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Mobility for humans and wildlife – cost-effective ways forward

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Photo on cover page:
Integrating wildlife and road networks is a way of reducing the impact of infrastructure on biodiversity. Two fauna bridges, crossing a highway and a local road respectively, under construction between Svendborg and Odense, Fyn, Denmark.

This report is: **FOR DECISION**

1. Executive summary

This report, *Mobility for humans and wildlife – cost-effective ways forward* is the outcome of the work of Project Group (PG) Wildlife and Traffic.

The group has worked with two main strategies to identify solutions in order to reduce the impact of infrastructure on biodiversity:

1. Use of the COST 341 Handbook *Wildlife and traffic – A European handbook for identifying conflicts and designing solutions*.
2. Strategic, institutional aspects: best practice in the EU regarding road networks and wildlife.

Based on the analysis of the use of the COST 341 Handbook released in 2003, the PG concludes that the handbook is a good tool for the countries concerned. In order to ensure the usefulness of the handbook, not only now but also in the future, it is necessary to revise it regularly and extend it with new subjects. Furthermore, there is often a need for the European guidelines given in the COST 341 Handbook to be adapted to national conditions.

From the analysis of the strategic, institutional aspects, it seems clear that certain countries have more success in avoiding/reducing ecological fragmentation than others. It has also been noted that national institutional arrangements can explain a great deal of the differences between the countries. The PG concludes that institutional arrangements are of vital importance to some countries' success in reducing ecological fragmentation in a cost-effective manner. Also of importance are the established procedures for interaction within public administrations, especially between the national road administrations (NRAs) and the environmental protection agencies. Over the years, these have led to increased understanding and mutual acceptance. Countries where institutional issues do not seem to be a problem have road administrations that have engaged with or employed ecologists for years and consider ecological connectivity as part of their responsibilities.

Three ways forward are presented. These are:

- the do-nothing scenario ('business as usual');
- taking action at national level;
- taking action at national and European level.

The result of the analysis of the three ways forward is that it will be more cost-effective if CEDR assists the NRAs in adapting to a more successful integration of road networks and wildlife than if each country does this alone. The PG therefore recommends the third way forward, i.e. taking action at national and European level. The key factors are coordination, cooperation, and the sharing of knowledge and experience from countries with different natural and political conditions but successful implementation.

The PG has recommended that CEDR help the member states adapt towards a more cost-effective and sustainable way of integrating wildlife and road networks. This can be done by a) facilitating actions at national level in the member states ***and*** by b) taking the initiative for actions at European level.

The ***most relevant*** recommendations from the PG are that CEDR take the initiative to:

A. promote the updating of the COST 341 Handbook;
B. start a research programme for cost-effective mitigation measures. This could be based on EU financing or as part of ERA-NET ROAD[1];
C. support a European exchange of knowledge through existing international networks;
D. recommend CEDR members to consider actions at national level that lead to success when it comes to cooperation with other stakeholders and spatial planning authorities, as well as cooperation within the NRA as described in this report and in the report from Gifford. The NRAs can choose from the list of factors leading to success, according to the challenges and situation in their country. CEDR could also arrange a seminar for employees from the member states on factors leading to success to avoid continued increased costs due to project delays, reputational damage, and damage to wildlife;
E. deal with environmental items as performance indicators according to the indicators identified by CEDR's PG Performance Indicators; and
F. share knowledge about public private partnerships (PPP) (and other ways of contracting) regarding mitigating measures.

After approval of the final report by the Governing Board (GB), the PG will take the initiative to develop an implementation plan.

[1] http://www.eranetroad.org/

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3. Definition of the issue

Purpose

According to CEDR's second strategic plan 2009–2013 (SP2), the mission for this period is to contribute to future developments in road traffic and networks under the environmental aspects of sustainability; to provide a platform for understanding and responding to common problems; to develop an involvement in EU developments; to use the existing representations on relevant international groups for mutual benefit; and to make use of common understandings and research.

In order to fulfil the mission mentioned above, a PG on Wildlife and Traffic was approved. The goals for the group described in SP2 are to discuss and share knowledge, 'best practice', and experiences gained with different actions to reduce the impact of infrastructure on biodiversity in Europe.

This report *Mobility for humans and wildlife – cost effective ways forward* is the outcome of the work of PG Wildlife and Traffic.

The focus on this topic is very much in accordance with developments in political interest in the field of biodiversity and ecology, as can be seen through several international initiatives. The EU Commissioner for the Environment has made it clear that biodiversity is an area of priority. On 3 May 2011, the EU Commission announced a new strategy to halt biodiversity loss within ten years[2]. This strategy emphasises the severity of habitat degradation caused by fragmentation and the importance of incorporating ecological connectivity and green infrastructure into spatial planning. In November 2010, the UN and the parties to the Convention on Biological Diversity adopted a new Strategic Plan for Biodiversity 2011–2020, which also stresses the need to integrate biodiversity values into planning processes and for all stakeholders to keep the impacts on natural resources within safe limits. The UN General Assembly has declared 2011–2020 the Decade on Biodiversity.

Hence maintaining a green infrastructure in Europe is of equally great importance to the EU as maintaining and developing a transport infrastructure. Methods of combining these two goals should, therefore, be investigated and best practices should be identified.

[2] http://ec.europa.eu/environment/nature/biodiversity/policy/index_en.htm

Linear infrastructure and diverse spatial use cause landscape fragmentation
Copyright: Danish Road Agency

In particular, the EU Habitats and Birds Directives, and the EU Directives on Environmental Impact Assessment (EIA) and Strategic Environmental Assessment (SEA) influence the planning, construction, and maintenance of roads. For example, the Habitats Directive commits the NRAs to use the best scientific knowledge in environmental impact assessments. An integration of wildlife and other ecological issues during the early stages of the planning process is also an investment in the future, as the coherence of Natura 2000 sites is a major concern in the EU.

It is a fact that linear infrastructure has caused loss of biodiversity, and, with the increasing political interest in this topic, the challenge to national road directors will be to:

- integrate the different EU directives concerning biodiversity into the work carried out within the NRA or on behalf of the NRA, especially in the planning and construction phase, to minimise risks of expensive delays due to claims;
- find a reasonable balance between the provision of mitigation measures and the need for consideration of biodiversity (to avoid over- and under-provision of measures);
- utilise the possibility of additional gains when taking action to avoid damage to wildlife e.g. improving road safety;

- meet the goal of EU policy on road safety, which is to reduce the number of road fatalities on European roads by 50% over the next 10 years. In many parts of Europe, reducing the number of accidents involving wildlife while the number of large animals is increasing (or at the same level as today) is a challenge; and
- meet expectations due to increased engagement by the public and NGOs in preserving wildlife and conserving biodiversity.

PIARC is about to finish its report on *Monitoring of environmental impacts of roads*[3]. The focus is on current environmental monitoring practice and on identifying best practices in order to draw recommendations that can be applied to new and existing road infrastructure. The work of PIARC and the work done by PG Wildlife and Traffic supplement each other.

PG Wildlife and Traffic has been kept informed about the work done by the PG dealing with performance indicators and, where possible, this work has been taken into consideration in this report.

Scope

Within the available time frame, it was necessary for the PG to choose themes that could be treated comprehensively. The group adopted two main strategies for identifying solutions to reduce the impact of infrastructure on biodiversity:

1. Use of the COST 341[4] Handbook *Wildlife and traffic – A European handbook for identifying conflicts and designing solutions*.

2. Strategic, institutional aspects: best practice in the EU regarding road networks and wildlife.

The PG chose to work with these two themes as there is already a great deal of knowledge and experience across Europe, due to the fact that the COST 341 Handbook on this subject was published in 2003. The COST 341 Handbook recommends measures and planning procedures with the aim of conserving biodiversity and reducing vehicular accidents and fauna casualties.

In order to examine the usefulness and reveal the shortcomings of this handbook, the PG decided to analyse its use. By doing this, the investment already made in the handbook was secured, i.e. the money spent on making the handbook is not lost but in fact is secured.

It was clear from the first meeting of the PG that the member states had very different experiences regarding the issue of wildlife and traffic. In part, it was possible to trace this difference in experience to institutional aspects, which means the institutional framework within which provision of mitigation measures is placed. Therefore the focus was to explore how these institutional issues are being addressed across the EU and to discover examples of what seems to be best practice and the evidence for this. Analysis has also been made of the extent to which institutional aspects are of importance in the provision of wildlife mitigation measures.

By examining institutional aspects, the PG has examined the framework within which provision of wildlife mitigation measures are carried out and their cost-effectiveness.

[3] *Monitoring of environmental impacts of roads*, PIARC, draft Version 4 January 2011.
[4] Cooperation on Science and Technology.

Although it is of interest to identify knowledge about and experiences of the costs and benefits of specific mitigation measures, this aspect has not been analysed in this report because it was regarded more as a technical issue. The issue of cost-effective mitigating actions should therefore be addressed in a more technical report.

Methodology

The participants in the group come from central and northern European countries (Belgium-Flanders, the Netherlands, Austria, France, Germany, Sweden, Norway, and Denmark).

In order to obtain information and experience from a wider range of CEDR member states, the group sent out questionnaires and presented the work at two workshops at the Infra Eco Network Europe (IENE[5]) conference in Hungary with participants from all over Europe.

In addition, a consultant was appointed to undertake a study on the issue of conflicts between road networks and wildlife and, in particular, to investigate best practice in European countries regarding road networks and wildlife at a strategic/institutional level and the sustainability of measures taken.

Use of the COST 341 Handbook

The *Wildlife and traffic* Handbook was published in 2003 as a result of the COST 341 action: 'Habitat fragmentation due to linear infrastructure'. The handbook provides general advice on reducing the impacts of transport infrastructure on habitat fragmentation.

The use of and experiences with the handbook were analysed on the basis of a questionnaire sent to CEDR member states. The raw data from the questionnaire is presented in Appendix 1. A total of 22 countries (85%) completed the questionnaire. The responses identified how the handbook was used as well as areas for improvement. A presentation of the results from the questionnaire was given at a workshop at the IENE conference in Hungary in September 2010. It should be noted that the conference attracted more than 200 people from all continents (with a strong concentration on European countries), representing stakeholders with views and experiences that differ from those of the NRAs.

The discussion of the results presented at the workshop provided valuable input to the analyses and the work of the PG as a whole. In addition to this, the IENE network has to a certain extent been used as a reference group.

Using the skills and experience of the members of the PG, the input from the questionnaire replies, and the response at the workshop, the PG discussed and analysed ways forward. Their conclusions and recommendations are presented below.

Strategic, institutional aspects – best practice in the EU regarding road networks and wildlife

PG Wildlife and Traffic began by comparing experiences from the countries participating in the PG and obtaining some initial hypotheses of parameters for success, which mainly dealt with institutional aspects.

[5] http://www.iene.info/. IENE is an informal network of experts from, among others, academia, government and consultants.

However, we realised that our own knowledge was not sufficient in order to verify these hypotheses. Therefore the consultant Gifford was engaged to conduct a survey to reveal the actual situation in European countries. The methods used were a questionnaire and in-depth interviews.

The questionnaire was distributed in CEDR member states as well as other countries. It was sent to 260 individuals representing road administrations, planning authorities, nature conservancy organisations, researchers, and consultants. There were contributions from 19 CEDR member states and 10 countries outside Europe. A total of 71 responses to the questionnaire were received.

In addition to the information from the questionnaire, in-depth interviews were also conducted in the Netherlands, Hungary, Spain (Catalonia), and the UK. The reason for this was the additional need for qualitative data. Gifford undertook one interview in each country with groups or relevant employees, including people from the road administrations, NGOs, scientists, and consultancies from the respective country.

The reason for choosing these countries was that the Netherlands has a long history and a great deal of experience in this field. Hungary is an eastern European country with impressive competency in this field. Spain has developed a modern infrastructure where ecology has played an important role and represents the south of Europe. The UK has worked with new procurement methods, involving public private partnerships (PPP), which may change necessary approaches to road ecology planning.

The work of Gifford also included a presentation at the workshop in Hungary. The purpose of this presentation was to obtain useful comments and suggestions from a broader audience of experts on how to deal with institutional aspects regarding habitat fragmentation caused by linear infrastructure.

The results of the questionnaire, the in-depth interviews, and the workshop at the IENE conference are presented in a report (appendix 2) where the implications of the findings of the research are discussed and some recommendations for best practice are proposed.

4. Results and a discussion of possible ways forward

To address the issue of cost-effective ways forward in mobility for humans and wildlife, the PG used the results of the analysis of the use of the COST 341 Handbook as well as the analysis of the institutional aspects.

This chapter will provide a short summary of the results of the two analyses and present three possible ways forward.

4.1. Outcome of the analysis of the use of the COST 341 *Wildlife and traffic* Handbook

One of the conclusions from the responses to the questionnaire is that the COST 341 *Wildlife and traffic* Handbook is useful for national road administrations. Altogether, 10 CEDR member states[6] have translated the handbook into their own languages and adapted it to the specific situation in their country. Twelve countries have not commissioned a translation, mainly because the English version is workable or a national handbook was already available.

[6] Nine countries in 2004–2007; one country in 2010.

The handbook is used in the design of mitigation measures for solving conflicts between wildlife and transportation infrastructure. It is a source of ideas for solutions and can be used as a basis for national standards. It is used both in EIA processes as well as during construction; hence it is used by consultants, planners, and designers.

In some cases, a number of themes were added or extended in the national, translated versions, for instance technical details, regional or national circumstances, and additional target species.

In many countries, it is an ongoing challenge to obtain the latest and most up-to-date information, based on the most recent research and knowledge, for use in national standards and guidelines (for example, designs for bridges and culverts, safety, inspection and maintenance, dimensions, materials, etc.).

The PG concludes that the handbook is a good tool for member states. However, in order to ensure the usefulness of the handbook in the future, it is necessary to revise it regularly and add new subjects to it. There is also often a need to adapt European guidelines given in the COST 341 Handbook to national circumstances.

The respondents to the questionnaire and participants in the IENE workshop came up with a list of subjects that would be useful if added or extended in the handbook:

- European policies, laws, and directives;
- the integration into the planning procedure of mitigating actions in order to avoid the creation of extra barriers to wildlife and the focus on traffic safety;
- target species from the EU Habitats Directive Annex 4 species, such as bats, but also birds, carnivores, reptiles, and insects (ground beetles, butterflies, and dragonflies);
- planning issues such as the number of passages per length of infrastructure, role of verges, and advice for cost-effectiveness;
- the updating of the technical details of measures;
- standards for maintenance;
- standards for monitoring use and effects on wildlife populations;
- scientific knowledge for mitigation measures, such as cumulative impacts of two or more projects, differences in ecosystems and national circumstances, and interaction between species;
- recommendations for recreational and agricultural shared use of fauna passages, and other ways to involve the local communities;
- the cost-effectiveness of mitigation measures.

The respondents to the questionnaire suggested several ways of improving the format of the handbook. For instance, it should be digital so that it is easy to use, distribute, and update. From the discussions at the workshop at the IENE conference it was clear that the participants feel it is necessary that someone (either a person or an institution) is responsible for the update. IENE was mentioned as one possibility.

4.2. Outcome of the analysis of strategic, institutional aspects: best practice in the EU regarding road networks and wildlife.

The result of the research on strategic, institutional aspects[7] demonstrates that there are substantial differences in the approach to ecological fragmentation and roads across the EU. These differences can be directly attributed to the institutional arrangements in each country.

Of the people who responded to the questionnaire, 70% think that current policies and guidance are not effective in preventing conflict between road networks and ecological networks. A total of 75% of respondents find institutional issues problematic in terms of the delivery of measures to avoid or reduce the ecological fragmentation effects of roads.

Differences in institutional arrangements can explain many of the differences between the countries. One of the PG's conclusions is that this is of vital importance for some countries' success in reducing ecological fragmentation in a cost-effective way.

The following factors were identified as best practice that leads to a successful integration of wildlife and road networks:

- Awareness of the issues and public or local involvement.
  The public awareness of ecological issues or ecosystem services varies across the EU. In the Netherlands, the reason given for why provincial governments accept the need for measures is that a National Ecological Network (*Ecologische Hoofdstructuur*) exists and local people understand and accept this approach.

- An ecological network that can be used, among others, by the NRA as a basis in spatial planning.
  It can be used to understand where key elements of the networks are located and furthermore to find effective approaches to a successful integration of wildlife and road networks. An ecological network can be used to assist in route selection at the earliest opportunity. This allows conflicts at project level to be avoided (or at least predicted). The Dutch National Ecological Network, for example, is recognised as material in spatial planning. The emerging Catalan Connectivity Sectoral Plan will be defined in legislation and will be recognised as material in spatial planning. Other countries such as Belgium, Denmark, and France also use mapped ecological networks for planning purposes.

- An overall strategy based on national and European legislation.
  In the Netherlands, having an overall ecological defragmentation programme in place is felt to be an important factor in delivering defragmentation measures. Several countries around Europe do have defragmentation programmes that focus on the existing road network, e.g. Switzerland, Germany, and Austria. EIA practitioners and ecologists consider such overall strategies to be a key tool in addressing ecological fragmentation. In countries that do not yet have an overall strategy, experts felt that it would be preferable to have a national strategy for ecological fragmentation approved by road and nature conservation administrations so that conflicts can be addressed at the planning level rather than on every project.

[7] *EU best practice wildlife and traffic*, Gifford. Report no. 18187. April 2011 (see Appendix 2).

- Use of the COST 341 Handbook as a basis for national guidelines or national standards.
  The COST 341 action to produce national 'state of the art' reports can be viewed as a driver of good practice and has led to varying degrees of acceptance of the principles in the handbook and the adoption of these principles in CEDR countries. For example, in Spain, the action has led to a regular multi-party Working Group on Habitat Fragmentation due to Transport Infrastructure. This working group has produced technical prescriptions for the design of fauna passages and other guidance, which are adopted as standards in some of the autonomous regions of Spain.

