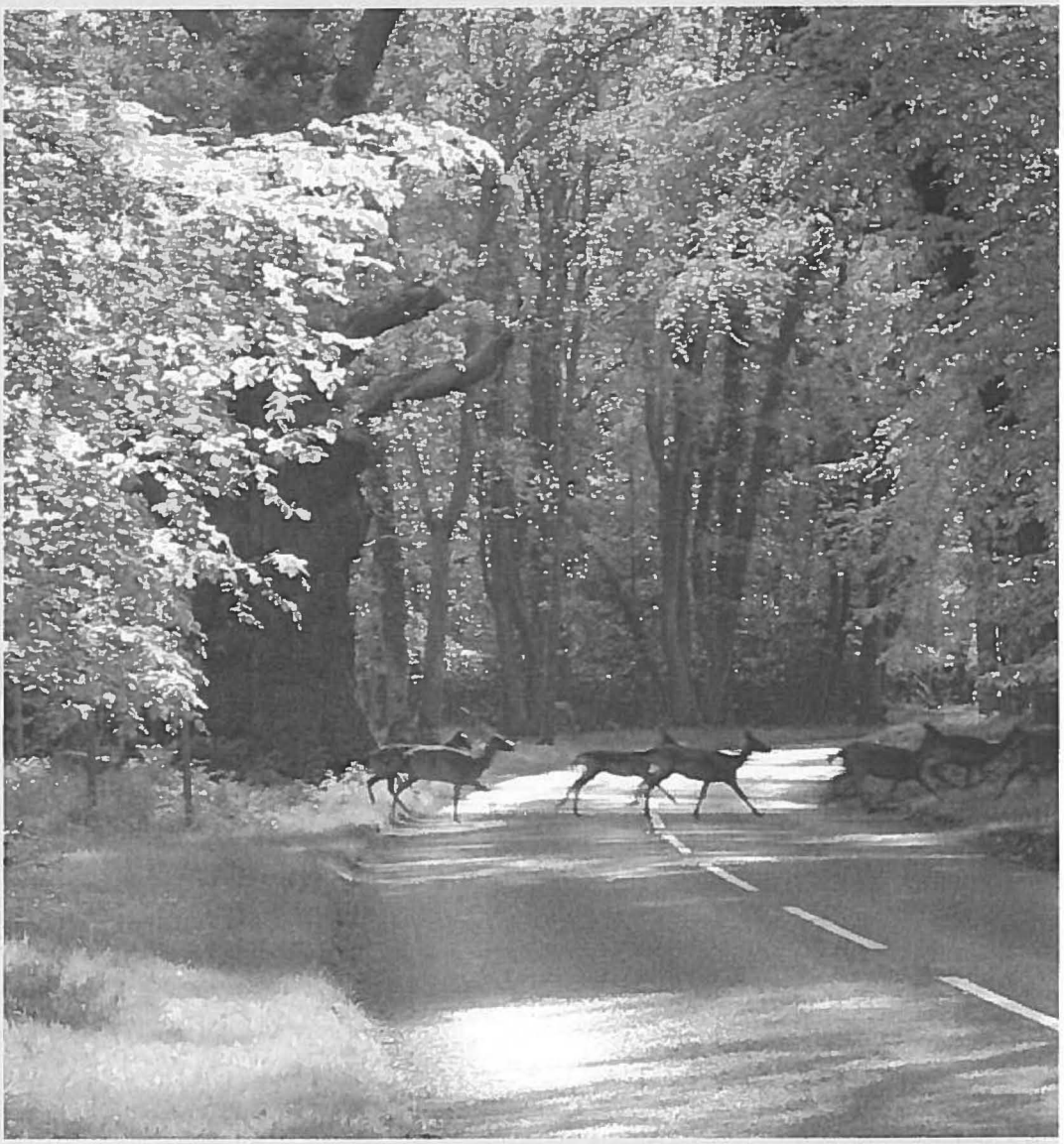

Traffic collisions involving deer have presented a problem in the UK for many years, and are implicated as a road hazard in around 500 human personal injury accidents and several human fatalities every year. The annual toll of deer killed or injured in such accidents was already thought to have reached 40,000 by the mid-1990s, but the continual rise in road traffic as well as deer numbers and distribution make further escalation of this problem in Britain almost inevitable. The above figures may come as a surprise to some readers, but are not atypical in a European context, where over 140,000 deer road casualties are reported annually in Germany, 55,000 in Sweden, 35,000 in Austria, and 10,000 even in smaller countries such as Switzerland and Denmark.

