Management, maintenance and monitoring of wildlife passages in France

Pierre Skriabine[1] & Jean Carsignol[2]

[1]Service d'Études techniques des routes et autoroutes (Sétra), France, [2]CETE de l'EST METZ, France; jean.carsignol@equipement.gouv.fr

Abstract. This work presents results of over 40-years experience in functioning of animal passages in France. Several types of basic monitoring equipment, permitting to track usage of passages, were characterized and some examples illustrating their effectiveness discussed. The prerequisite condition of efficient functioning of the whole system aimed at the protection of biodiversity is the proper management of passages and monitoring equipment.

Key words: highway, motorway, wildlife passages, camera trapping, video surveillance, management, France

1. Introduction

Wild fauna passages, overpasses as underpasses, would they be dedicated to big or small animals, do exist in France since almost forty years. Their efficiency is usually controlled with the help of various footprint recording systems (sand beds, etc.). These devices give indications about the level of use by various animals, gut do not deliver any information about fauna's behaviour while approaching the passage or while crossing the road using the passage. This is why systems as photographic infra red filming or video monitoring offer interesting abilities for studying such behaviours.

This paper shows results obtained with different techniques and materials (cameras equipped with light amplifying devices, thermic cameras) and shortly describe the various photo or video monitoring systems, infra red or radar activated, in use in etc. It will then explain and comment some of the acquired knowledge with the help of these instruments. It will then explain and comment some of the acquired knowledge with the help of these instruments.

2. Camera trapping and video surveillance

A camera trap is a system in which the pressure exerted by an animal on a switch (generally a wooden board hidden under vegetation) triggers a camera (which may be disposable). The camera may also be triggered when an animal takes bait.

Infrared and radar photo-surveillance systems may be made using equipment available from photographers or alarm specialists, or may be purchased in complete kit form (Jama Electronique, Trail Master 1500). A radar system may be used instead of the infrared barrier. Infrared and radar photo-surveillance systems may be used for photographing small subjects (amphibians and micromammals) or other creatures such as lynx and bats.

Current digital cameras offer a number of advantages – they are silent, can store up to 100 images (3 times as many as conventional cameras) and may be left for 5 to 6 days (the limiting factor being the battery). The use of radio waves eliminates the need for cables running between the sensor and the camera.

The cost of a Trail Master system in a metal case with a radar detector, electronic counter and auto-focus camera with built-in flash is approx. €800, excl. VAT. Installation time is 2 hours.

'Light' video surveillance: a simple, compact system requiring no triggering sensor may be put together using a video-surveillance camera with original watertight case combined with a 12 V battery, a VCR recording 12 hours on a three-hour VHS cassette and an infrared lamp. The continual operation of this system means that the operator must view the entire cassette even if no animals have used the passage. This disadvantage is counterbalanced by the easy installation and high degree of reliability. The system ensures that all events are filmed.

The cost of such a system, comprising an infrared lamp mounted under a camera on a tripod, with a battery and VCR in a watertight container on the ground is approx. €5,000, excl. VAT. The system can operate for 12 hours.

'Heavy' video surveillance: Figure 1 shows the arrangement for a system comprising a video-surveillance camera, one or two infrared lamps (200W to 450W), one or more infrared barriers, a VCR (VHS), 4 standard batteries + a timer, a detection counter, etc. This system, which may be set up using standard equipment, costs some €12,000, excl. VAT.