- Good collaboration with nature conservation administrations and other stakeholders.
  The research identified several examples of cooperation between stakeholders leading to successful delivery of practical measures, for example, the German Konjunkturpaket II project of 18 ecoducts delivered by the road administration, nature conservation administration, and NGOs.
  In Belgium-Flanders, all fauna bridges are co-financed by the Road Administration and the Ministry of the Environment; the Kikbeek Ecoduct in the Flemish region of Limburg was cited in a questionnaire response as a project that was delivered in conjunction with the local community.
  It was noted in the Netherlands that having a high-level agreement to fund measures in place (for instance from the Road and/or Nature Conservation Administration) means that funding issues do not usually result in conflict or delay at project level. In contrast, in England, where no such framework exists, every project involves the resolution of conflicts between engineers and ecologists about the type of measure that can be included.

- Utilisation of synergy effects with other objectives such as traffic safety, water management, spatial planning, agricultural and recreational objectives, and adaptation to climate change.
  For instance, the costs associated with the implementation of defragmentation measures may be associated with ecosystem services (the benefits society gains from ecosystems, which include providing and regulating ecosystem or cultural services that directly affect people and the supporting services needed to maintain other services).

- Long-term commitment and continuity to ensure that commitments are effective on a long-term basis.
  In some countries, the commitments made in EIAs have not been met, and there is no mechanism in place to check that measures have been implemented or to enforce delivery. In such cases, there is a clear need for a system to ensure commitments are met and transferred to the maintaining agent, and to ensure that funds for biodiversity measures are not used for other purposes. This happens, for example, in Spain (Catalonia) and Hungary where the EIA declaration is a legal obligation (the delivery of which is monitored in Catalonia for two years by an independent monitoring commission made up of road and environmental administration representatives).

The overall conclusion on best practice is that countries where institutional issues do not seem to be a problem have road administrations that have engaged with or employed ecologists for years and consider ecological connectivity as part of their responsibilities. Also of importance are the established procedures for interaction within the public administrations, especially between the NRA and the environmental protection agencies. Over the years, these interactions have led to increased understanding and mutual acceptance.

4.3. Three ways forward

Three possible strategies for road directors are considered in the section that follows. These are: i) do nothing (business as usual) ii) action at national level and iii) action at national and European level.

i. The do-nothing scenario ('business as usual')

One possible way forward is to continue as usual. Many European countries do quite impressive work, both in road investments and in retrofitting, i.e. defragmentation programmes. The last 10 years have led to increased knowledge both of the needs of wildlife and of effective mitigating actions. However, the situation across Europe varies significantly. The existing practice of devising solutions at national level has not been very cost-efficient. This scenario will thus not be very efficient in reducing the conflicts between wildlife and human mobility.

A scenario with ongoing conflicts between wildlife and roads demands preparedness in the NRAs to meet external pressures, especially from environmental agencies. It will influence road planning and flexible planning will be needed. Conflicts will result in the demand for new solutions in the planning process and the NRA will have to accept that some projects will be stopped or delayed. Many examples in Europe show that road projects can be very costly due to these conflicts. The do-nothing scenario also leads to a need for good ecological competence within individual projects, in order to facilitate dialogue between the actors in conflict, e.g. on mitigating measures.

This way forward demands a lot of resources in order to meet increased interest in biodiversity and ecology and the conflict arising from the locating and construction of roads. Due to a lack of good knowledge, over-investment in mitigating actions or investment in mitigating actions that are not efficient does occasionally occur. It is also a problem that lack of knowledge leads to poor maintenance and loss of function.

ii. Taking action at national level

The studies undertaken have shown that different European countries have different approaches to the challenge of mobility for humans and wildlife. The initial situation and circumstances differ between countries. Furthermore, most of the actions have to be taken at national or regional level. For this reason, the national level is an important way forward.

The PG has been able to identify several factors that lead to success, but the potential will depend on the conditions in each country. In the Netherlands, a country that possesses a strong tradition of joint landscape planning, it is easier to have an area-oriented approach (see below) than in countries like Sweden, which has a sector-separated approach.

The actions that need to be taken can be divided into three major themes:

Planning:

- The establishment of a common understanding of the problem and opportunities within the road administration (as in the Netherlands). The COST 341 Handbook can be used as a basis.
- The provision of a good starting point for planning by having a common understanding of a defined ecological network (as in Denmark, France, Austria, Belgium-Flanders). This is a way of avoiding over-investment in expensive mitigating measures without having real knowledge of the effects on populations.
- Use of an area-oriented approach, i.e. collaboration with spatial planning authorities and other stakeholders (as in the Netherlands). Seeking Interreg funding from the EU might be a way of increasing interest in and knowledge about the subject.
- Use of a strategic plan to decide about investment in mitigating actions rather than an ad hoc approach on each project. Hence the effects of the project will be assessed by taking into account the qualities and characteristics of the surrounding landscape and spatial use (agriculture, infrastructure, waterways, ecological network, natural areas, cities, etc.). By using a broader perspective, it will be possible to assess the project on a larger scale and not only the project on its own.

CEDR can facilitate the transformation towards more cooperation with other stakeholders and spatial planning authorities by producing a catalogue of the factors leading to success from which the NRAs can choose. CEDR could also arrange seminars on this subject.

Action within the national road administration:

- Improvement of coordination within the road administrations (planning, constructing, maintenance, and monitoring);
- hire employees within the NRAs with ecological skills;
- ensuring better follow-up on contractor performance (has the mitigation measure been constructed at all and if so, has it been constructed in a way that is suitable for wildlife?); and
- with PPP and other contracts it is important to describe the goal of the mitigation measures in quality terms (what is the purpose of the mitigation measure) rather than technical terms/requirements.

CEDR can help the member states learn from each other in this area. Several countries have experience of different ways of contracting. How to make the most of the money spent is an area where knowledge and experiences need to be shared between countries, e.g. by establishing a CEDR working group on the subject. An updated COST 341 Handbook would be important, both as a basis for standards and as a tool for monitoring effects.

Synergy effects with other target areas:

- If one action can contribute to achieving more than one objective, this obviously increases the cost-benefit ratio, and a given budget will result in a higher number of mitigation measures. For example, cycle paths, agriculture or forestry passages combined with fauna passages.

- In the future, road user demands will have a stronger influence on road construction and operations. It is possible to plan actions aimed at increasing the benefits for road users at the same time as enhancing ecological sustainability. For instance, in many countries fauna passages and fencing are implemented primarily for road safety reasons, even though they benefit road ecology issues as well. In Sweden, it has been found that ordinary road users appreciate a road that is in harmony with the surrounding landscape. In fact this was the strongest parameter in determining the overall assessment by road users of road quality. Several examples can also be found when an attractive landscape around the road will benefit tourism etc.

CEDR can help member states to learn from each other in this area.

iii. Taking action at national and European level

The third way forward is to take action at both national and European levels. There are several actions that can be taken besides those mentioned above in section ii) Action at national level:

- continuously updated guidelines or standards for best practice. This could be done through collaboration with other organisations;
- European cooperation for a research programme for cost-efficient mitigation strategies leading to a guideline for mitigation and for standardised monitoring. It could be in the form of EU-financed research or ERA-NET ROAD collaboration or a combination;
- standardisation of mitigation measures. One part of this action is updating the COST 341 Handbook and standards; and
- analysis of the extent to which the Natura 2000 sites function as a network. This is most likely outside the direct scope of an NRA. Other agencies should be leading this work but the competence of NRAs should be included so that the need for good transport solutions for humans are also included in the analysis.

CEDR can help member states by supporting an update of the COST 341 Handbook, a research programme for cost-effective mitigation strategies, and an international non-governmental organisation that can undertake the compilation of standards and guidelines, for instance IENE.

5. Comparison of ways forward

5.1. Doing nothing (the 'business as usual' scenario)

In light of the recognition of the significant impacts of roads on wildlife due to fragmentation, a strategy of continuing as usual will not meet future challenges.

By using the COST 341 Handbook as it is, i.e. without updating it, the NRAs run the risk of increased costs due to project delays and reputational damage. In addition, it will, of course, ultimately be detrimental to wildlife if NRAs continue to use the material in the handbook when it is no longer the state of the art in scientific knowledge.

Existing networks, such as IENE, cannot be relied on because the network will not be financially supported in the 'do nothing scenario'.

PG Wildlife and Traffic cannot recommend this way forward because using at least one of the two other ways forward (or using them in part) would be more cost-effective and sustainable. The do-nothing approach represents a missed opportunity to embrace some of the lessons of best practice developed by some countries.

Societally: it will lead to no improvement.

Economically: it may seem attractive in the short term, however, European experiences have shown that conflicts with ecological interests lead to project delays and thereby higher costs.

Environmentally: reduced biological diversity, not sustainable.

5.2. Taking action at national level

Taking action at national level involves relatively easy objectives, such as better coordination, cooperation, and communication. It should be within the power of administrations to do this.

A country can be most effective in addressing the issue of defragmentation and roads in those cases where a problem with fragmentation issues has been defined and a mechanism (such as a national ecological network, which is recognised as material in spatial planning) has been implemented to deliver the necessary measures in road projects.

The national-level scenario consists of a list of opportunities from which each country can choose.

The PG recommends that CEDR helps member states improve their performance by choosing from this list, as this will be more cost-efficient and sustainable than the 'business as usual' scenario.

Societally: the benefit for society is better traffic safety, a better experience when driving on the road (pleasant scenery), increasing deer populations leads to an increased recreational use by the public and hunters (more deer to see and hunt), and better coordination with human pathways and cycle routes etc.

Economically: demands more resources in the early stages of road planning (strategic level) and the stages before individual projects are implemented (overall landscape use strategy). Experiences show that additional benefits will be obtained at later stages due to a lower risk of delays and over-investment in mitigating measures. To obtain this benefit, it will be necessary to have sufficient resources in the early stages of the planning process.

Environmentally: sustainable integration of wildlife and traffic at local, regional, and national level. However, as countries act alone, this way forward is not sufficient for being sustainable from an overall and long-term point of view. It is, nevertheless, more effective than the 'business as usual' scenario.

5.3. Taking action at national and European level

This approach includes the national-level scenario, as most countries will gain the best outcomes by combining the European way forward with the national way forward (or parts of the national way forward).

Action at European level has the advantage that it can inform and guide the behaviour of EU countries through the sharing and promotion of good practice, whereas countries acting alone would not benefit from shared experience. The recommended action at national and European level is largely in knowledge sharing, cooperation, and standardisation of approach, for example, revision of the COST 341 Handbook. As such, this approach is likely to be cheaper and require fewer resources than the national-level strategy, although there would be clear environmental benefits and feedback that would ensure more efficient engineering solutions.

Societally: the benefit for society may be a higher level of traffic safety, a better experience when driving on the road (pleasant scenery), more deer, better coordination with human pathways and cycle routes etc.

Economically: shared costs will reduce total costs. Standards and guidelines can lead to more cost-effective approaches/solutions.

Environmentally: synergy effects from learning from each other. Cooperation is very important for cross-border areas and in relation to animals with large habitats moving long distances and not respecting national borders.

5.4. Scoring table

Scale 1–3, where 3 is the highest score.

	Societally	Economically	Environmentally
Do-nothing approach	1	1	1
National approach	3	2	2
National + European approach	3	3	3

6. Conclusions

From the analysis it seems quite clear that certain countries are more successful than others in avoiding/reducing ecological fragmentation due to linear infrastructure.

It would be more cost-effective if CEDR were to help NRAs adapt to a more successful integration of road networks and wildlife by improving European cooperation than if each country were to do so on its own. Combined action at national and European level is, therefore, the most favourable way forward. The key factors are coordination, cooperation, and sharing of knowledge and experience from countries with different natural and political conditions but nevertheless with successful implementation.

The PG has recommended that CEDR assist member states in moving towards a more cost-effective and sustainable integration of wildlife and road networks. This can be achieved by a) facilitating actions at national level in each member state ***and*** b) by taking the initiative to carry out necessary activities at European level.

Therefore the ***most relevant*** recommendations from the PG are that CEDR take the initiative to:

A. promote the updating of the COST 341 Handbook;
B. start a research programme for cost-effective mitigation measures. This could be based on EU financing or as part of ERA-NET ROAD;
C. support a European exchange of knowledge through existing international networks;
D. recommend that CEDR members consider actions at national level that lead to success when it comes to cooperation with other stakeholders and spatial planning authorities, as well as cooperation within the NRA as described in this report and in the report from Gifford. NRAs can choose from the list of factors leading to success, according to the challenges and situation in their country. CEDR could also arrange a seminar for employees from the member states on factors leading to success to avoid continued increased costs due to project delays, reputational damage, and damage to wildlife;
E. deal with environmental items as performance indicators according to the indicators identified by the PG on Performance Indicators; and
F. share knowledge on PPP (and other ways of contracting) regarding mitigation measures.

After approval of the final report by the GB, the PG will take the initiative to develop an implementation plan.

As there is no doubt that the challenge of integrating wildlife and traffic in a sustainable way will become greater in the future, the CEDR Wildlife and Traffic group cannot recommend do-nothing (the 'business as usual' approach). Despite the fact that some European countries are currently doing quite well, the risk associated with this approach is expensive project delays. There is also a risk of over-investment in mitigation measures or investment in measures that are not effective, as they are not planned, constructed, or maintained according to the latest scientific findings and experiences.

7. Budget for proposed actions

Budget for financing the recommendations above for the upcoming four years:

	Amount	Financed by
Revise the COST 341 Handbook on Wildlife and Traffic	€200,000	EU or member states
European exchange of knowledge	€110,000	Member states
European research programme	€2,000,000	EU or member states

APPENDIX 1: Questionnaire

Responses to the questionnaire on the COST 341 Handbook *Habitat fragmentation due to transportation Infrastructure* and *Wildlife and traffic – a European handbook for identifying conflicts and designing solutions*, as well as other guidelines in this area.

1. General: several countries have translated COST 341 into their own languages and adapted it to the specific situation in that country

1.1 Has your country produced such a translation?

Austria	No
Belgium-Wallonia	No
Belgium-Flanders	Yes, the relevant parts of the handbook have been translated and adapted to the Flemish situation. It can be consulted on the administration's Intranet. Communities and consultancy agencies can consult it on the administration's public website.
Cyprus	It does not appear that the handbook has been translated into Greek.
Denmark	No
Estonia	No/Yes
Finland	FinnRA produced its own handbook in Finnish simultaneously with the COST 341 Handbook. The draft of *Habitat fragmentation* was used to complete the Finnish version.
France	Yes http://www.setra.equipement.gouv.fr/Faune-et-trafic.html
Germany	No
Hungary	Not an exact translation, rather an adaptation of certain chapters of the handbook. Thus two technical guidelines for roads were prepared (one for fauna passages, one for protective fences)
Iceland	No
Ireland	No
Latvia	As far as we know, no translation into Latvian has been produced.
Lithuania	It has not been translated as COST 341; it has been used as one of the main information sources for the creation of more detailed Lithuanian standards.
Netherlands	Yes, *Leidraad faunavoorzieningen bij Wegen* (in Dutch). It can be found at www.mjpo.nl under publications. There is a hard copy in a folder/ring binder.
Norway	Yes, in the handbook series of the Norwegian Public Roads Administration. HB 242 *Veger og dyreliv*
Poland	No
Portugal	No
Spain	Yes
Sweden	Yes, it was one of several sources for the national handbook.
Switzerland	No
UK	Being written in English, the document can be consulted by UK designers. There has been no urgency to issue a passage in the *Design manual for roads and bridges*.

1.2 If not, why not?

Austria	Most people in Austria understand English.
Belgium-Flanders	
Belgium-Wallonia	Not necessary.
Cyprus	Not sure why this was not done or who was responsible for translating the handbook.
Denmark	The national guideline was published just three years before COST 341 and is well implemented in our work. A revision of this guideline is just about to begin, and COST 341 will be integrated in the revised guideline.
Estonia	So far we have managed with the English version and it has been acceptable for both consultants, such as environmental experts and road designers, as well for road authorities. The Estonian Road Administration in conjunction with the Estonian Naturalists' Society is currently preparing *Wildlife and traffic in Estonia. Handbook for conflict management and technical solutions for avoidance, mitigation and compensation measures*, which is based mostly on COST 341.
Finland	
France	
Germany	Germany was not involved in the development of COST 341.
Hungary	
Iceland	Wildlife has not been a problem for traffic in Iceland
Ireland	The 2003 English-language version of *Cost 341 Habitat fragmentation due to transportation infrastructure* was referred to in the production of the National Roads Authority's *Environmental assessment and construction guidelines*.
Latvia	In case of necessity, the English version may be used. In addition to that, there are only a few new road projects, therefore the need is not particularly great.
Lithuania	If translated in its original format, it wouldn't have any legal status, and opportunities for its use would be minimal.
Netherlands	
Norway	
Poland	There was no need to translate it. The new version will be probably translated.
Portugal	Unknown.
Spain	
Sweden	
Switzerland	Because most of the content of the COST 341 Handbook resembles the Swiss national State of the Art report in native language (preceding the COST 341 Handbook) and content was used for Swiss standards.
UK	See above. A draft DMRB Advice Note has been prepared and will be issued in 2010-2011 FY.