In the UK there is no legal requirement to report collisions with non-domestic animals unless human injury results, and hence until recently good information on the extent and distribution of this problem in Britain had been lacking. To address this the National Deer Collisions Project (NDCP) was launched in 2003, organised under the auspices of The Deer Initiative, with funding from the Highways Agency and the Scottish Executive. Although the majority of deer road casualties still go unreported, a database of over 30,000 deer vehicle collisions (DVCs) has now been built up by the study. Final entry of 2005 data and detailed analysis remains to be completed, but preliminary findings and further information about the project are provided at www.deercollisions.co.uk where fuller

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Above and below: Video surveillance is valuable in identifying deer behaviour and the effectiveness of accident reduction measures.

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Variable messaging on the A835 in Scotland.

results of the work should also be available later this year.

From the point of view of road safety, hitting a deer poses a heightened risk compared to collisions with smaller animals such as badgers, foxes or rabbits which also commonly fall victim to road traffic. Most vehicles involved in accidents with deer of course also suffer some damage ranging from minor dents to total write-offs. Extrapolation of insurance claims data provided by Fortis-Group Insurance, who hold approximately 4.5 % of the private vehicle motor policies in Britain, suggests that annual car repair costs (excluding commercial vehicles) resulting from DVCs alone exceed £11M in England and £2.5M in Scotland. However, it is the relatively high cost of human injury accidents which may hold the key to persuading local authorities to allocate greater resources to deer accident prevention in future. The economic 'value of prevention' of human injury traffic accidents at 2003 figures amounts to an average of over £65,000 per accident, totalling over £30 million for the 500 or so deer related human injury accidents occurring annually in the UK. Although not all such accidents are preventable, even only a small proportion of the cost they incur allocated annually towards minimising DVCs could clearly go a long way to reducing the problem.

What measures are available to reduce DVCs ?

Numerous differing approaches have been proposed over the years to minimise DVCs, ranging from roadside fencing to various optical, auditory and chemical deterrents, management of verge vegetation, control of deer numbers, signage and other means of raising driver awareness. For most methods however, scientifically based research into their actual effectiveness remains limited, and we have therefore now begun to initiate a series of roadside trials to research in more detail not merely changes in accident frequency where mitigation is installed, but also the behaviour of deer themselves when they cross roads and their responses to various novel deterrents.

Attempts at reducing the frequency or severity of deer-vehicle collisions may broadly divided into three main categories

- Preventing or controlling crossing, by the use of highway fencing, reductions in local deer population density, roadside optical or acoustic warning reflectors, chemical deterrents or car-mounted warning whistles.
- Increasing driver awareness, through the use of various driver warning systems – whether through the use of fixed signage, signs responsive to driver speed or activated by animals, or in-car hazard detection devices.
- Provision of safer crossing places for deer by the installation of dedicated wildlife overpasses or underpasses ('green bridges'), or modification of existing structures to dual use, or by the creation of designated 'cross-walks' across the carriageway itself.

Among this wide range of options, *high tensile roadside fencing* still remains the primary and only well proven method used to reduce road-crossings and resultant accidents at identified sites of high risk. However, long sections of complete barrier fencing to prevent all road-crossings are rarely justifiable from view of high cost of installation, long-term maintenance and likelihood that they will prove ineffective due to some animals eventually forcing the fence. Fencing must therefore be of adequate specification (height/mesh size) for the deer species present and be designed not with the expectation or aim of attempting to prevent road-crossings altogether, but rather to channel animals to cross elsewhere, whether across, under or over the carriageway.

Reductions of deer density have been found effective in some but by no means in all areas where this has been used as the main approach, not least as unless carefully planned over very wide areas, heavy localised culls risk rapid infill from neighbouring areas or shifting the problem rather than solving it[1]. Relationships of DVCs and deer numbers are rarely

linear, and many other influencing factors including habitat connectivity, safe crossing areas and traffic flow become increasingly more important than density in determining level of risk at a more localised level[2].