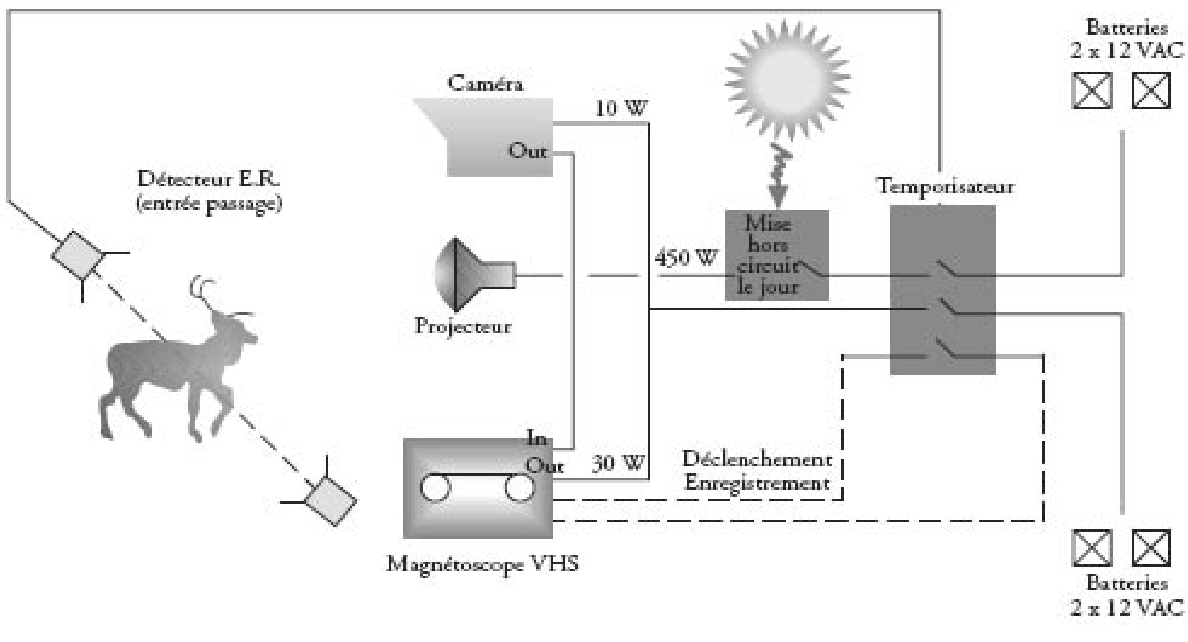


Fig. 1. Arrangement for video-surveillance system (Source: J. Carsignol/Sétra; CETE de l'Est; 1988)

Laser cameras: in the future, this type of equipment could render video surveillance simpler by eliminating the need for the infrared lamp (energy savings, lower cost and fewer connections). The civilian market offers laser cameras whose performance could be enhanced through the provision of additional light.

Thermal cameras: while this type of equipment provides images of exceptional quality, it is still prohibitively expensive (€30,500, excl. VAT), despite a 50% drop in prices over the past few years. Thermal cameras are much less bulky than they were, and now feature built-in batteries (2 kg for a high-resolution portable camera). Images may be recorded using PAL video outputs. Despite their remarkable performance – such systems are capable of detecting a roe-deer a kilometre away with a wide-field lens covering a large expanse of terrain – the cost factor means that they are not yet a viable alternative to the conventional infrared systems.

Photography and video surveillance may be used for different applications depending on the studies to be carried out and on the information to be gathered (Table 1).

Table 1. Applications of photography and video surveillance

Types of use	Information
Experimentation	• Test various types and sizes of passage, passage components (parapet and light well), floor and wall coating, etc. • Analyse the effectiveness of reflective systems, attractants, etc. • Evaluate the influence of vegetation at the entry or on the platform: does the density of the vegetation discourage use of the passage (implications in terms of management)?
Behavioural studies	• Observe moving animals discreetly: analysis of the approach and crossing conditions, study of the exploratory behaviour of certain species or individuals, and study of habituation
Pedagogical documents and promotion of know-how	• Release details of successful experiments, and transmit information and know-how.
EP, APS and APA/DP operational studies	• Determine the precise locations of passages during studies, • Listing of species on identified runs.
Effectiveness monitoring	• Know levels of use by wild fauna and other users. • Check (mixed or non-specialist) passages where track traps cannot be set up (coated or hydraulic passages). • Analyse the reasons why animals refuse to use the passage although using the vicinity regularly.
Counting and identification	• Estimate the biological significance of the use of passages and runs. • Evaluate competition within and between species (e.g. role of dominant male).

3. Results and lessons

3.1. Examples

Example of passage at St Alban d'Hurtières (specific lower passage, Vallée de la Maurienne)

Located on A43/SFTRF (Vallée de la Maurienne): fauna dedicated lower passage (20 m wide with a single span). This passage, which is on a regional deer route, is also used by small local fauna from the mountain and the Vallée de l'Arc (Table 2).

Table 2. Use pattern for passage at St Alban d'Hurtières since 1997

Animals	%
marten species	6
roe-deer	34
stag	6
wild boar	24
fox	18
badger	12

(Source: Fédération Départementale des chasseurs de Savoie, 2002)

Example of passage at La Rougellerie (specific (fauna dedicated) lower passage, Sologne)

Located on A71/COFIROUTE (Sologne): passage at La Rougellerie; 6 m long and 3 m high. (Source: M. Galet; COFIROUTE).