1.3 When was/is your version published?

Austria	
Belgium-Flanders	2004 (websites)

Belgium-Wallonia	
Cyprus	
Denmark	
Estonia	It will be published in 2010.
Finland	The version was published by FinnRa 2003. *Väre Seija, Huhta Marjaana and Martin Anne 2003 Eläinten kulkujärjestelyt tiealueen poikki* (The facilities for animal movements across highways and roads) FinnRa publications 36/2003
France	September 2007.
Germany	
Hungary	2007
Iceland	
Ireland	N/A.
Latvia	
Lithuania	It has been produced, but not published yet.
Netherlands	Published May 2005. Based on the COST 341 Handbook and our former handbook from 1995. An update has been started with new information based on research, experiences, new solutions, failures, and upcoming points for attention (monitoring focused on effectiveness of measures). There is also a need to update the handbook to bring it in line with the new style of contracts.
Norway	2005
Poland	N/A
Portugal	
Spain	2005
Sweden	2006
Switzerland	
UK	See above

1.4 What was added to your version that wasn't in the original version?

Austria	In Austria, a similar study about fragmentation caused by motorways and its minimisation was produced und published in 2001 (VÖLK et al. 2001, *Kostenreduktion bei Grünbrücken durch deren rationellen Einsatz; Kriterien – Indikatoren – Mindeststandards*). Further studies and the later published guidelines were based on this first study. It was also used as background for the COST 341 handbook.
Belgium-Flanders	We added pictures of measures implemented in Flanders and we added national specifications for some measures (e.g. fences, guiding walls for amphibians). Irrelevant fauna passages were dropped. There are no bears or moose in Flanders.
Belgium-Wallonia	Nothing.
Cyprus	
Denmark	

Estonia	The Estonian version of the handbook will include chapters about avoidance, mitigation, and compensation measures for birds, bats, and pollinators (butterflies and bees). In addition, all mitigation measures provided in COST 341 will be adapted to the Estonian/Nordic situation. The consultant will also analyse other European and North American guidelines on the subject and will provide best practice in the Estonian document.
Finland	The planning measures and standards were adapted to Finnish conditions.
France	We have added a paragraph about the COST 341 handbook.
Germany	-
Hungary	The animal species were classified and subgrouped at family level and groups were formed according to the needs of the subgroups (families) in relation to the fauna passage types.
Iceland	
Ireland	N/A.
Latvia	
Lithuania	The Lithuanian version is more technically detailed and intended for road designers.
Netherlands	Adaptation to the Dutch situation (low land without mountains; situations with peat and high water tables; fauna present in the Netherlands). Experiences (shared use of civil works). Extra information concerning typical Dutch concerns.
Norway	Winter conditions, wildlife fences, and moose were given more attention. A few relevant animal species were described. Norwegian examples added.
Poland	N/A
Portugal	
Spain	
Sweden	The most significant is chapters about animals affected by infrastructure and traffic and one about management and maintenance.
Switzerland	
UK	The DMRB Green Bridges Advice Note is structured to meet UK conditions, project types, and potential for connectivity.

1.5 How was your version or the original one distributed within your country?

Austria	A printed version of the above-mentioned study was published by the FSV (Austrian Association for Research on Road, Rail, and Transport).
Belgium-Flanders	The original version was distributed at the IENE congress in Brussels, where the most relevant Flemish representatives (administrations, communities, provinces, scientific organisations, NGOs, and consultancies) were present. Information about the Intranet and Internet version was communicated during several presentations and meetings.
Belgium-Wallonia	In the normal way.
Cyprus	
Denmark	
Estonia	The final document will be distributed via the website of the Estonian Road Administration. A print version may be produced in the future.
Finland	The Finnish version was distributed to road planning and environment authorities, consultants, and NGOs. The COST version was distributed to Helsinki University Scientific Library and Helsinki University of Technology Main Library.

France	Internet download.
Germany	
Hungary	The two technical guidelines for roads are accessible as they are public documents.
Iceland	
Ireland	N/A.
Latvia	We found out about it at international meetings and conferences on the environment and have also had personal contacts with Mr Hans Becker from the Netherlands, who is one of the developers of COST 341.
Lithuania	It has not been published yet.
Netherlands	Within the road administration, accompanied by a letter that stated that the handbook was obligatory. Distributed in hard copy to involved and related organisations. Available on public website.
Norway	Disseminated throughout the organisation of the NPRA, through regional meetings with other stakeholders, and sent out to educational institutions.
Poland	N/A
Portugal	Unknown. Access through Internet.
Spain	A book has been produced. It is on sale and is also available on the Internet. http://www.mma.es/portal/secciones/biodiversidad/desarrollo_rural_paisaje/fragmentacion_rural/pdf/fauna_trafico_2005.pdf
Sweden	It is published on the Internet; hardcopies were distributed within the Swedish Road and Railway Administrations and also to authorities involved in infrastructure planning.
Switzerland	Standards for wildlife and traffic are given out by the Swiss Association of Road and Transportation Experts (VSS).
UK	Copies of the COST 341 Handbook were distributed within the Highways Agency and it was recommended to design consultants as a reference document.

1.6 Has your country got other national guidelines on this topic not based on COST 341?

Austria	We do have guidelines called RVS (Guidelines for the design, construction, and maintenance of roads) dealing with the avoidance or minimisation of habitat fragmentation due to transportation infrastructure (*RVS 04.03.12 Wildschutz*). Another guideline deals with the evaluation of the impact on wild mammals (*RVS 04.03.14 Schutz wildlebender Säugetiere (ausgenommen Fledermäuse)*). The ministry also released a directive including monitoring of fauna passages and defragmentation of the existing motorway network.
Belgium-Flanders	A limited version existed before the COST handbook. Afterwards, it was adapted on the basis of the handbook.
Belgium-Wallonia	No
Cyprus	
Denmark	Yes, '*Fauna and human passages – a guideline*', Danish Road Agency, October 2000.
Estonia	No
Finland	Yes, by Centres for Economic Development, Transport and the Environment (ELY-keskus), water authorities and game and fisheries research (RKTL).
France	*Facilities for small fauna, 2005, technical guide, 2005* http://www.setra.equipement.gouv.fr/Technical-guides.html*Natura 2000, impact assessment principles for land transport infrastructures, information note, 2007* http://www.setra.equipement.gouv.fr/IMG/pdf/US_NI_EEC_78_GB.pdf Not translated:

	- *Mesures de limitation de la mortalité de la chouette effraie sur le réseau routier, information note,* 2006. - *Les mustélidés semi-aquatiques et les infrastructures routières et ferroviaires -Loutre et vison d'Europe*, 2006. - *Clôtures routières et faune, critères de choix et recommandations d'implantation, information note*, 2008. - *Chiroptères et infrastructures de transports terrestres, menaces et actions de préservation, information note*, 2010. - *Rapport bibliographique, Routes et Chiroptères, état des connaissances*, 2008. - *Actes de colloque – 4ème rencontres Routes et faune sauvage, infrastructures de transport et petite faune*, 2008. - *Route et passage à Faune, 40 ans d'évolution, Guide technique*, 2006.
Germany	Yes, guidelines for the construction of crossings for animals and habitats on roads.
Hungary	There are several national standards about fitting buildings and structures into nature conservation areas, and one standard about the establishment of fauna passages crossing public roads.
Iceland	
Ireland	The NRA has produced a series of documents entitled *Environmental assessment and construction guidelines* (see http://www.nra.ie/Environment/). A number of the guidelines, including the *Guidelines for assessment of ecological impacts of national road schemes; A guide to landscape treatments for national road schemes in Ireland;* and *Ecological surveying techniques for protected flora and fauna during the planning of national road schemes* were written with regard to COST 341.
Latvia	
Lithuania	COST 341 was used as one of the information sources for Lithuanian standards on this topic.
Netherlands	Yes. 1. A small handbook for maintenance: typical points of note for each type of measure, target species, frequency/time of inspection, photos with good and bad examples. 2. We use guidelines for measures to enable fauna to pass canal embankments made of sheet piling. A guideline for monitoring the use of fauna passages
Norway	No
Poland	No
Portugal	The Instituto da Conservação da Natureza e da Biodiversidade, I.P. (ICNB) (Institute for Nature Conservation and Biodiversity) has a guidelines manual for infrastructure mitigation (in Portuguese).
Spain	
Sweden	Yes, but integrated into other guidelines.
Switzerland	All our guidelines are based on COST 341. Amphibian guidelines are much more detailed and go further.
UK	Yes. Within Volume 10 DMRB.

1.7 Other information

Austria	
Belgium-Flanders	
Belgium-Wallonia	

Cyprus	
Denmark	
Estonia	
Finland	
France	
Germany	Research report on the use of green bridges and other structures for mammals crossing. Leaflet on roads and animals.
Hungary	
Iceland	
Ireland	
Latvia	
Lithuania	
Netherlands	The handbook is sometimes part of the contract as background/source for implementing fauna measures.
Norway	Some parts of the handbook were also integrated into other relevant handbooks and guidelines in the NPRA (wildlife fences, vegetation clearing, etc.).
Poland	In Poland, a book was produced by the Mammal Research Institute of the Polish Academy of Sciences Białowieża entitled *Animals and roads. Methods of mitigating the negative impact of roads on wildlife.*
Portugal	
Spain	A working group has been established based on COST 341. They published several guidelines: *Prescripciones Técnicas para el diseño de pasos de fauna y vallados perimetrales* (2006) *Prescripciones Técnicas para el seguimiento y evaluación de la efectividad de las medidas correctoras del efecto barreta de las infraestructuras del transporte* (2008)
Sweden	
Switzerland	
UK	Attached a draft design manual for roads and bridges

2. Gaps, mistakes, use, experiences

The handbook was written between 1998 and 2002 with the knowledge and ideas of the time. Since that time, knowledge and experiences related to the topic of de-fragmentation have developed rapidly. Some of these experiences are important for use in an update of the handbook. On the other hand, there may be elements which are missing.

2.1 Which subjects are missing? For example, cost-effectiveness, (group of) species, durability of measures, tools, experiences, literature, standards, etc.)

Austria	The new state of the art, best practices, and experiences of recent years should be included.
Belgium-Flanders	Use (effectiveness) of measures related to the type of environment. Planning tools in other countries. Pure technical and planning information for engineers. How to deal with compensation measures assigned after EIA or appropriate assessment. How to integrate accompanying measures into the surrounding landscape. Cooperation with spatial planning and land users. Cost-benefit analysis.
Belgium-Wallonia	Cost-effectiveness.
Cyprus	
Denmark	Bats, insects. Role of verges, maintenance, cost-efficiency, cumulative effects, efficiency on a population level, area-oriented approach, spatial planning, integrating the planning of infrastructure (roads) and nature .
Estonia	As mentioned before, we found that some of the important groups of wildlife (birds, bats, etc.) were not covered by COST 341. Furthermore, the subject of cost-effectiveness may need further development, with clear examples. In addition, all paragraphs on mitigation measures (over- and under-passages, fences, etc.) could include some 'Dos' and 'Don'ts', based on real experiences—both good and bad. There must be a great deal of new experience that could be added in a new version of COST 341.
Finland	As structures are expensive, we still need arguments to justify the need for green bridges, small animal passages, etc., comparison of alternatives, cost-effectiveness experiences of different types, planning measures, and standards.
France	
Germany	No knowledge.
Hungary	More details on the density of fauna passages are needed. A practical approach to cost-benefit analysis would also be useful.
Iceland	
Ireland	The NRA's *Environmental assessment and construction guidelines* cover the vast majority of issues covered by the COST 341 Handbook. The NRA would be keen to improve the cost-effectiveness of ecological mitigation. It also promotes 'joined-up' thinking, encouraging those involved in the planning and design of national road schemes to consider whether farm underpasses etc. could be used to reduce fragmentation. It also promotes 'ecological landscape design' to ensure that ecological issues and habitat fragmentation are considered in the design of landscapes. Standards and specifications in relation to ecological mitigation measures are limited, e.g. we have Road Construction Details in relation to mammal-resistant fencing and otter and badger underpasses, but other mitigation would be designed on a more ad hoc basis during detailed design.
Latvia	
Lithuania	COST has been developed as recommendations for all of Europe, but it has little or no data about possible differences in ecosystems, occurring animal species, climate and other regional differences, which might influence possible impacts and selection of

	mitigation measures. For example, cattle grids in warm climate regions are more effective than in countries with long-lasting, heavy snow coverage. COST has information on 'best possible practice', but has no information on the history of how it was achieved and in what direction it might be developed. For example, in some cases, older versions of mitigation measures might be cheaper and more effective. COST has little or no data on comparison of mitigation measures, value of animal habitats, value of species, financial value and methods of defining value, i.e. not everything needs to be protected or the protection of one species might threaten another. Thus it is useful to know the most and least valuable. The points mentioned as examples in the question would also be useful.
Netherlands	Detailed specifications on the design of fauna passages, standards for inspection, and maintenance, more information on avoiding traps for animals: escape ramps in gutters, at fences, target species (bats, amphibians, reptiles, insects), the role of fauna passages in tackling problems in and between the Natura 2000 network sites, monitoring at population level, road safety (collisions with large animals, collisions with fences), role of fauna passages related to legal issues (laws, rights), fauna passages and the spread of livestock diseases (e.g. swine fever, foot and mouth disease), shared use of fauna passages with recreation, scientific proof around the usefulness of fauna passages.
Norway	In 2003, the focus was also on cost-effectiveness, size, and dimensions, and how to design the best measure for different purposes. But at that time there was a lack of knowledge about these issues, and we had to use 'the best knowledge available'. Several monitoring projects have been carried out since then, and so there is probably a need to revise many of the measures described. IENE and the International Conference on Ecology and Transportation (ICOET) should be used to collect state-of-the-art knowledge.
Poland	Experiences from previous years, legal regulations concerning fauna passages, monitoring methods and their effectiveness, effectiveness of different types of fauna passages for different animal groups
Portugal	Details of mitigation measures (e.g. frequency between underpasses, fences for different species), measures for threatened carnivores, cost, monitoring evaluation, references.
Spain	Detailed technical prescriptions (dimensions, types of measures), design, and alternatives.
Sweden	Important groups of species, such as bats, butterflies, ground beetles, and grasshoppers. New inventory techniques such as DNA. Standards are an important next step.
Switzerland	There are still a lot of open questions on the optimal size of fauna underpasses for large mammals. A good overview of the effectiveness of other measures to keep animals away from the road—such as reflectors, scent barriers, etc.—is also missing.
UK	Cost-effectiveness/cost-benefit analysis of measures.

2.2 Other information

Austria	
Belgium-Flanders	
Belgium-Wallonia	
Cyprus	
Denmark	
Estonia	
Finland	Also taking habitat fragmentation into account in projects not needing EIA or in repair projects. Add a chapter on 'Defragmentation programmes' at national and local level. Barrier mapping deals only with the existing road network, not with the big picture of natural conditions. The importance of systematic monitoring in projects. Cost-benefit analysis methodology and willingness to pay (updating Chapter 5.7). Updating Chapter 7 with new information. Updating and extending Chapter 9 on monitoring.

France	
Germany	
Hungary	
Iceland	
Ireland	In order to revise and improve upon our *Environmental assessment and construction guidelines,* the NRA has commissioned a number of Research Fellowships. One of these Research Fellowships, entitled '*The effectiveness of ecological mitigation measures on national road schemes in Ireland'* will have the following relevant outputs: A) an analysis of the effect of national road schemes on habitat connectivity and dispersal behaviour of various species including mammals, amphibians and birds; B) analyses of the efficacy of ecological mitigation measures for targeted mammals, amphibians and bird species on national road schemes; C) recommendations for the improvement of the NRA's guidelines having regard to engineering, cost and legal implications; D) a GIS database indicating the location of mammal, amphibian and bird fatalities on the national road network along with recommendations for the cost-effective remediation of hotspots; and E) fulfil the NRA's commitments as outlined in the Species Action Plans for otters and other animals. The results of this PhD research will be used to revise and improve upon our current guidelines.
Latvia	
Lithuania	
Netherlands	The handbook is not specifically designed for making contracts. It gives more background information. For contracts you need information that is clear and unequivocal. It is not good when information is vague and ambiguous.
Norway	The methods and techniques for monitoring have also developed a lot during the last years.
Poland	
Portugal	
Spain	
Sweden	
Switzerland	
UK	

3. Usefulness

3.1 Is the form in which the handbook has been published (print instead of digital, level of details, language used, text versus tables, diagrams, boxes and figures, etc.) useful?

Austria	A digital version (e.g. download from the Internet) would probably reach a broader range of users.
Belgium-Flanders	It is useful for people who are interested in the ecological content. Most road engineers are only interested in the technical data. For them, there is too much text and too few formulae, measurements, diagrams, and examples in different situations.
Belgium-Wallonia	Yes
Cyprus	

Denmark	Yes
Estonia	COST 341 is very well structured, with 10 visually well-distinguished chapters. It makes the document easy to follow. It contains a large number of illustrative photos and diagrams. However, figures and diagrams might be better used digitally and also the whole handbook might be more useful not in pdf format, but as a searchable document where all articles and figures are in an easily transformable digital format. More clear and simple diagrams with numeric measurements are needed as a direct basis for planners and designers.
Finland	Yes, but the Finnish version is used more by designers. The Finnish version is also in digital form.
France	
Germany	All in all it seems to be very useful, but it should be more specific with regard to special species or habitats.
Hungary	Yes
Iceland	
Ireland	It is an excellent document. What would be extremely useful is if a companion set of sample road construction details were produced in an AutoCAD format (or similar) and specification in MS Word (or similar) could be adapted for national requirements. These could then be amended and placed into the NRA's generic contract documents, specifications, etc.
Latvia	Yes, it is useful, however, a digital version would be even more useful.
Lithuania	A digital version would be more useful than the printed one. More drawings outlining most important details on measures would be useful.
Netherlands	Yes, the layout is very useful. To improve it: more diagrams, illustrations, photos, and step-by-step plans. Where the information available is likely to increase, it is important to be aware of the necessity of making up-to-date information accessible. Add more boxes with good examples. A digital format would be good, especially if there is the possibility of improving search options; make a real web tool of it.
Norway	OK.
Poland	There should also be a digital version.
Portugal	We did not have access to the handbook with colour photos (which would had been useful), just a print-out of the digital report.
Spain	Yes
Sweden	It should be published digitally, everything else is quite satisfactory.
Switzerland	Yes
UK	The handbook is fine. It would have been useful to have an electronic version.