Vegetation Management to provide better forward visibility for drivers as well as animals near the verge is another obvious solution and likely to be appropriate in at least some areas. From our own analyses risks of DVCs do tend to increase near woodland and especially where dense vegetation comes right down to the roadway, but many further practical trials involving vegetation removal are required to confirm its effectiveness in terms of accident reductions.

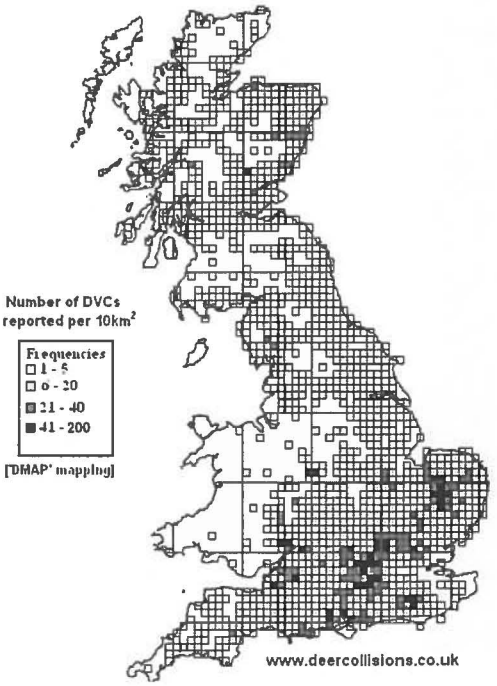
Optical wildlife-warning reflectors remain one of the most common forms of mitigation deployed in the UK. They are intended not to stop animal movements across roads, but to delay these to times when there is no traffic on the carriageway; working on the principle that light from approaching headlights is reflected onto the verge to alert deer to oncoming traffic at night. By definition they can only be effective when lights are in use and since they are designed not to prevent crossing, but delay it until the road is clear, they can also only hope to be effective on roads of low traffic volume where there are adequate gaps in the traffic to allow animals to cross, and lesser likelihood of habituation by deer to the light barrier created. After more than 30 years of use of such reflectors in Europe and US and numerous conflicting reports and studies into their effectiveness[1,3], the balance of evidence suggests few if any lasting effects. Nevertheless, a newer generation of roadside reflectors that incorporate auditory signals in addition to the reflection of lights is now available and seems worth exploring further. Some promising early results are reported from trials in roe deer areas in Germany and Austria and trials with a number of differing devices form part of the new research trials set up in England over the past year, which are discussed further below.

Various types of *chemical deterrents* encapsulated in slow release organic foam and applied to roadside posts or trees, or in the form of slow dissolving scent rods or scent sprayed on pieces of felt, have also been tested in various areas, but with rather mixed success and the conclusion that while deer feeding movements may be affected, such substances rarely deter from crossing the road somewhere nearby. *Car-mounted deer-whistles* are widely advertised as a cheap solution, but independent studies have shown no behavioural avoidance by deer of vehicles equipped with such devices[4] and comparison of various types of car-mounted products suggest most are at the limits or outside the auditory range for deer, or inaudible over the general traffic noise[4].

Increasing Driver awareness

One of the major factors contributing to DVCs as for other traffic accidents is speed and the general lack of hazard awareness among drivers. Standard *animal warning signs* displaying the figure of a stag in a red triangle are the most frequently used measure to reduce deer-vehicle accidents in the UK, but no evidence exists that these standard highway code signs actually help at all in reducing DVCs, not least as they are used so prolifically and often tend to be positioned to warn drivers of hazards continuing for several miles. With advances in road technology *dynamic signage* is becoming an ever more realistic option, with a variety of animal activated lighted signs already in use in Europe and US, and as of April this year deployed for the first time also in England. Animal-activated systems mostly work by detecting the presence of animals near the carriageway by radar, laser beams or heat-sensing infra-red systems and then activating an illuminated digital road sign. Costs of such systems are becoming less expensive, with some now available from around £10-15,000. They have the advantage that while drivers quickly habituate to standard signage and rarely even notice the