Photographic monitoring of the passage at La Rougellerie on the A 71 recorded 175 events over a 16-month period (i.e. one event every three to four days), thus demonstrating the usefulness of the lower passages for small fauna as a whole (Table 3).

Table 3. A71/COFIROUTE (Loir-et-Cher): animals crossing the La Rougellerie passage

Species concerned	Crossings recorded
stone marten	58
pheasant	37
roe-deer	30
hedgehog	18
fox	15
wood pigeon	4
wild cat	4
hare	2
coypu	3
red squirrel	2
+ walkers, hunters and hunting dogs	1

Source: V. Vignon and P. Orabi/OGE/COFIROUTE (2000)

Example of the E 44 (Trèves-Luxembourg, two specific upper passages)

In Luxembourg, on the E 44 motorway (Trèves, Luxembourg), camera-trap monitoring of fauna at two upper passages (12 m wide) recorded 575 events concerning 9 species of mammals (Table 4).

Table 4. E44 motorway (Treves – Luxembourg): breakdown of the species using two green eco-bridges between 23 September 2003 and 9 March 2004 (Source: Public Works Ministry, Grand Duchy of Luxembourg 2004)

Species	%
wild boar	55.8
roe-deer	24.9
polecat	0.2
marten cat	0.2
hare	2.6
badger	0.3
wild cat	1.2
cat	5.7
fox	9.1

3.2. Lessons

Infrared video-surveillance studies conducted in Switzerland (Sempach ornithological station) on the use of 22 fauna passages between 8 m and 200 m in width provided new insights into passage construction requirements.

The regression curve obtained using data concerning use by various species (roe-deer, boar, deer, fox, hare, badger, marten and stone marten) is asymptotic (see Fig. 2).

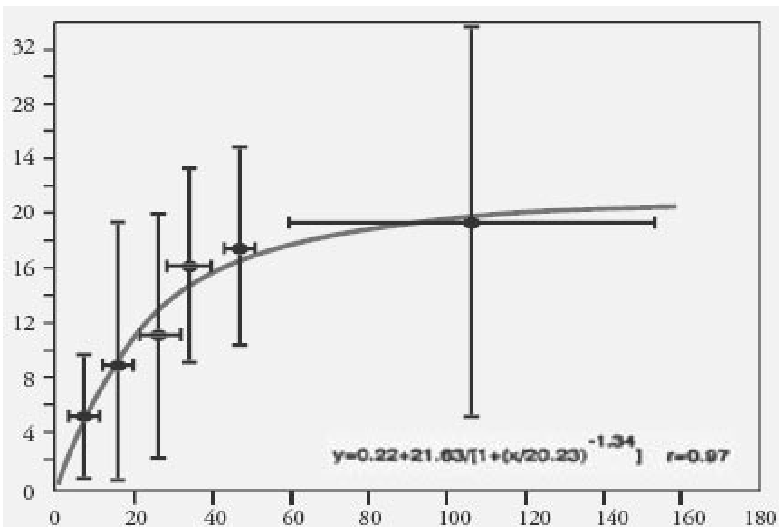
This illustration shows that:

- up to 20 m in width, the curve is characterised by strong linear growth, corresponding to a reduction and considerable variance in the cost-effectiveness ratio;
- between 20 m and 50 m in width, slowing growth corresponds to the stabilisation of the cost-effectiveness ratio;
- beyond 50 m in width, the curve flattens out gradually as far as 100 m, approx.: the additional width over and above 50 m makes only a very slight contribution to effectiveness, while the cost-effectiveness ratio rises considerably.

The results of this study show that:

- passages of less than 20 m in width would be of limited effectiveness, and are deemed undersized by the observers at the Swiss ornithological station. Fauna generally rush through (or even avoid) such passages, whereas they find the wider versions less stressful, and even spend time in them;
- passages of between 20 m and 50 m in width prove sufficiently effective for hoofed animals;
- beyond 50 m in length, the curve rises more slowly, the number of additional crossings becomes smaller and the additional effectiveness gained is due to use by particularly demanding species;
- the optimal observation frequency (i.e. the number of animals encountered per night, which is an indicator of the exchange rate) occurs between 80 m and 100 m. This large widths recreate multifunctional links between population nuclei.

Number of wild animals per night



Width in metres

Fig. 2. Average number of animals observed by class and width of passage. (Source: Pfister *et al.* 1997)

More detailed observations using video surveillance cast light on animal behaviour in the vicinity of passages and in/on passages, and on the factors responsible for such behaviour or reactions.