3.2 Does the handbook fit in with the way your organisation (part of the organisation) works? (Procedures, tendering, availability of information and tools, control of results of contractor etc.)

Austria	Yes
Belgium-Flanders	The COST 341 handbook does not. It would be useful to have some information on the items mentioned, but still it has to be adapted to the national situation.
Belgium-Wallonia	Yes
Cyprus	
Denmark	Yes, mostly (but not concerning control of results of contractor).

Estonia	The handbook fits well for all levels of road designing and for different parties in the process. Road authorities are able to refer to the document as a reference book for new road projects. Also, on methods and mitigation measures presented in the handbook, EIA experts can find the solutions for the best alignment of the road and propose mitigation measures for the indicated conflict areas.
Finland	Yes, engineers can also use it. For architects, the landscape concept should be made clearer. The handbook is not very well-known among planners in Finland. If the new version of the handbook is published, it should also be translated into Finnish to make it more useful for planning.
France	
Germany	No official use.
Hungary	Not exactly. This is why the adaptation of the handbook was made by preparing two technical guidelines for roads.
Iceland	
Ireland	The handbook is very useful, but it would be useful if, as stated above, there were some more detailed 'contractual' type details which could be easily amended and incorporated into member state roads authorities' contractual documents.
Latvia	It contains useful information for the evaluation of work by consultants who have prepared environmental impact assessments.
Lithuania	Yes
Netherlands	Yes, the translated version is already in use as background information for planners and designers, ecologists, technicians, contractors, and the public. No, it doesn't work for controlling the contractor. No, information for maintenance is lacking.
Norway	OK
Poland	Yes, the handbook fits in with the way our organisation works, as a starting point for the adaptation of national guidelines.
Portugal	The report was used for the guidelines manual mentioned above.
Spain	The Spanish guides have been developed on the basis of the handbook. Our guides fit perfectly with the way our organisation works.
Sweden	Yes, as a starting point for the adaptation of our national procedures.
Switzerland	Yes
UK	Partly. Good reference document but does need to be adapted to the UK context and incorporated into DMRB for UK highway application.

3.3 Other information

Austria	
Belgium-Flanders	
Belgium-Wallonia	
Cyprus	
Denmark	
Estonia	
Finland	Some details: figure on page 5/5 should be updated; there are several source references in the text that are not named in the list of sources (e.g. page 5/14 Holzgang 2001; p. 5/16 Trocme 2002; p. 7/10 Hlavac & Andel 2002; p. 7/11 Oord 1995).
France	

Germany	
Hungary	
Iceland	
Ireland	
Latvia	
Lithuania	
Netherlands	The handbook helped to enhance common sense on the part of organisations involved and is useful for people new to the field (new employees, students). In future, the handbook could be a standard work for involved (governmental) organisations.
Norway	
Poland	
Portugal	
Spain	
Sweden	
Switzerland	
UK	

4. Other information

4.1 Is there any other information or ideas that we could use in an update of the handbook?

Austria	The 'new' European countries in particular reported that they are facing many problems concerning habitat fragmentation. The handbook should help them to avoid repeating the mistakes we made in central Europe in the past. In central Europe, the topic of defragmentation has become more relevant. Further information, experiences, and best practices relating to this topic could be included in the handbook.
Belgium-Flanders	For our Flemish website, I produced two extensive chapters. One covers ecology and how that information is used to write guidelines for designers and planners, and the second (entitled 'Guidelines for ecological engineering') is a purely technical enumeration.
Belgium-Wallonia	
Cyprus	
Denmark	
Estonia	
Finland	New research results about animal movements in different countries. In Finland, we have research since 2003 about animal movements in the road environment, animal mortality, impact on animal populations, use of small animal passages and water bridge underpasses, GPS collar follow-up research of moose, white-tailed deer, roe deer, lynx, wolf, and bear.
France	
Germany	
Hungary	
Iceland	
Ireland	More contractual-type details and examples of cost-effective mitigation.

Latvia	
Lithuania	The handbook could be developed as a digital book. This would provide the opportunity to use video and other tools to expand its informative possibilities.
Netherlands	When there is an update of the COST 341 Handbook, implementation should be part of the process. This demands special attention because the handbook is distributed around the world. Use of existing networks, such as ICOET and IENE, would be a good possibility.
Norway	At the moment, the answer is no.
Poland	
Portugal	
Spain	
Sweden	
Switzerland	Yes the whole issue of 'wildlife traps', optimising design so as to avoid mortality, needs to be developed. We have worked on optimising drainage systems (tropes for amphibians and small animals). But a lot more is needed.
UK	Need to take account of low-cost adaptation of existing measures, such as farm access, bridge structures and some specific wildlife crossings such as badger tunnels.

Countries that did not respond:

Greece, Italy, Luxembourg, Malta, and Slovenia.

APPENDIX 2: Gifford report

Report No. 18187/INFPLA/R02_A
April 2011

EU BEST PRACTICE WILDLIFE AND TRAFFIC

FINAL REPORT

C O N T E N T S

1. Executive summary

Gifford has been appointed by the Conference of European Directors of Roads to undertake a research commission as part of Task 7 Wildlife and Traffic. This report addresses the issue of conflict between road networks and wildlife and, in particular, investigates strategic/institutional-level best practice in EU countries regarding road networks and wildlife and the sustainability of measures taken.

This report presents the findings of a questionnaire, a conference workshop, and interviews with road and planning administrations and other stakeholders from the Netherlands, England, Spain (Catalonia), and Hungary. The report presents the findings of the research, discusses the implications of the findings, and makes recommendations for best practice. There were contributions from 19 CEDR countries; 71 responses to the questionnaire were received.

The research carried out to inform this report has demonstrated that there are substantial differences in the approach to ecological fragmentation and roads across the EU and these differences can be directly attributed to the institutional arrangements that are in place.

In the questionnaire, 70% of people noted that policy (and guidance, where available) is not effective in preventing conflict between road networks and ecological networks, and 75% thought that institutional issues are a problem in the delivery of measures to avoid or reduce the ecological fragmentation effects of roads.

Having an overall strategy for the issues of roads and wildlife is noted by more people in questionnaire responses as the most important factor in successful integration of road networks and wildlife than any other factor. This was supported in interviews where it was noted that where there is ecological understanding of the scale of the ecological fragmentation issue in a country, this understanding can inform an overall strategy. Success has been achieved in countries with an established national ecological network that is recognised as material in spatial planning. This results in project-level problems being avoided or reduced (because the principle issues have been addressed at strategic level).

Another key reason for successful implementation of policy and guidance to prevent conflicts between road networks and wildlife relates to clear roles and responsibilities being defined; the main reasons why institutional issues are considered a problem relate to the continuity of applied expertise and funding. Countries where institutional issues do not seem to be a problem have road administrations that have engaged with or employed ecologists (often for many years) and therefore consider ecological connectivity in their core activities.

Four possible strategies for road directors are considered. These are: do nothing, take action at national level (quick wins), take action at national level (step changes), and take action at European level.

In light of the strong recognition of the issue of roads and wildlife fragmentation, a strategy of doing nothing has little to commend it. Good practice is identifiable and proven, and the barriers to transferring this good practice to other administrations for many actions appear surmountable. Therefore a failure in moving towards the adoption of this practice will, for road directors, result in continued increased costs due to projects delays, reputational damage and, of course, will ultimately be to the detriment of wildlife.

Quick wins at national level involve relatively easy things to achieve such as better coordination, cooperation, and communication, and this will usually be within the power of administrations to deliver without significant institutional change.

Most of the practical aspects relating to the installation, maintenance, and monitoring of the effectiveness of practical measures can be addressed at national level.

Step changes at national level will lead to much improved working practices and institutional arrangements, with fewer delays and conflicts at project level. These changes are underpinned by the need for governments to have an understanding of whether there is a significant problem with ecological fragmentation as a result of roads in their country/region. This can only be defined by ecological investigation.

A high-level government desire to deal with the issue of ecological fragmentation as a result of roads is required across its administrations to provide funds and resources to most effectively address fragmentation. When several administrations work together on these issues using existing structures and procedures, a culture of acceptance can begin to develop, and the potential for conflicts between administrations and associated delays is reduced.

A country can be most effective in addressing the issue of defragmentation and roads when a problem with fragmentation issues has been defined and a mechanism (such as a national ecological network, which is material in spatial planning) has been implemented to deliver the necessary measures in road projects.

Action at European level has the advantage that it can inform and guide the behaviour of EU nations through sharing and promoting good practice, whereas a member state acting alone would not benefit from shared experience. The recommended action at European level is largely in knowledge sharing, cooperation, and standardisation of approach and as such it is likely to be cheaper and require less resources than the national-level step changes, although there are clear environmental benefits and there would also be feedback into more efficient engineering solutions.

We recommend that the directors of roads implement the actions termed quick wins on a national basis and the actions at European level.

We recommend that the directors of roads reconsider the existing situation in their country/region and, in particular, whether there is an understanding of whether ecological fragmentation as a result of roads is an issue.

Where step changes in the administrative arrangements are required in order to deal with fragmentation issues effectively, the directors of roads should request that their governments seek changes in the cross-administration arrangements or spatial planning framework that are required to address these issues most effectively.

2. Definition of the issue

2.1. Purpose

Gifford has been appointed by CEDR to undertake a six-month research commission as part of Task 7 Wildlife and Traffic. The work is based on a CEDR Call for Proposal and Tender for technical assistance dated 26 August 2010, and this report presents the findings of the research, discusses the implications of the findings, and makes recommendations for best practice.

This report addresses the issue of conflict between road networks and wildlife and in particular investigates strategic/institutional-level best practice in the EU and member states regarding road networks and wildlife and the long-term viability of measures taken.

2.2. Scope

This report presents the findings of an Internet-based questionnaire, a workshop at an international conference on ecology and transportation, and interviews with road, planning and other stakeholders from four EU countries. The discussion in later sections of the report is limited by the information that has been obtained in this manner.

This report uses the findings of the conference workshop, the Internet questionnaire, and the interviews that have been carried out to present discussion on the types of strategic/institutional issues that can lead to conflicts, it identifies best practice and how this has been achieved. The report also highlights issues that prevent good practice being achieved and makes recommendations as to how these might be addressed.

The European Concerted Research Action COST 341 'Habitat fragmentation due to transportation infrastructure' determined the state of the art in respect of this subject in EU member states. The action produced the COST 341 Handbook[8], which recommends measures and planning procedures with the aim of conserving biodiversity and reducing vehicular accidents and fauna casualties. This report continues this theme, but concentrates on the wider institutional framework within which the provision of any measures sit rather than on the practical aspects. Consideration is given to how these specific measures fit within any overall strategy to address fragmentation and, where such a strategy is in place, the extent to which institutions impacted by the strategy support and subscribe to it.

The main focus of this report is to explore how these institutional issues are being addressed across the EU to discover what seems to be best practice and evidence for this. In addition, the report also explores the issues of construction, maintenance, and monitoring to ensure that planned infrastructure is constructed correctly and maintained to retain its operational efficiency.

2.3. Methodology

This section describes how the research was carried out and gives background as to what procedures were used; explanation is included as to why a particular investigative approach/methodology was chosen.

IENE Conference

The project team attended the 2010 IENE International Conference on Ecology and Transportation, entitled 'Improving Connections in a Changing Environment'. The purpose of attending this conference was to meet the members of the CEDR task group 7, to refine the questionnaire survey employed as the first stage of the research (see below), and to meet international experts and interested parties who would be able to contribute their knowledge and experiences to inform this project. A workshop was held at the conference during which broad themes that should be explored during the project were suggested by the conference delegates.

Questionnaire survey design

The primary purpose of the questionnaire survey was to identify where to focus the attention for a more detailed investigation of the issues. The survey sought to identify the institutes and people who have the most relevant experience in the field of road networks and ecological fragmentation, as well as to obtain answers to questions about the issues that would help formulate topics for further exploration at interview.

[8] COST 341 *Habitat fragmentation due to transportation infrastructure; Wildlife and traffic – a European handbook for identifying conflicts and designing solutions.*

The questions were intended to determine broadly where people feel that institutional issues obstruct or do not obstruct the delivery of measures to avoid or reduce ecological fragmentation.

An initial list of topics and questions to be used in the survey was drafted and this was reviewed and refined with CEDR task group 7 at the IENE conference. Following the IENE Conference, the survey was issued to the members of CEDR task group 7 for their comments and several questions were added (for example, those relating to power structures).

The agreed survey was designed to include both 'open' and 'closed' questions to encourage the greatest response, most varied analytical options and to capture detail and enrich responses where possible. The survey was created using the Internet survey tool, Survey Monkey (www.surveymonkey.com).

Questionnaire survey distribution

The survey was distributed by e-mail link to approximately 260 people. This included all IENE members, all IENE conference attendees, the PIARC (the World Road Association) committee TC A1 mailing list, and any other contacts who had been suggested during the process of consultation. The survey was introduced with a description of the project, and recipients were encouraged to forward the survey link on to anyone they felt might have something to contribute to the project. Follow-up e-mails were used to encourage the greatest response. There were responses from people in 19 CEDR member states and 71 responses in all.

Approach to interviews

On the basis of the analysis of questionnaire responses, in-depth interviews were organised with those people and institutions identified as having the most relevant knowledge and experience.

Interviews were held with groups of relevant organisations (i.e. organisations from an individual country) and the interviews took the form of a facilitated discussion.

The interviews were undertaken face-to-face in order to gain an in-depth understanding of the responses given and to introduce supplementary questions. The interviews were undertaken in December 2010 and February 2011.

Interviews were carried out with representatives from four EU countries, following discussions with CEDR task group 7 on whom to interview. The countries interviewed were the Netherlands, England, Spain (Catalonia), and Hungary. The interviews were carried out to sample a cross-section of EU countries and to address the specific responses from the selected interviewees in their questionnaire survey response (with the exception of Hungary).

The participants in the interview in the Netherlands were:

Hans Bekker (Senior Advisor ecological engineering; Rijkswaterstaat Centre for Traffic and Navigation);
Anne Martine Kruidering (Ecologist, Arcadis consultancy);
Arjan Hassing (Defragmentation Coordinator, Provincie Noord-Holland); and
Ruben Huele (Assistant Professor, Faculty of Science Leiden University).

The participants in the interviews in England were:

Tony Sangwine (Senior Principal Environmental Advisor, Highways Agency); and
Stuart Wilson (Ecologist, Highways Agency);

The participants in the interview in Catalonia were:

Mònica Laje (GISA public company, Road administration);
Mª Mercè Martínez (DG Roads – Generalitat de Catalunya, Catalan Government);
Antoni Sorolla (Environment administration: Environmental Impact Assessment - Generalitat de Catalunya, Catalan Government);
Joan Pino (CREAF Research Centre – Universitat Autónoma de Barcelona); and
Carme Rosell, Ferran Navàs (MINUARTIA consultancy).

We felt it would be worthwhile to investigate the institutional arrangements and ways in which ecological fragmentation issues in relation to roads are dealt with in countries that have recently joined the EU. In order to investigate this aspect, an interview was held in Hungary. No completed responses to the questionnaire were received from Hungary, therefore a briefing note was sent to participants prior to the interview to provide them with context for the discussions.

The participants in the interview in Hungary were:

József Zsidákovits (operation engineer, Transport Coordination Centre);
Dóra Hunyadi (Assistant Lecturer, Faculty of Civil Engineering, Budapest University of Technology and Economics);
Ágnes Török-Szabó (Chief Environmental Engineer, National Infrastructure Developing Company);
Péter Jóna (National Infrastructure Developing Company); and
Zita Egyházy (Ministry of National Development).

Themes covered in interviews

The interviews explored how a model where stakeholders can work together to solve ecological fragmentation issues can be established and how ecologists working in road administrations or in regular liaison with these administrations can successfully convey the importance of ecological connectivity.

The interviews explored the framework in the country/region in question in which the roles and responsibilities of the various stakeholders are defined.

The interviews explored to what extent the country/region in question has overall roads/wildlife strategies, long-term policies, or binding habitat corridors in place and whether follow-up/enforcement of EIA requirements is carried out. The interviews (with the exception of the one in Hungary) linked back to the questionnaire responses given by the people from that country on whether policy/guidance/standards are effective in preventing ecological fragmentation and whether institutional issues pose problems in delivering practical measures.

The interviews explored whether countries are having success even in the absence of coherent strategies and, if this is the case, what lessons could be learnt and applied in other countries.

Funding issues were explored in the interviews to determine whether embedding budgets to address ecological fragmentation in road administration funding or whether having separate financial arrangements available is the most desirable option (or the most practical outcome or default situation). The financial crises across Europe at the time of the interviews was discussed, but was not a focus of the interviews.

The centrally funded, spatially based approach to fragmentation issues adopted in some countries/regions seems to be very successful; however this high-level adoption of ecological principles throughout road planning may be unachievable in other countries. Therefore the interviews sought information on practical, institutional measures that could be applied to any road administration or at a national policy-making level.

3. Possible ways forward (solutions)

3.1 Questionnaire survey – analysis of respondents

Results were received from a wide cross-section of stakeholders in managing fragmentation issues e.g. national transport authorities, private concessionaire companies, maintenance and management organisations, academics, engineers, and environmentalists.