Overview of distribution of deer-vehicle collisions reported to the project during January 2003 to December 2004. (based on sample of 11,687 records with known locations)



presence of the signs, the warning on these dynamic signs is only illuminated when there is an increased risk of accident, and that warning is also likely to be reinforced when drivers actually see deer cross near the roadside when signs are lit, and raise awareness of the very real hazard which many drivers are unaware of until involved in a DVC themselves. Alternatively, as speed is often a primary factor affecting frequency and severity of DVCs, it may be that even rather less intricate digital signs which are activated by speeding vehicles when they exceed advertised speed restrictions, such as are often used for traffic calming near village entrances, could suffice to help reduce DVCs at some blackspots. Cost/benefit studies are much needed to look into the relative effectiveness of the many differing signage option now becoming available.

Highway deer fencing is at its most effective if it seeks not to prevent all animals crossing the road, but to direct them to safer crossing points. On roads carrying high volumes of traffic, such crossings may include purpose built wildlife underpasses or 'green' bridges to preserve or increase connectivity of wildlife habitats fragmented by roads. However, on existing roads, and in cases where the primary concern is over road safety more so than enabling free interchange of deer from populations resident to either side of the road, then adaptation of other (often existing) structures such as farm accommodation bridges, viaducts or cattle-creeps may help to provide a 'bolt-hole' for those deer determined to cross and alleviate pressure from fences. The types of structures most likely to be used by deer will be bridges or underpasses which are already close to some concealing cover or can be further enhanced through planting and by provision of deer-fencing to funnel animal movements towards the passage. A good example of how even large wild deer may become accustomed to using quite simple, seemingly uninviting structures is shown in the photograph, taken from video footage I filmed on a narrow (4m) bridge over the six-lane wide M25 London orbital road – the busiest road in Britain!

New initiatives and deterrent trials underway

There are no cheap or easy solutions to the ever increasing issue of DVCs, and hence the search for better ways of deterring deer from crossing into traffic continues. Such systematic research into deer mitigation options as has been undertaken in the past has nearly all been carried out in the US or continental Europe, where the deer species, their management and traffic situations are often quite different from those in Britain. To begin to address this, one key objective of the National Deer Collisions project has been to initiate accident prevention schemes and their detailed monitoring to determine what works and what does not. Thanks to the interest and support of several local authorities as well as national trunk roads authorities, it has been possible over the past year to commence a series of such trials in different parts of the country; including testing of new types of acoustic reflectors, rumble strips, animal and speed activated signage, verge management and raising public awareness.

A number of more sophisticated wildlife reflectors have come on the market recently which incorporate acoustic signals in addition to optical flashes from reflected headlights. Trials with two such novel roadside devices (the *Acoustic wildlife warning reflector* produced by WEGU-Gft in Germany; and *Ecopillars* produced by Eurocontor in Slovenia) were established last autumn. These devices can both be triggered by headlights and, in case of the second, also by vibration of on-coming traffic, and have integral solar-cells for recharging during the day. When activated by vehicles the Acoustic reflectors (mounted on wooden posts spaced at 50m intervals near particular blackspots) emit a high pitched whistle audible to the human ear as well as reflection of light into the verge, whereas the Ecopillar emits a range of both low frequency and ultrasound signals in expectation that deer may habituate less readily to this rather than to a single signal.

Trial sections with these devices were established at the end of last year on the B4506 at Ashridge Forest in the Chilterns supported by the Three Counties Traffic partnership (Hertfordshire, Buckinghamshire, Bedfordshire) and also on the A39 near the Quantock Hills by Somerset County Council. Two further trials with the Ecopillars will commence on two trunk roads (A38 in Devon and A49 in Herefordshire) this spring commissioned by the Highways Agency. To study their effectiveness, rather than merely waiting for reports of changes in accident statistics over future years, the local funding authorities are providing support to enable us to undertake behavioural monitoring of these trials using periods of day/night digital video surveillance, the latter being used to

This deer was prepared to use a 4m wide bridge across the M25.