4. Managing passages and other facilities

4.1. Principles

Management, which is a vital component, is often neglected, despite the fact that feedback has taught us that creating a facility is not enough. Facilities must be monitored to ensure that they are used only for the intended purposes, and must be maintained regularly if they are to remain effective.

Facilities for small fauna – and particularly for amphibians – are often managed by voluntary workers, which means uncertainty over the long term. Certain installations encountering special difficulties due to their location or to climatic conditions require regular, sometimes-heavy maintenance (use of mechanical equipment to clear entries, high-pressure hosing to clear conduits and installation of deflectors) to keep the passages from being obstructed by earth. Highly-motivated local naturalists may provide project owners with advice, but will not always be able to manage the facilities subsequently, even if paid.

There are various ways of enhancing the effectiveness of facilities:

- Management issues need to be taken on board in the initial phases of a project, and addressing such issues successfully is one of the keys to ensuring the effectiveness of small-fauna facilities. Decisions taken at the works phase can have a profound effect on the operation of facilities. Sites should be visited on a weekly basis during the implementation phase, and site workers should, ideally, be made aware of the issues.
- Wherever possible, construction work should be conducted without damage to vegetation. Measures (acquisition or management agreements) should be taken to ensure that the land is used appropriately and that fauna can move freely.
- Later, during the operations phase, it is essential to conduct weekly visits during the first year, and one or two visits per month subsequently. Overall coherence must be ensured.
- The effectiveness of the facilities also depends on: (*i*) regular surveillance of the facilities and their vicinity in order to detect any environmental modifications; (*ii*) maintenance of the facilities and their vicinity; (*iii*) monitoring of activity regulation and of land use near the passage.
- Management agreements (see below) must be arranged.

4.2. Management agreements

Although they are becoming more common for large-fauna passages, management agreements are not often initiated in respect of passages built for small fauna. Such agreements – which serve to optimise surveillance, maintenance and inspection – name a manager and define the roles of the various partners. They should be initiated very early on, since it is difficult to appoint a manager once a facility has been completed.

The management agreement must be signed by the infrastructure operator (State, Department or Concessionary), who maintains responsibility for the facilities. That party either contributes to management costs or provides the appointed manager with the requisite resources.

A management agreement specifies:

- the purpose of the facility, and the use to which it is to be put;
- the technical characteristics of the facility and the components planned for the vicinity (drainage, dedicated approach area, vegetation and track traps);
- the special protective measures: game reserve, nature reserve or listed wooded area (such regulatory constraints and easements make for better protection of the vicinity, and facilitate the work of the managers);
- the written agreements between the project owner, the manager and the adjacent owners; such agreements may, in effect, constitute easements (free or paid waiving of hunting rights to facilitate the manager’s work; commitments regarding fencing and use of the land for agriculture or forestry, etc.);
- the conditions governing acceptance of the facilities, it being clearly stated that said conditions concern only the management of the land and of the components in the vicinity of the passage (the passage itself remaining the property of the project owner, who is responsible for its maintenance);
- the conditions governing effectiveness monitoring (one visit weekly the first year, and two visits monthly subsequently). Concerning surveillance, two or three visits annually suffice to enable maintenance or police operations to be triggered where necessary (visit reports should be produced);
- the nature of the maintenance;
- the cost of management.

4.3. Potential managers

In France, the main potential managers are:

- Municipalities;
- The national hunting and wildlife office or ONCFS (Office national de la chasse et de la faune sauvage) and the fisheries council or CSP (Conseil supérieur de la pêche);
- Nature-conservation associations and organisations;
- Département hunters' federations, and fisheries and fish-farming federations.

5. Conclusion

To conclude briefly, management, maintenance and monitoring of wild fauna passages remain the key to obtain new data and to improve our knowledge in this field, and management and maintenance actions are necessary to guarantee the basic functioning of such facilities, which are one of the main keys for maintaining biodiversity.

References

Carsignol J. (1988). Surveillance automatique des passages pour la faune, piégeage photographique et suivi video". Information memo, Economics – Environment series, no. 59, 8 p. Sétra/ CETE de l'Est.

Pfister H.P., Keller V., Reck H. & Georgii B. (1997). Bio-oekologische Wirksamkeit von Gruenbruecken ueber Verkehrswege. Forschung, Strassenbau und Strassenverkehrstechnik, 756. Bundesministerium fuer Vehrkehr, Bonn.