A breakdown of the people who responded to the questionnaire is shown in Table 1. The number of questionnaires received means that for some questions, there were few answers and this is a limitation of the data in representing the issues from across the EU. Nevertheless, the responses highlighted common ground and key themes and have enabled focused interviews to be carried out to investigate the issues raised in more detail.

Table 1: Responses to questionnaire survey

Total number of responses	71
Number of countries represented	29
Number of EU member states represented	18
Number of CEDR member states represented (of 25 member states)	19
Number of responses from people from CEDR member states	56
Number of responses from road administration/agency staff	22
Number of responses from road administration/agency staff in CEDR member states	19

The EU member states that were not represented in the questionnaire responses were:

Bulgaria
Cyprus
Czech Republic
Greece
Latvia
Lithuania
Luxembourg
Malta
Romania
Slovakia

The CEDR member states that were not represented in the questionnaire responses were as follows (please note that for countries where there are autonomous regions, not all regions were represented, for instance only responses from Flanders were received for Belgium and therefore the responses may not have been representative of the country as a whole):

Greece
Iceland
Latvia
Lithuania
Luxembourg
Malta

CEDR member states where no responses were received from road administration staff were as follows:

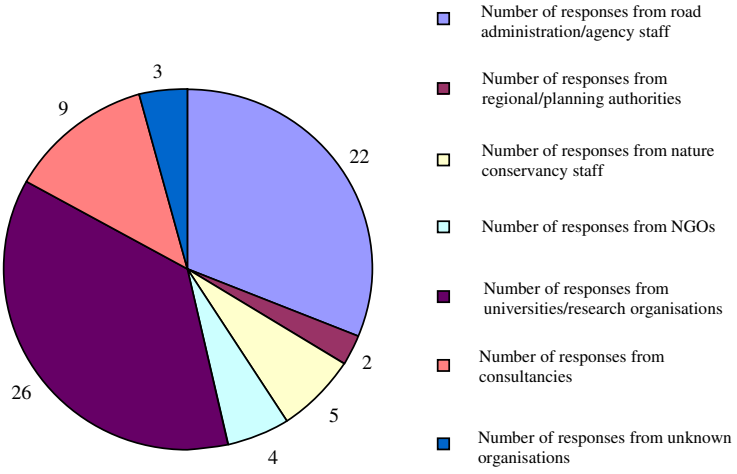
Estonia
France
Italy
Hungary
Poland
Slovenia
Spain

Several people from non-EU or non-CEDR countries responded to the questionnaire. The countries involved were:

Australia
Brazil
Canada
Croatia
India
Japan
Kosovo
Ukraine
United States of America

The graph below shows a breakdown of all responses to show the type of organisations for which people responding to the questionnaire work.

Responses to questionnaire survey by organisation



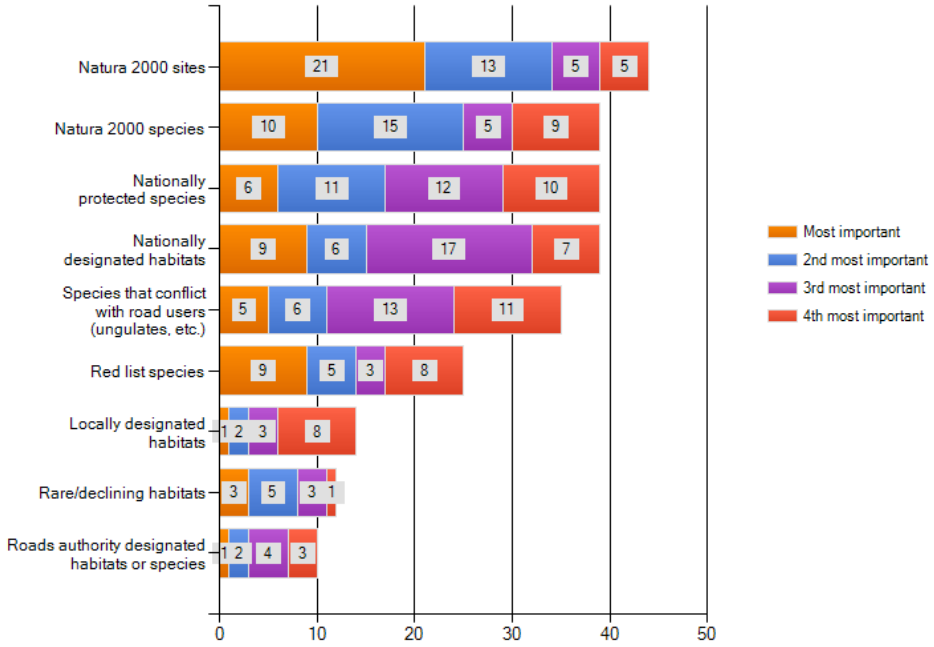
3.2 Questionnaire survey – discussion of survey responses

The responses to the questionnaire are discussed in two sections. The first relates to institutional issues that form the main focus of the project and the second focuses on the practical aspects of installation, maintenance, and monitoring of the effectiveness of measures to avoid ecological fragmentation.

Institutional issues relating to road networks and ecological fragmentation

Q1 related to personal information about the person completing the questionnaire and relevant information is included in Table 1 above.

Q2 Which of these drivers are key to the inclusion of measures to avoid fragmentation effects of roads in your country? Please rank the top four drivers from the list, with one being the most important.



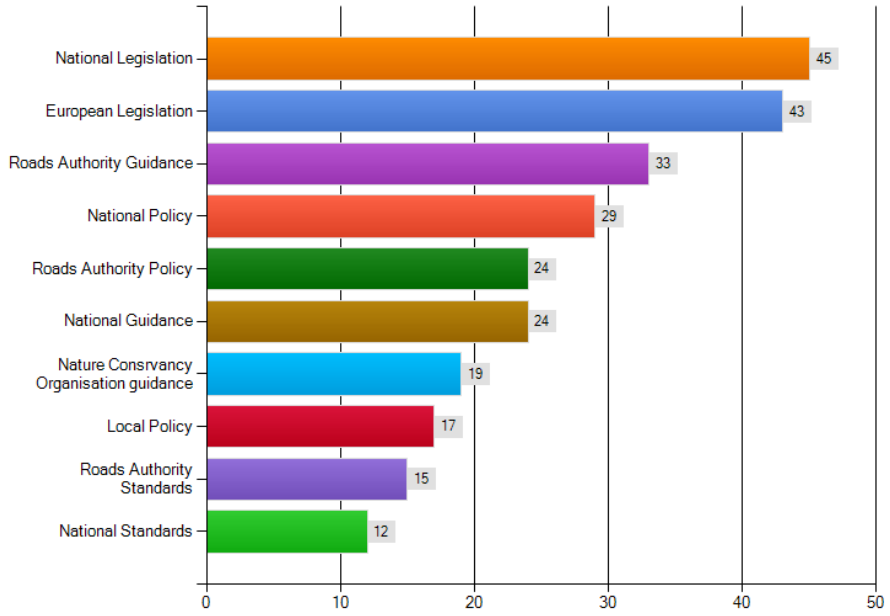
Natura 2000 sites, Natura 2000 species, nationally designated sites, and nationally protected species were listed as the most important drivers for measures to avoid ecological fragmentation effects of roads. Twenty-one people listed Natura 2000 sites as the most important driver to inclusion of such measures, more than twice the number of people noting that nationally designated species or Natura 2000 species were most important.

The answers from EU member states only indicate that nationally designated habitats are more important drivers than nationally designated species (presumably as a result of the influence of measures included for Natura 2000 protected species in the EU). Also, species that conflict with road users (ungulates etc.) are more important than Red List species.

Only five staff from nature conservation administrations responded to the questionnaire so any conclusions from their responses should be seen as very indicative. For this group, species that conflict with road users, Natura 2000 sites, and Natura 2000 species were the highest ranked drivers for inclusion of measures to avoid fragmentation effects.

Twenty-two road administration staff responded to the questionnaire; their responses broadly reflected those of the whole dataset, with the exception that nationally designated habitats were second only to Natura 2000 sites in being listed as the most important driver.

Q3 What legislation, policy, and guidance on preventing conflict between road networks and ecological networks is available in your country?



National legislation is the most commonly noted legislation/policy/guidance noted in responses (45 (68.2% of responses)) but taking EU member states only, European legislation becomes more important (41 (80.4% of responses).

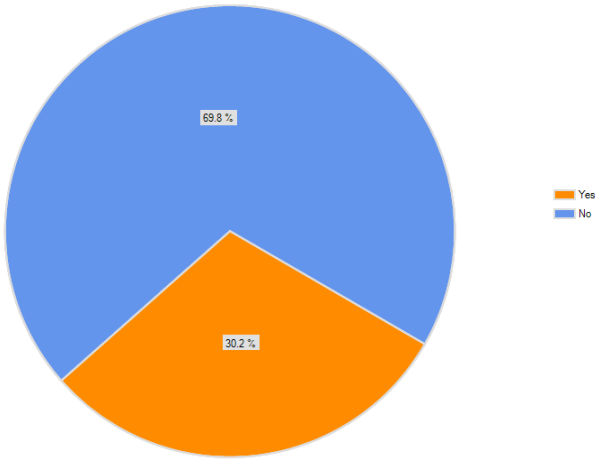
Very few people note that there are environmental standards for preventing conflicts between road networks and ecological networks (18% and 23% for national and road administration standards respectively). This compares with European and national legislation, which is cited by 65.2% and 68.2% of people in this context. Road authority guidance (50%) and national policy (43.9%) were also commonly noted.

CEDR member states with road administration and national standards are Germany, Denmark, the Netherlands, and Switzerland. Countries with road administration standards only are Sweden and Scotland, while countries with national standards only are Finland and Spain.

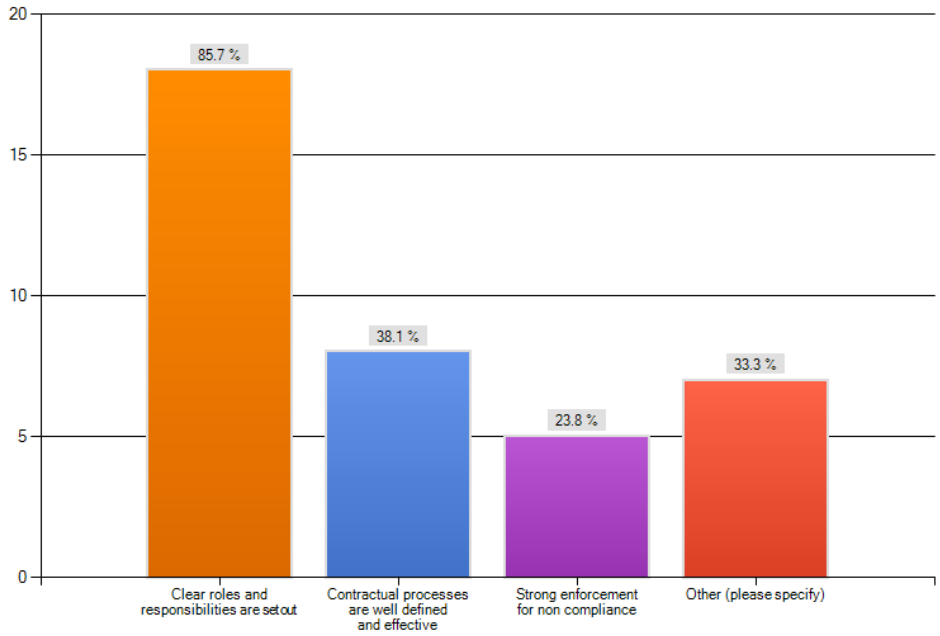
Sixty-three people answered Question 4, of whom 44 (70%) noted that the legislation, policy, and guidance available is not suitable for preventing conflict between road networks and ecological networks. When considering EU member states only, the respective proportion was similar (32 people (66.7%)).

Responses from nature conservation administrations were split evenly, suggesting that this group is happier with the effectiveness of legislation, policy, and guidance than the majority. A total of 57.1% of the road administration staff noted that the legislation, policy, and guidance available is not suitable for preventing conflict.

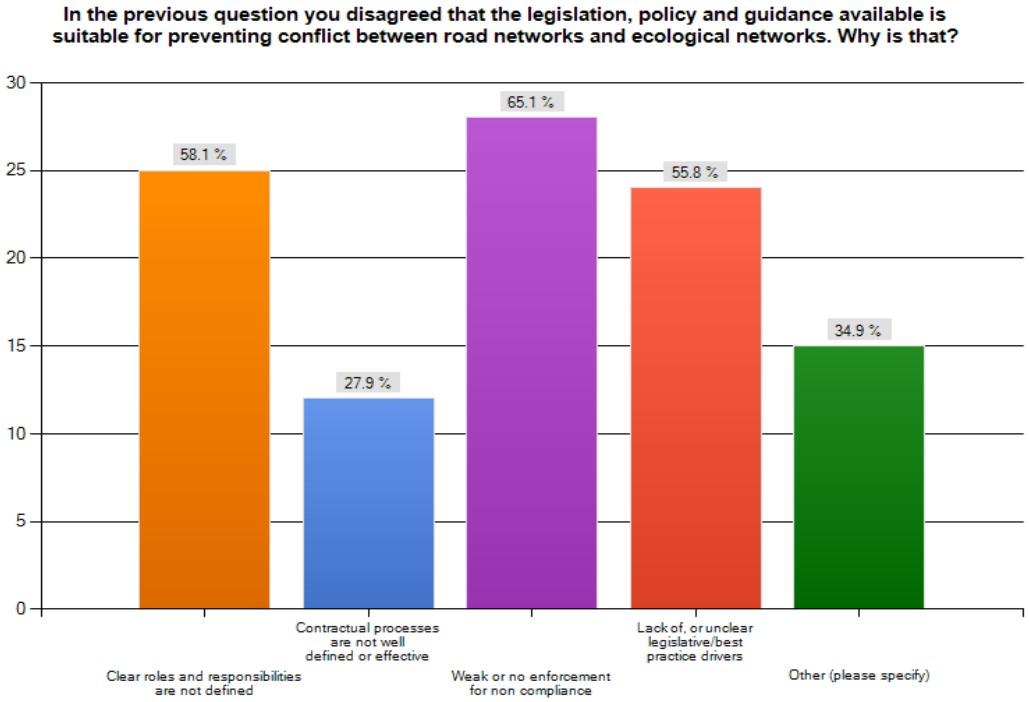
Q4, Q5, Q6 Is the legislation, policy, and guidance available suitable, i.e. is it effective in preventing conflict between road networks and ecological networks?



Clear roles and responsibilities being set out was the main reason (with 85.7% of responses, 82.4% from EU countries) why legislation, policy, and guidance was felt to be suitable for preventing conflict between road networks and ecological networks for the 19 people (32%) who responded positively to this question.



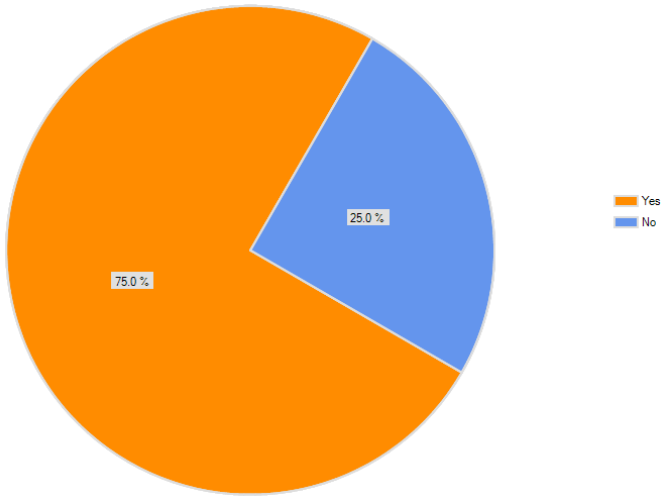
The main reasons why people felt that the legislation, policy, and guidance available is not suitable for preventing conflicts were: weak or no enforcement for non-compliance (65.1%); clear roles and responsibilities not being defined (58.1%); and lack of, or unclear legislative/best practice drivers (55.8%) (see below). The values and relative proportions were very similar when considering responses from EU countries only, for example, 71% felt there is weak or no enforcement for non-compliance. The reasons given by staff from nature conservation administrations who felt legislation, policy, and guidance is not suitable for preventing conflicts were the same, with both people (100%) listing weak or no enforcement for non-compliance and clear roles and responsibilities not being defined as reasons.



Q7 What common visions/plans are available to address the integration of road networks and wildlife? For example, national strategies to address fragmentation involving multiple agencies, strategies for road networks, etc.

Some countries (notably mainly western European countries) have national strategies, regional/state strategies, and even national ecological corridor initiatives to address the integration of road networks and wildlife. Other countries (such as the UK and eastern European countries) have no such common visions or plans.

Q8, Q9, Q10, Q11 In general, are institutional issues a problem for you in the delivery of measures to avoid or reduce the ecological fragmentation effects of roads? For example, conflicts in institutional objectives etc.



A total of 75% of people (73.9% of people from EU member states) who responded to this question felt that in general, institutional issues are a problem in the delivery of measures to avoid or reduce the ecological fragmentation effects of roads. The response from nature conservation administration staff may indicate that these organisations are more confident in the institutional framework than for the whole dataset as responses were evenly split (although, as previously noted, there were a very small number of responses from nature conservation administration staff).

The main reasons why institutional issues are considered a problem are continuity of funding (68.9%, 67.6% for EU member states, the second percentage in the following figures indicates EU responses only), lack of long-term commitment (46.7% (44.1%)), the issue of establishing agreements (42.2% (47.1%)), unwillingness of organisations to accept and/or fund mitigation due to lack of data to demonstrate effectiveness of measures proposed (42.2% (38.2%)), and no follow-up by environmental authorities (42.2% (38.2%)). Transboundary issues were only noted by 13.3% (14.7%) of people as a reason. Experience not being fed back to stakeholders in a formal manner is more of a concern for those responding from EU member states than from the whole dataset (37.8% in general, 44.1% from EU countries only).