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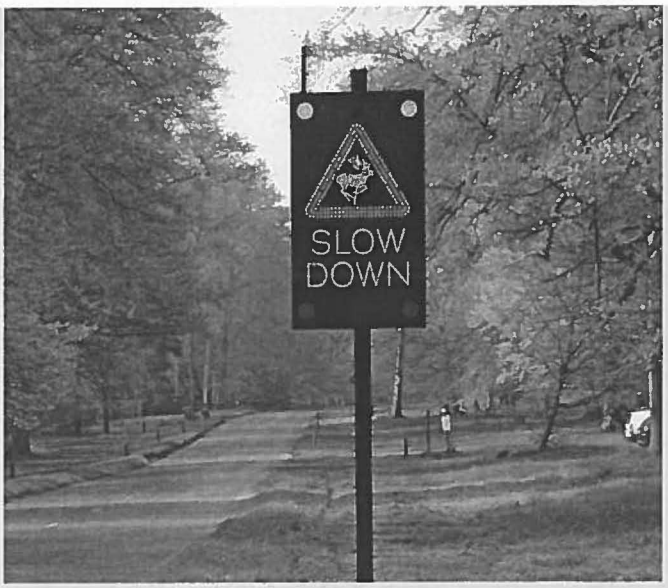
The Ecopillar incorporates accoustic signals and optical flashes from reflected headlights.



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Interactive signage was deployed for the first time this year in Britain.

determine whether deer do actually tend to delay crossing longer after traffic has passed where such devices are present, and also whether any reaction elicited differs either between the devices on test and/or between our different common species of deer. A similar approach to monitoring is being utilised on the B1106 through Thetford Forest in Suffolk, where the County Council is interested in assessing whether rumble strips, in addition to potential reduction of driver speeds, may also have some effect in alerting deer to oncoming traffic[5].

Another innovative measure, interactive signage triggered by deer as well as by driver speed, was deployed for the first time in Britain during April of this year at Ashridge Forest funded by Hertfordshire Highways. Here two laser beams are set parallel to the road along a particular short DVC black spot, where the deer tend to cross from the Forest onto a golf course. The digital signs to either side are triggered when a deer or other large animal moves onto the verge, and flashes up the image of a deer and a 'slow down' message to forewarn drivers. As many DVCs result from excessive driver speed, the signs are also triggered when approaching traffic exceeds the new 50 mph speed limit and in this case displays the speed limit and alternate flashing lights instead. Installation of similar signage, to be activated either by speed only and/or animals is also likely to be recommended by the Advisory Panels set up by the Deer Commission for Scotland, who were appointed to put forward concrete proposals for the best approach to mitigation in a number of 'Priority areas' within Scotland with high risk of DVCs Recommendations for dynamic signage are likely to be included amongst a suite of other measures proposed by these Advisory Panels in a number of areas, including sections of the A835 near Ullapool and A82 over Rannoch Moor. On the A835 permanent 'variable digital message signs', normally used to advise of road closures or provide other travel information, are also now being employed to advise drivers of high risk of deer being in the roadway at certain times of the day or year.

Research on these and other novel measures remains at too early a stage to reach firm conclusions as to their individual effectiveness and in most situations the best results are likely to be achieved by integration of several complementary approaches rather than reliance on any single measure. This is well demonstrated by a quite dramatic reduction of DVCs that has already occurred at the National Trust's Ashridge Forest: over 110 deer were killed on local roads there each year between 2000 to 2004, yet this toll fell to 68 during 2005. Here, aside from installation of the deterrents discussed above, public awareness of the issue of deer accidents has been actively raised with help of the local media, speed limits and other traffic calming measures are being installed, whilst improved co-ordination of deer management between the National Trust and their neighbours has helped gain control over expanding deer populations.

The National Deer Collisions database remains on-going, and we would much welcome further submissions of information not least from BDS members.

References

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[2] Seiler, A. 2004. Trends and spatial pattern in ungulate-vehicle collisions in Sweden. - Wildlife Biology 10(4): 301-313.

[3] Hedlund, J. H., P. D. Curtis, G. B. Curtis,and A. Williams. 2004. Reducing deer vehicle crashes: What works, and what does not. Traffic Injury Prevention 5:122–131.

[4] For other references quoted in text relating to effectiveness of deer mitigation, please see Putman et al 2004 available for free download at http://www.deercollisions.co.uk/ftp/mit_review.doc

[5] Wilson, A and J Langbein (2004) Culling carnage on the highway. 'Surveyor' Oct 2004 p.15-19