A minority of people note the following reasons why institutional issues are not seen as a problem in the delivery of measures to consider the ecological fragmentation effects of roads: a long track record of working together to solve these issues, ecologists working in road administrations, regular liaison and consultation between road and ecology staff, the serious way in which road administration staff view Natura 2000 sites, and the high value placed on ecological connectivity by the road administration.

The people responding positively to this question were from Belgium-Flanders, Denmark, the Netherlands, and Switzerland. Examples of projects were given, mainly from those countries noted above where people responded positively.

Q12 What help did you get from international organisations such as Infra Eco Network Europe (IENE)?

Fourteen people answered this question and, of those, only seven responses noted help from sources such as the IENE COST 341 Handbook. However, a previous study by CEDR task group 7[9] found that the COST 341 Handbook is an extremely useful publication and has been well adopted (it has been translated into 10 languages). Several countries have adapted it to their own national circumstances but there is a need to keep the handbook updated. The apparent difference in the responses to the two questionnaires may reflect the relative composition of the two sets of people responding, or the direct question about the handbook in the CEDR questionnaire as opposed to the more open nature of Question 12.

Q13 Which institutional aspects do you think are most important in securing successful long-term delivery of effective measures to prevent ecological fragmentation?

Thirteen responses were received and several themes were addressed in the responses. Of these, the need for monitoring of effectiveness was noted by seven people as being important, a clear framework/long-term plan/policy was noted by four people as being important and cooperation (both people responding from nature conservation organisations noted the importance of these two aspects). Networking and willingness to work together was mentioned by four people.

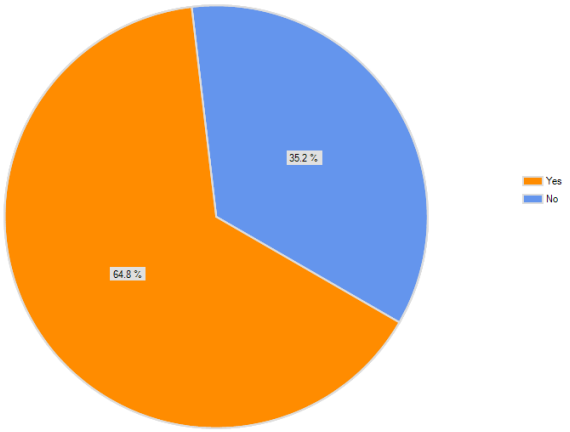
Other issues raised were enforcement of good practice, funding (including from Europe), and the importance of the participation of local stakeholders.

[9] CEDR task group 7 *Use of the COST 341 Handbook 'Wildlife and traffic – A European handbook for identifying conflicts and designing solutions'*

Q14 What is the power structure between stakeholders in road projects?

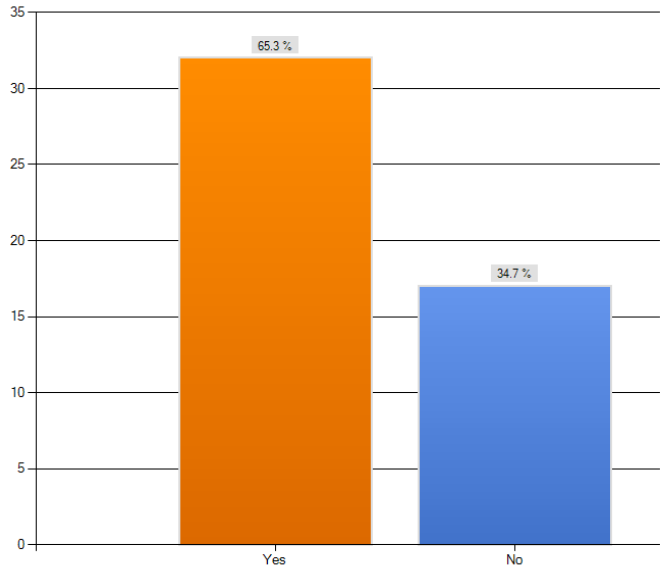
There were 44 text responses, and these were reasonably well balanced (both in the full data set, the EU member states only, and in nature conservation administration staff only) between those who felt that the ecological stakeholders are well represented/respected and those who felt that their road administrations have a dominant role in institutional terms in relation to nature conservation stakeholders.

Q15 In your experience, do the respective stakeholders generally cooperate successfully in road projects?



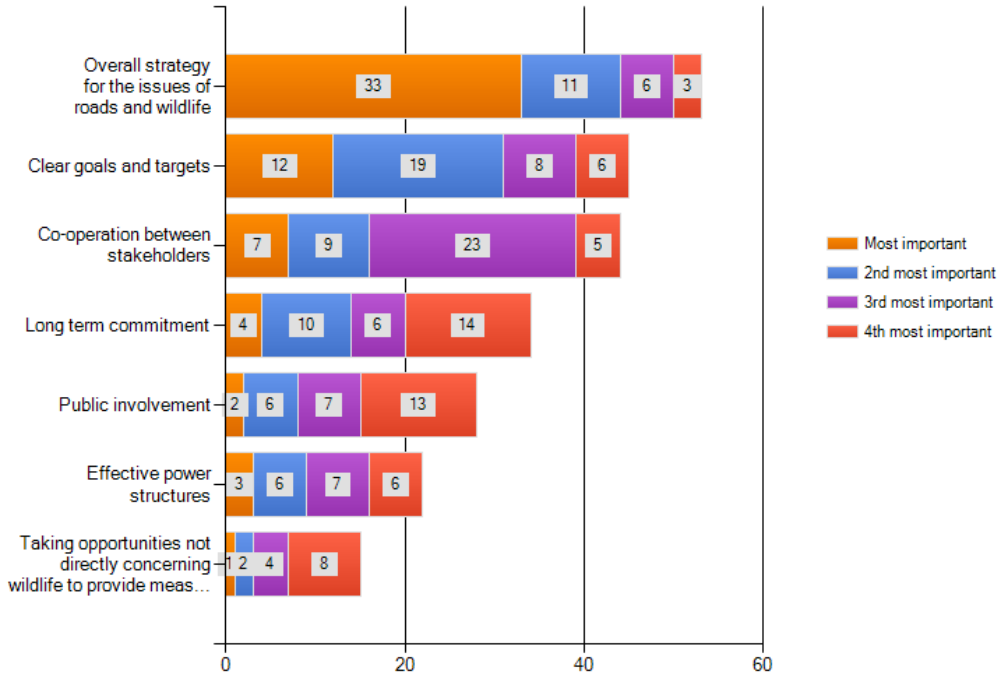
A total 65% of people who responded to this question noted that stakeholders generally cooperate successfully, this proportion is similar for EU member states only. The split in the responses from nature conservation organisations and road administrations indicates a more positive experience with 75% and 89.5% respectively having experience of stakeholders generally cooperating successfully.

Q16 Are procedures (technical, procedural, and financial) in the respective stakeholder organisations compatible?



Of the people responding to this question, 65.3% noted that procedures in the respective stakeholder organisations are compatible. Responses from the EU member states only indicate more compatibility in procedures than from the full dataset (73% agreeing procedures are generally compatible).

Q17 Which of the following do you think are the most important factors in successful integration of road networks and wildlife?



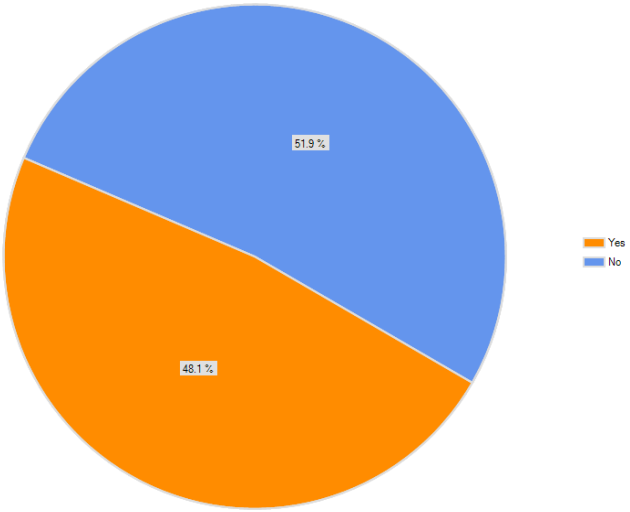
The most important factor for half of all respondents answering this question is having an overall strategy for the issues of roads and wildlife (and this factor had the highest total response rate). Clear goals and targets were most important for 20% of people, and cooperation between stakeholders was most important for 12% of people. These factors were in more people's list of top four drivers than the other factors.

Public involvement was cited by only two people as the most important factor.

Responses from EU countries were broadly the same as for the whole dataset. Road administration staff also answered in broadly the same way, although cooperation between stakeholders was not noted as being the most important factor by anyone in this group. The small sample of people from nature conservation organisations also had the same three factors as most important.

Practical aspects relating to the effectiveness of measures to avoid ecological fragmentation

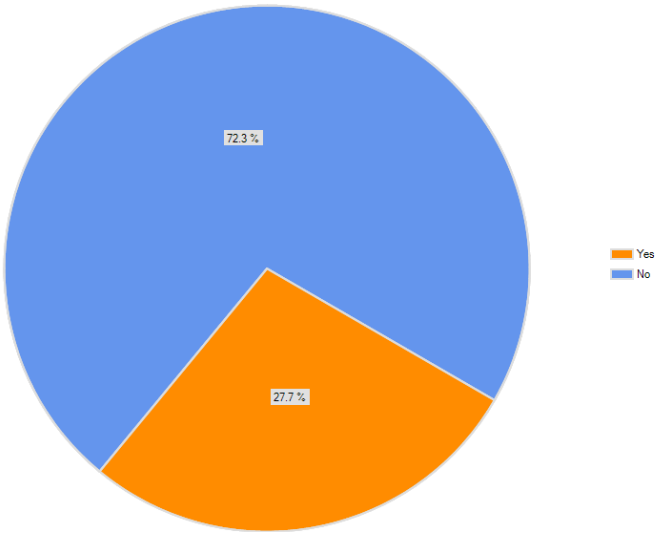
Q18 Do the measures planned to avoid ecological fragmentation get installed correctly according to the plans?



A total 52% of people (and a similar proportion when considering EU member states only) think that measures planned to avoid ecological fragmentation do not get installed correctly. This proportion changes to 64.7% of staff from road administration staff and 75% of the small group from nature conservation organisations.

Responses from people from Germany, Belgium-Flanders, Switzerland, Austria, and the Netherlands noted success; this was noted as being due to good enforcement and good interaction/cooperation. Where measures are not installed correctly, this was cited as being due to problems with commitment to build being binding, financial constraints, and lack of interpretation on how measures should be built.

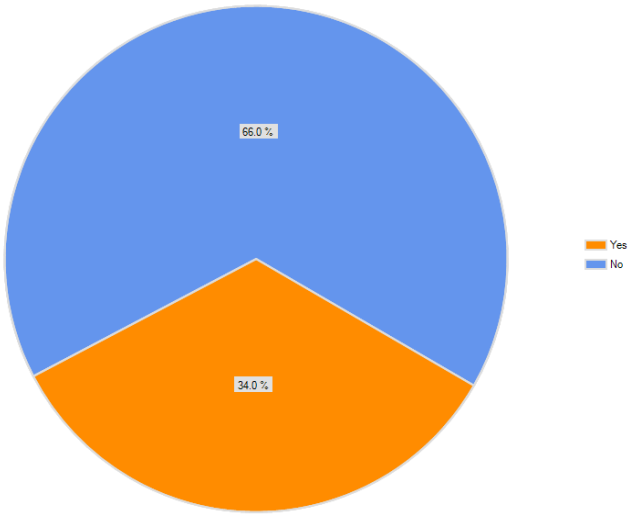
Q19 Do the measures installed to avoid ecological fragmentation get maintained such that they continue to operate as intended?



Altogether, 72.3% of people who answered this question think that measures are not maintained so that they operate as intended to avoid ecological fragmentation (the proportion is only slightly better when considering EU member states only (71.1%)). This proportion decreases to 62.5% of staff from road administration staff; the response from the small group from nature conservation organisations is similar to the whole dataset.

Where measures are maintained, this is because there is a dedicated organisation dealing with maintenance, or there is a contractual obligation. Budgetary constraints, lack of agreements or an appropriate organisation to take ownership of maintenance, and lack of enforcement of maintenance obligations are the main reasons for lack of maintenance. Retrofitting measures into existing roads is noted as more difficult to achieve than the installation of measures during construction.

Q20 If the effectiveness of mitigation measures is monitored, is this fed up to the strategic level (for example policy makers, heads of nature conservancy, and road authorities) effectively?



Among the people who answered this question, 66% think that the effectiveness of mitigation is not fed up to the strategic level (the proportion is better when considering EU member states only (57.5%)). This proportion changes to 58.8% of staff from road administration staff; the response from the small group from nature conservation administrations is similar to the whole dataset.

Where effectiveness of measures is fed up to the strategic level, this is often patchy or only recently introduced. Where it is not, this is because there is very little monitoring to report, or if monitoring is carried out and it is reported, this is not done in a comprehensive manner or is kept internal to road administrations.

3.3 Interviews – discussion of main themes

The key themes taken from the answers to the questionnaire were explored in follow-up interviews, the findings of which are discussed in this section, grouped by themes (although it should be noted that some issues relate to several themes).

Context for interviews

From the questionnaire responses, it appeared that certain countries have more success in avoiding/reducing ecological fragmentation. Respondents from Germany, Denmark, Portugal, the Netherlands, Switzerland, and Austria generally felt that the legislation, policy, and guidance available is suitable for preventing conflicts between roads and ecological networks and that institutional issues are not a problem in avoiding or reducing ecological fragmentation effects of roads. In contrast, in Spain, the respondents generally felt that the legislation, policy, and guidance available is not suitable for preventing conflicts between roads and ecological networks. Institutional issues are also a problem in avoiding or reducing the ecological fragmentation effects of roads. This seems to be the case in the UK also, but fewer people responded to the questionnaire, making this a less robust conclusion.

The Netherlands is regarded as one of the western European countries that has a good record in delivering measures to avoid or reduce ecological fragmentation and thus the interview there was intended to investigate why institutional issues seem to be less of a barrier to implementation of measures than elsewhere. The Netherlands also has a National Ecological Network and the relevance and usefulness of this to other CEDR countries was explored in the interview.

The questionnaire response from the English Highways Agency noted that England has no policies or programmes for defragmentation to improve connectivity across linear infrastructure, and that without such a framework, biodiversity loss cannot be addressed. Furthermore, the road administration was noted as being dominant over other statutory bodies, and non-governmental organisations (for example, nature conservation trusts) are said to be marginalised. Delivering long-term commitments was also noted as being an issue. The Design, Build, (Finance), Operate model (a type of PPP), which has been applied in the UK in road projects since the 1990s, is of interest in a wider context in Europe. Therefore we interviewed representatives from England as a counterpoint to the Dutch example.

Questionnaire responses from Spain suggested that the legislation, policy, and guidance available is considered to be unsuitable for preventing conflicts between roads and ecological networks and institutional issues are felt to be a problem in avoiding or reducing ecological fragmentation effects of roads, so an interview was held with representatives from the Autonomous Community of Catalonia in Spain.

We felt it would be worthwhile to investigate the institutional arrangements and the way in which ecological fragmentation issues in relation to roads are dealt with in countries that recently joined the EU. In order to investigate this aspect, an interview was held in Hungary. No completed responses to the questionnaire were received from Hungary, therefore a briefing note was sent to participants prior to the interview to provide them with context for the discussions.

Drivers

The COST 341 action to produce national 'state-of-the-art' reports can be viewed as a driver to good practice and has led to varying degrees of acceptance of the principles in the handbook and the adoption of these principles in CEDR countries. In Spain, the action has led to a regular multi-party Working Group on Habitat Fragmentation due to Transport Infrastructure. This working group has produced technical prescriptions for the design of fauna passages and other guidance, which are adopted as standards in some of the autonomous regions of Spain. This body lacks powers but is assisting in conflict resolution and in delivering a standardised approach. The working group procures scientific research into ecological fragmentation and plays an important role in raising awareness of ecological connectivity in the road industry in Spain.

In Catalonia, there is an emerging Connectivity Sectoral Plan. The primary purpose of the plan is to connect or prevent isolation of Natura 2000 sites. It is a government plan that will be material in spatial planning. Similarly, it was noted in a questionnaire response from Denmark that there is a strong political desire to avoid controversy where road projects might affect Natura 2000 sites. Therefore, the presence of Natura 2000 sites can be an effective driver for mitigation measures (although see also the Hungarian perspective below).

In England, the Highways Agency operates without any national strategy on ecological fragmentation and roads, and generally only responds to legal requirements; beyond this, the involvement is ad hoc and opportunistic. The Highways Agency produced an advice note on fauna passages in 2004 in response to the COST 341 action. It was produced by the Highways Agency alone and had no recognition or support from the UK central government. The Highways Agency did not publish its advice note, following concerns from senior staff in relation to costs and delays that could be experienced at project level through adopting the designs described in the COST 341 Handbook. Comparison of the Spanish and English response to COST 341 indicates that this has led to very different outcomes in different countries and highlights that success requires an effective driver.

Hungary followed a similar path to England in response to COST 341 and produced a report recommending adoption of the principles of the handbook (which was not adopted other than for the design of measures). The driver for good practice in Hungary has been the desire to avoid road traffic accidents (RTAs) involving deer and boar (i.e. a societal driver). This has led to the installation of many measures, such as fencing and ecoducts, and road safety where collisions (particularly with ungulate species) are a concern has been an effective driver for delivery of defragmentation measures across the EU.

In contrast to the effective action to address the traffic safety aspects, the designation of 20% of Hungary as Natura 2000 sites and fragmentation affecting Annex II species has not been as effective a driver. This is in part due to the relationship between the road administration and the nature conservation administration (these two organisations engage in little dialogue other than that which is legally required, please also see the text concerning cooperation). As noted in responses from several other counties to the questionnaire, this has led to an adversarial situation where the road administration does not consider that it has a role in addressing ecological fragmentation and feels that establishment of a defined ecological network is an environmental issue, not a roads issue.

Another form of driver to good practice that can be very effective is public pressure. In the Netherlands, the roads sector was in the past portrayed as 'Attila on a bulldozer'. The contentious A27 road project and a severe decline in badger numbers as a result of mortality on roads led to strong media and political pressure. This had an influence on central government policy and led to treasury funding the road and nature conservation administrations to deliver the Dutch National Ecological Network (*Ecologische Hoofdstructuur (EHS)*) over 28 years. Similarly the M3 Twyford project in England was controversial and the public scrutiny led to a considerably more comprehensive mitigation package than is usual in UK road projects.

Awareness of issues/public or local involvement

At the IENE 2010 conference, public/local involvement in avoiding ecological fragmentation was noted as important. Overall, however, this was the fourth or lower priority in most questionnaire responses, and public involvement was cited by only two people (both from universities/research establishments) as the most important factor in successful integration of road networks and wildlife.

Nevertheless, in all four interviews, the power of the public was discussed and noted as an effective driver for inclusion of defragmentation measures. In the Netherlands, the reason given for why provincial governments accept the need for measures is that the National Ecological Network exists and that local people understand and accept this approach.

The public awareness of ecological issues or ecosystem services varies across the EU. In the Netherlands, there have been water management boards since the 1300s and there is consequently a very high public perception of the value of ecosystem services relating to water. This was noted in the Dutch interview as a potential reason why the public accepts the costs of defragmentation measures. In other countries such as Hungary, by contrast, there is no such obvious close link with natural systems and little public awareness of nature conservation issues.

Another influence on institutional arrangements noted in the Netherlands was the Dutch national characteristics. The country has a long history of being densely populated and this was noted as being a reason why there is a culture of different stakeholders (for instance national and regional government, water boards and recreation organisations) getting on well with each other.

Spatial national network/framework

The Dutch National Ecological Network is material in spatial planning, and those interviewed stated the importance of this network in delivering measures to address ecological fragmentation. The emerging Catalan Connectivity Sectoral Plan, which defines ecological networks, is underpinned by a good understanding of the ecological networks present.

In the interview in England, it was noted that without such an ecological network (and the research that is needed to define it), there is no focus or standardisation in the approach to defragmentation. In Hungary, where the focus is on the prevention of RTAs, it is accepted that understanding of the movement of wildlife across the country is lacking. With the exception of the results of a small number of studies commissioned by the National Infrastructure Developing Company (especially of mammal species), there is little data to support designation of corridors in an ecological network.

An ecological network can be used to assist in route selection at the earliest opportunity and this will allow conflicts at project level to be avoided (or at least predicted). This was noted as desirable due to the fact that the provision of compensation measures can be onerous. In Catalonia, it is hoped that the adoption of the Connectivity Sectoral Plan will lead to avoidance of routes that could affect Natura 2000 sites.

By contrast, when Hungary acceded to the EU, the simultaneous designation of Natura 2000 sites and motorways as part of the E-road network led to conflicts where new motorways were routed through Natura 2000 sites. It was noted in the interview that to avoid these large sites would result in significantly longer and therefore more expensive roads; this indicates that institutional arrangements need to be able to address fragmentation issues at the highest institutional levels. There is no designated national ecological network other than Natura 2000 in Hungary (the nature conservation administration has defined a non-statutory network that is not recognised by the road administration). The legacy of this situation (as in other countries with no national ecological network) is that defragmentation measures need to be considered at project level.

Overall strategy – legislation/policy/framework/mechanism

Having an overall strategy that considers the issues of roads and wildlife was noted by more questionnaire respondents as the most important factor in successful integration of road networks and wildlife than any other factor. This should be considered in the context of comments from delegates at the IENE conference, where it was noted that even strategies may not have the power that legislation would have to avoid conflicts, and that this may be difficult to achieve because of differing organisational remits.

A total 70% of people who responded to the questionnaire think that the current policy and guidance is not effective in preventing conflict between road networks and ecological networks and 75% think that institutional issues are a problem in the delivery of measures to avoid or reduce the ecological fragmentation effects of roads.

In the Netherlands, having an overall ecological defragmentation programme in place (the *Meerjarenprogramma Ontsnippering (MJPO)*) is felt to be an important factor in delivering defragmentation measures. In Catalonia, the Connectivity Sectoral Plan in preparation (the primary purpose of which is to connect Natura 2000 sites) will be defined in legislation and will be material in spatial planning. EIA practitioners and ecologists consider this to be a key tool in addressing ecological fragmentation. Those attending the interview in Hungary considered that it would be preferable to have a national strategy for ecological fragmentation approved by road and nature conservation administrations so that conflicts can be addressed at the plan level rather than in every project.

The realisation of the Dutch EHS is a project that started in 1990 and will run until 2018. This long timescale allows the costs to be spread, which makes it more acceptable for the treasury. In addition, the progress can be measured annually to ensure the programme is on course.

Acceptance from the treasury is seen as key to the success in the Netherlands (the treasury needed to understand the importance in order to approve funding). There was agreement with this point of view in England from the Highways Agency, which noted that from the earliest stages, project assessment should consider the financial cost of implementing defragmentation measures and managing them in the long term.

Policy can be effective if backed up with funding for delivery mechanisms (e.g. the centrally funded MJPO in the Netherlands); legislation is another route that can also lead to success (e.g. the Connectivity Sectoral Plan will be material in spatial planning in Catalonia).

In the absence of an overall strategy based on an ecological network, conflicts between road and nature conservation administrations are likely to be harder to resolve, and in such cases, a strong character/leader is required to work across borders between the administrations.

Effective drivers can sometimes be ineffective in leading to practical systems where defragmentation measures can be adopted.

A lack of (or unclear) legislative/best practice drivers was one of the main reasons noted by questionnaire respondents for why policy and guidance is seen as ineffective. An example of this is in England where the recent *Making space for nature* report[10] calls for the establishment of a coherent and resilient ecological network in England and notes the role that public bodies responsible for roads should play in establishing such a network. There is also a forthcoming UK Government Environment White Paper; both documents are clear drivers for change in England.

However, the Highways Agency noted in the interview that without a 'duty' or mechanism to deliver the changes that would be required (and which can lead to funding and withstand political/policy change), there will be no effective action. The lack of a mechanism has led to a culture in the roads sector where ecological connectivity measures such as those recommended in the COST 341 Handbook are resisted by engineers and not really proposed in EIA mitigation packages (there are few examples of ecoducts in England).

10 Lawton, J.H. et al (2010) *Making space for nature: a review of England's wildlife sites and ecological network*. Report to DEFRA.

The prevailing culture in the English roads sector and resistance to practical measures as part of new infrastructure means that defragmentation of existing infrastructure is not considered in England. This is in contrast to countries such as Switzerland, where defragmentation programmes are focused on existing infrastructure, and Catalonia, where the emerging Connectivity Sectoral Plan will consider existing infrastructure. It is important to consider existing infrastructure because most EU countries have a roads programme that is unlikely to include significant amounts of new road building.

The conflicts that can arise from resistance to implementation of defragmentation measures on financial grounds can be avoided if there is an overall strategy. It was noted in the Netherlands that having a high-level agreement to fund measures in place (for instance from the road and/or nature conservation administration) means that funding issues do not usually result in conflict or delay at project level. In contrast, in England, where no such framework exists, every project involves resolving conflicts between engineers and ecologists about the type of measure that can be included.

There is a growing consensus on the effectiveness of fauna passages (in ecological function and RTA avoidance terms), which makes the cost easy to justify (for example in Catalonia). However, the retrofitting of such measures in existing infrastructure has so far proven difficult due to cost (which is likely to be a greater constraint in times of recession). The problems with delivering measures in existing infrastructure may also be due to the comparatively short length of time over which defragmentation issues have been considered.

Power structures

Some questionnaire participants have the perception that road administrations do not take nature conservation seriously or that they take advantage of a more powerful position in the power structure when ecological fragmentation and connectivity is considered. This point was strongly made at the IENE 2010 conference and some responses from road administration staff endorse the point of view that road administrations can be dominant over other stakeholders such as nature conservation administrations or NGOs (e.g. in England) and this despite the fact that nature conservation administrations have a statutory role and defined responsibilities. In Catalonia, it was noted that the power lies with the organisation that can deliver economic prosperity (i.e. the road administration) and that, for example, public perception favours irrigation of steppe habitat for agricultural purposes over the conservation of the intrinsic ecological value. Public perception is that roads are of benefit to society whereas wildlife is not regarded in the same way (see, however, the text concerning alternative agendas for consideration of the role of ecosystem services). The effects of these factors are likely to be especially acute in times of recession.

Nature conservation administrations appear to be most respected in countries with longer histories of having an overall strategy for ecological fragmentation and where this has led to shared experience in addressing issues at a project level and acceptance in the road sector of standardised measures.

Science

A common theme in the interviews was the need to have enough ecological understanding to demonstrate the scale of the fragmentation problem, to define ecological networks, and to understand where key elements of the networks are located. This is required if there is to be an effective approach to avoiding/reducing ecological connectivity problems that addresses the most important aspects.

A metric for fragmentation (or surrogate measurement) leading to better understanding of issues by all parties is necessary (the level of understanding is considered to be sufficient in Catalonia whereas in England and Hungary no such understanding exists).

It was noted in interviews in England and the Netherlands that using the Natura 2000 network of protected sites as a basis of an approach to avoiding ecological fragmentation may not be the most effective approach. This is because the Natura 2000 network is a series of sites which management aims to maintain in a steady condition and where dynamic connections between the sites that might be relevant in considering ecological fragmentation may be less important. In addition, the Natura 2000 network does not consider species other than the qualifying species.

This is not perceived as a conflict in Catalonia where the approach to defragmentation is supported by perceived good understanding of the movement of Natura 2000 species at the scale of the whole landscape where the Natura 2000 sites are situated. In Hungary, the road administration noted that they have installed lots of fauna passages based on very limited ecological understanding, which indicates that these may be in the wrong places to deliver ecological benefits. This reinforces the findings of the questionnaire where this same situation was noted in several other countries.

Questionnaire responses indicated that there is unwillingness in road administrations to accept and/or fund mitigation due to lack of data to demonstrate the effectiveness of measures proposed. The aim to secure investment may need to be informed by studies that show that defragmentation measures are used by wildlife, but also that they allow ecological processes to operate more effectively than in the absence of such measures. This links with the desire to have a transferable and accepted metric of fragmentation.

Cooperation

The IENE 2010 conference delegates felt cooperation between stakeholders was the most important institutional factor, and the responses to the questionnaire appear to show that this is not a constraining factor; more than 60% of questionnaire responses agree that stakeholders cooperate (despite the responses on institutional issues noted above) and that technical and financial procedures are compatible. This implies that all parties work within the frameworks as best they can to achieve positive outcomes, although there are countries where this is less evident.

The English Highways Agency has noted that without a landscape-scale approach (i.e. an approach that considers the land use adjacent to and beyond the road corridor), measures to address defragmentation issues cannot be successful. An example that illustrates this point is a crossing installed on the M40 motorway to facilitate movement of deer across the road that was fenced by the UK government Forestry Commission to prevent deer accessing and damaging the tree crop in adjacent woodland.

The English Highways Agency remarked that a liaison group (a group with representatives from different stakeholders such as planners, farming, and forestry groups) considering the issues at a landscape scale would be beneficial in avoiding conflicts and delivering effective measures. The role of major roads as facilitating other economic development that contributes to ecological fragmentation was mentioned in the UK context and endorsed by the participants in the interview in Catalonia. This suggests the need for an organisation considering landscape scale defragmentation effects that are not solely a roads or linear transportation infrastructure issue.

The research found several examples of cooperation between stakeholders leading to successful delivery of practical measures, for example, the German Konjunkturpaket II project of 18 ecoducts delivered by the road administration, nature conservation administration and NGOs. In Belgium-Flanders, all fauna bridges are co-financed by the Road Administration and the Ministry of the Environment; the Kikbeek Ecoduct in the Flemish region of Limburg was cited in a questionnaire response as a project that had been delivered in conjunction with the local community.

Hungary is a good example of a country where little cooperation is evident between stakeholders although this is also the case elsewhere; the road administrations do not perceive ecological fragmentation as part of their responsibility, they consider this part of the nature conservation administrations remit. In addition, they see the nature conservation administration as having a role in stopping or delaying roads projects, rather than being part of the project itself.

In the Netherlands, there is a specific government programme that considers defragmentation (MJPO). Wherever possible, this programme uses existing procedures to streamline reporting and monitoring. However, it does hold liaison groups ('platforms'), which monitor progress and are used for conflict management. The Dutch model was noted as effective because the programme and platforms have no history of conflict with stakeholders that might have impacts at project level.

The co-funding of the MJPO (from the budget of three government ministries) has also led to a desire to avoid conflicts between parties; the Spanish Working Party, while having no power, is a multi-party organisation that demonstrates the effectiveness that such bodies can achieve.

Where co-uses of fauna passages/ecoducts can be found, this can also provide a substantial proportion of the funding (this is the case in the Netherlands where co-funding can be provided by recreation and water management bodies). Such funding is likely to be especially important in times of recession where there is pressure from central government to reduce budgets.

In Catalonia, England, and Hungary, it was noted that road administrations are not always the most suitable organisation to deliver long-term ecological management of defragmentation measures, for example, at a landscape scale or where land outside the highway boundary is required. In Hungary, it is difficult for the road administration to expropriate land and then arrange for management by another party; in Catalonia, England, and Hungary, it was noted that some vehicle to manage and deliver such measures would be the most effective way of ensuring long-term success.

Role of standards

In Spain, the national prescriptions for ecological measures (e.g. fauna passages) are adopted as standards in some regions or treated as such in certain EIA declarations, but the Catalonian Connectivity Sectoral Plan is also expected to lead to an element of standardisation in approach that is hoped will ultimately reduce institutional conflicts.

In Hungary, there are issues with conflicting standards that may also exist in other EU countries. There are two conflicting standards for fauna passages, one designed by the nature conservation administration and one designed by the road administration. The road administration standard (which is based on the COST 341 Handbook) is more detailed than the other standard and is obligatory on state roads. This design has been implemented in many road projects and can therefore be considered a success. However, the nature conservation administration do not accept this design, which has led to institutional conflict between government departments.

Use of alternative agendas

In the Netherlands, the sustainability agenda is well understood by politicians and government organisations. This was noted as being a key factor in long-term justification of funding for defragmentation measures. It was noted as being important to justify the requirement for defragmentation measures (especially in times of recession) by associating the subject with an agenda in which the government is currently interested. For instance, the costs associated with implementation of defragmentation measures can be associated with ecosystem services (the benefits people obtain from ecosystems, which include provisioning, regulating, and cultural services that directly affect people and the supporting services needed to maintain other services[11]). However, in the interview in England, it was noted that for small projects (such as junction improvements and widening works, which form the majority of the English Highways Agency work) it would be impossible to demonstrate the value of ecosystem services as a means to secure investment in defragmentation measures.

The most common form of alternative agenda used to justify defragmentation measures (and not wholly unrelated) is the prevention of road traffic accidents. By preventing accidents that could kill or injure people, wildlife also benefits. It is common practice to include animal-proof fences to prevent access to the road for large ungulates across the EU and structures crossing the road allow animals to cross without danger to road users. This was noted as a useful tool to justify defragmentation measures in Catalonia; the focus on avoidance of RTAs with game leads to ecological benefits that are not necessarily the aim of the measures.

In the Netherlands, the provincial governments have an obligation to provide defragmentation measures (which are centrally funded and deliver national policies). It was noted in the interview that delivering local defragmentation measures is associated with national road administration measures in delivering the EHS. In this way, local measures (delivered by the provincial government as a key organisation) are able to achieve better outcomes for wildlife, and the public is aware of the requirement (from the national work) and the overall purpose.

Using public concern/awareness of issues associated with charismatic species (such as badgers) may allow the delivery of defragmentation/connectivity measures for rarer or more fragmented populations of species for which there is less public awareness/empathy (such as invertebrates).

Political or public perception issues can be a strong driver for implementation of defragmentation measures. Instances where this has occurred were cited in three interviews and are summarised in Table 2 below.

Table 2: Road projects where other agendas have been used to deliver connectivity measures

Country/region	Road project	Other agendas instrumental in delivering connectivity measures
England	A3 Hindhead Tunnel	Landscape (visual impact) issues
	A21 Lamberhurst	Cultural heritage and visual impact
Catalonia	C37	Permeability for agricultural management, visual impact and favourable cut/fill balance
Hungary	N7	Hunting (movement of game across roads)

[11] Millennium Ecosystem Assessment Board (undated) *Living beyond our means: natural assets and human wellbeing*.

In the projects listed in Table 2, the implementation of considerable measures to avoid fragmentation was possible because the projects were contentious and because the road administrations wanted to ensure they were permitted. In several cases discussed in the interviews, the ecology section of the EIA did not justify the measures for fragmentation reasons, but for political reasons the measures were provided (e.g. in Catalonia). In Hungary, over-provision of fauna passages seems to be the usual approach for new roads to ensure acceptance by the environment ministry. This approach was also successful on the contentious A34 Newbury scheme in England.

Long-term commitment and continuity

The institutional arrangements relating to EIA commitments vary between CEDR countries and the ability to deliver successful measures is dependent on the arrangements in place. Delegates at the IENE 2010 conference noted that measures such as legal commitments and sanctions are required where commitments are not fulfilled and the questionnaire responses indicate that environmental administrations fail to follow up on commitments made in EIAs.

In England, the commitments made in EIAs have not always been met, and there is no mechanism in place to check that measures have been implemented or to enforce delivery. There is a clear need in England for a system to ensure commitments are met and transferred to the maintaining agent, and to ensure that funds for biodiversity measures are not used for other purposes. This is in contrast to Catalonia and Hungary, where the EIA declaration is a legal obligation (the delivery of which in Catalonia is monitored for two years by an independent monitoring commission made up of road and environment administration representatives).

The main reasons why institutional issues were considered a problem by questionnaire respondents relate to the continuity of applied expertise and funding but also have parallels with role and responsibility definitions (lack of long-term commitment and issues with establishing agreements). Countries where institutional issues do not seem to be a problem have road administrations that have engaged with or employed ecologists (often for many years) and therefore consider ecological connectivity or the sensitive nature of certain sites in their core activities.

In most EU member states, there is a clear separation between organisations planning new road projects, organisations constructing the project, and the maintaining agents of the roads. This was cited in interviews in England, Catalonia, and Hungary as being a problem because the aims of defragmentation mitigation are not communicated effectively between the organisations responsible for the different phases. For instance, maintenance contractors are not familiar with the requirements of the EIA and so are not aware of the intentions of the measures to address fragmentation.

PPP projects were noted by CEDR task group 7 as potentially offering a good model for ensuring continuity in the approach to ecological defragmentation between the EIA stage and operational management of roads. The roads that are managed in this way in England are considered among the best maintained in the country, but the Highways Agency notes that delivering ecological enhancement or improved connectivity has not been a main aim of the contracts.

The Highways Agency feels that this model can deliver good outcomes for ecological connectivity, but this aim needs to be carefully incorporated into the contract because the contractor does not have much flexibility in its work. The same model is being adopted across the EU; in Hungary, there is one road with this arrangement (M6), and in Catalonia, this approach has been in place for around five years. The relevant interview panels did not have any indication of the success of this approach, however, in Catalonia, they felt that this type of contract would make installation of effective measures easier.

Another factor in PPP arrangements is that the contract money is allocated in advance and therefore any budget reductions to the road administration (for instance, in times of recession) do not affect the PPP roads, but must be met from the administration.

Practical aspects relating to the effectiveness of measures to avoid ecological fragmentation

A key theme relating to practical aspects of measures to avoid ecological fragmentation that emerged from the questionnaire is that only around half of respondents noted that mitigation measures get installed correctly (often due to lack of continuity from the EIA/planning stage to implementation).

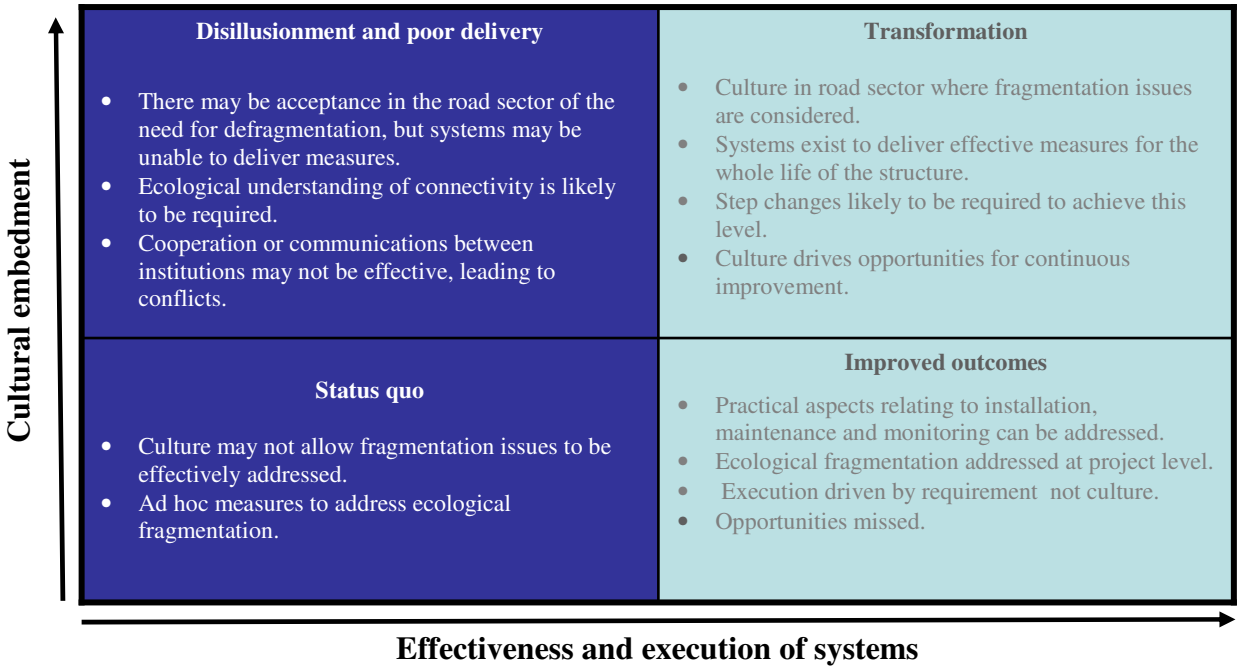
In all four interviews it was noted that in general, measures are installed correctly and this seems to reflect the control that is possible at this stage of the project where the EIA is a recent document that defines the commitments (to a varying degree depending on the country). Issues to do with incorrect locations for measures highlighted in the interviews were as a result of poor understanding of the ecological corridors present.

The questionnaire responses indicate that measures are seldom maintained to function properly and this was endorsed in the Catalan interview where it was noted that maintenance teams' roles are not well defined (particularly in older schemes). In Catalonia, defragmentation measures are designed to require little maintenance, and the aftercare period following construction is two or three years, after which there is little or no maintenance of fauna passages. Hungary is an example that illustrates the situation in many EU member states, where maintenance is focused on the structural aspects and vegetation management of defragmentation measures and has little or no input from ecologists.

Monitoring of defragmentation measures was noted as uncoordinated or sporadic in most questionnaire responses, and it was observed that results are often not passed to the strategic level for dissemination. The Dutch road administration noted that monitoring of the effectiveness of badger tunnels is not required because these measures are known to be effective. In Catalonia, monitoring tends to be carried out by maintenance staff and is intended to see if the structure is functioning; ecological monitoring of effectiveness is less common and is often carried out by academic institutes. In Hungary, the National Infrastructure Developing Company has carried out studies into the effectiveness of measures and the results are used to inform future projects; the results of the monitoring are not shared with other organisations in any formal way. However, in most cases, studies have looked at the use of structures by animals rather than considering effects on species populations.

3.4 Possible ways forward

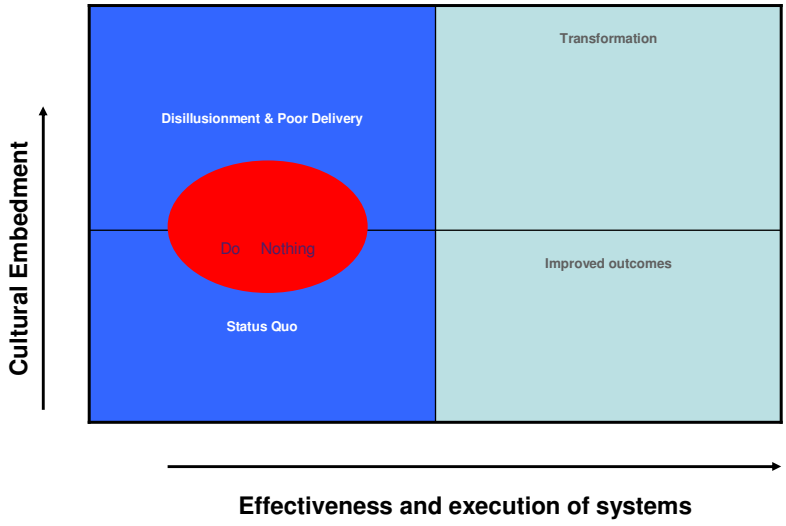
The ways in which a country moves forward will depend on the way in which ecology is considered in the road sector and the prevailing institutional arrangements. The change grid diagram below shows scenarios and trajectories which countries could follow.



The top right of the diagram is the adoption of best practice combined with cultural embedment. Based on the evidence of the surveys and interviews, it is considered that this would represent transformational change for most organisations. Improvements in procedures and increased cooperation will lead to more effective systems being adopted, but such changes alone will not lead to transformational change. For a country to move into the top half of the diagram, some form of change in the culture is required. The following paragraphs discuss the various ways road administrations/sectors can take action to move through this diagram.

The do-nothing scenario

Doing nothing is not a strategy for moving in the right direction through the change grid. Doing nothing would effectively be an oversight of a deteriorating situation. It would represent a missed opportunity to embrace some of the lessons of best practice developed by some countries. This would be to the detriment of all. Countries where good practice is adopted will continue to deliver schemes with defragmentation measures, but to deliver further gains they need to benefit from a concerted European research effort. In countries with less good practice, projects will continue to be subject to delays due to institutional conflicts with a growth in disillusionment and poor delivery. The collective reputation of road administrations will be affected detrimentally. The diagram below shows the location on the change grid that the do-nothing strategy would achieve.



Action at national level – quick wins

There are actions that can be taken by road administrations and other stakeholders (such as planning administrations and contractors) that do not require any international cooperation and can be relatively easily achieved. These quick wins will address real issues, which have been highlighted in the research but will not require the fundamental reorganisation of administrations or budgetary structures. Moreover, the actions do not require substantial funding (and should therefore be more acceptable in times of economic downturn than other actions) and have the advantage that they would cumulatively deliver better benefits than if adopted alone. Road administrations would benefit politically from cooperating better and delivering efficiencies discussed in this section.

The disadvantages of the actions recommended in the paragraphs below are that they do not address the fundamental issues at the highest level and are therefore unlikely to be able to lead to significant changes. The recommendations are as follows:

Central government should effectively coordinate between its departments and should provide a forum in which to consider broad ecological fragmentation and urbanisation issues. This should consider the issues on the landscape scale and should engage government bodies and NGOs with interests in linear infrastructure, spatial planning, landscape and rural issues (agriculture, forestry, hunting and recreation), and land use. The aim should be to deliver a realistic spatial plan that does not lead to conflicts between stakeholders (especially government departments) because conflicts could lead to delays. It is accepted that in many countries, developing effective ways to cooperate may not be a quick win.

As part of the remit of landscape-scale stakeholder engagement, government should facilitate the cooperation of road administrations and nature conservation/environmental administrations in addressing the specific topic of ecological fragmentation and roads. This could be in the form of working parties following the Spanish example or platforms as in the Netherlands. The aim should be to encourage all parties (farming groups, hunting organisations, recreational groups, etc.) to work across administration boundaries on this issue to avoid costly delays in projects.

An example of how such stakeholder cooperation might reduce conflicts (and therefore potential delays to projects) would be if nature conservation administration staff were trained to better understand road engineering techniques and project procedures. This would allow for better use of time and would lead to fewer misunderstandings.

Countries with longer histories of addressing the issues appear to have fewer institutional issues and therefore the aim in countries with no tradition of defragmentation ecology should be to encourage dialogue with all parties to make this topic part of the culture in road ecology.

The working party should use existing governmental procedures and administrative and budgetary structures as much as possible in order to minimise the administrative burden and so that fragmentation issues can become part of the culture more easily than if the arrangements were unique and outside normal administrative arrangements.

Opportunities to deliver ecological benefits because of other agendas, such as concerns about visual impact, hunting, and permeability for agricultural management, should be actively explored. The benefits are:

- cooperating and delivering measures in this way will demonstrate good cooperation between administrations;
- delays can be avoided;
- shared use can lead to co-funding, but also solutions may be cheaper if they do not conflict; and
- budgets can deliver more measures than if opportunities presented by other agendas are not adopted.

The working party/platform would be the ideal forum to investigate such opportunities. Road safety considerations are a good way to justify fences and crossing points in countries where there are lots of RTAs involving large animals (notably ungulates). Climate change and adaptation is another agenda where there might be parallel work and where efficiencies might be delivered by considering this alongside issues of roads and wildlife. Co-funding opportunities should also be sought, since these tend to be very effective as a result of the mutual desire to deliver measures without conflict and may enable more measures to be delivered (especially in times of recession where obtaining best value is essential).

Administrations should strive for better coordination between the plan level and projects to avoid conflicts as a result of fragmentation concerns rather than needing to resolve them at project level (where delays would result in additional costs). A working party organisation could facilitate such coordination. Where there are programmes for major maintenance works, safety improvements, or road reconstruction, these opportunities should be used to construct defragmentation measures in order to minimise costs.

An overall approach is required for the whole project lifecycle, which enables ecological expertise and appropriate resources to consider connectivity/fragmentation to be secured through to the operational phase. This can be achieved by defining the procedures and required information at each transition from design to construction and management, which will allow the required specialists to have input when this is required. Where the specialists are properly informed, this would minimise opportunities for delay and would ensure funds spent on measures are not wasted by being compromised by lack of understanding of their purpose.

There should be a mechanism in place to ensure that EIA commitments are delivered, and to enforce delivery (in those countries where this is not already the case or where it is ineffective).

The mechanism for passing information from the consultants who have designed and built defragmentation measures into new or existing infrastructure to the maintaining agents should be formalised within reporting procedures and built in to asset management systems to ensure that, if specific information on the maintenance or monitoring is required, it is available to those who need it. The advantage is that measures will continue to function as they were designed.

The arrangements by which measures are delivered should be investigated, for instance, whether any barriers that prevent agreements being made with third parties for maintenance funded from a road administration budget can be removed.

In Catalonia, one per cent of major road project budgets is allocated to 'cultural' purposes. The Catalan delegation suggested a similar proportion of project budgets should be allocated to ecological monitoring of the effectiveness of ecological defragmentation measures. Where funding does not already allow, contracts should include a small percentage for ecological monitoring of effectiveness, to inform changes to designs that might be necessary and with the aim of justification of such measures for future projects.

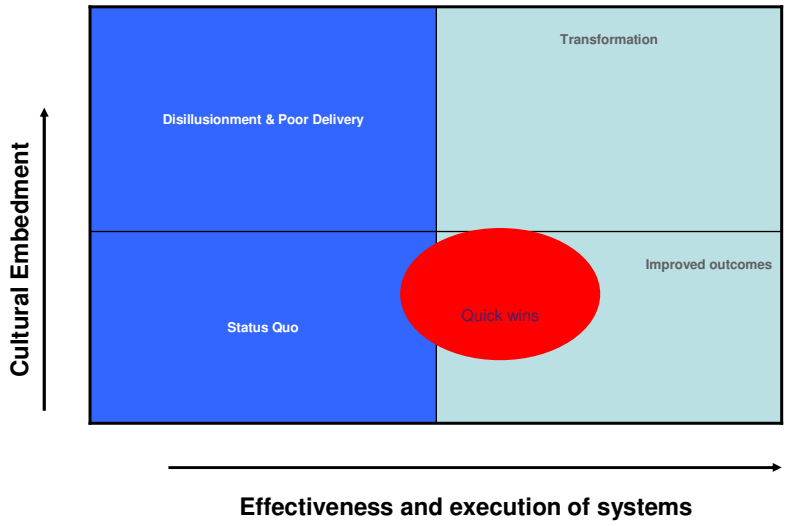
Defragmentation measures that have not been proven to be successful through monitoring should be monitored according to a defined national set of aims. The monitoring reports should briefly describe whether the measure is effective and, if it is not, ways in which to increase its effectiveness. The results of the monitoring should be collated by the road administration and should be disseminated to other interested stakeholders (notably the nature conservation administration) so all parties are aware of which measures work best in the country (i.e. which measures should be invested in and which should not).

Where PPP-type contracts are awarded, they should include clauses to deliver ecological benefits including those relating to fragmentation issues in the long-term management of the highway estate. The ecology actions/measures should be incorporated into other clauses (for instance landscape maintenance) so that they are embedded in standard procedures. This way they will be cost effective and not an additional requirement necessitating additional resources. The goals of the ecology actions/measures should be explained in general quality terms so that these can be understood by non-ecologists.

The use of penalty clauses in maintenance contracts, for instance pro rata for RTAs (which would include particularly nationally protected or Annex 1 species), should be investigated.

Justification of measures should include public involvement and this should consider the national perspective on ecosystem services that is needed (e.g. the Dutch public understands water issues; in Norway, there is a different set of values associated with understanding of space and wilderness). If the public feels that it owns a defragmentation measure, it will take care of it, there would be fewer conflicts, and the measure would be more effective for the money spent than otherwise.

The diagram below shows the location on the change grid that the strategy of quick wins would achieve.



Action at national level – step changes

This section describes actions that can be taken at national level and which, to be delivered, will require institutional change or adaptation. The advantages of the actions described below are that they do not require international cooperation and will generally result in avoidance of institutional conflict at a high level. The actions will result in a road sector with fewer institutional conflicts. The adoption of these changes will also result in reduced conflicts at project level and consequently fewer project delays. In addition, the potential benefits to the environment are significant.

There are disadvantages to these actions, namely the burden of administrative change and perhaps resistance from certain parties/administrations to such changes. In addition, some reorganisation of administrations is likely to be required, and there would be implications for budgets/budgetary structures as a result of the actions proposed. For this last reason, the economic climate may determine when to embark on such changes, although governments should acknowledge the need for action where required. If necessary, action should be postponed until funds become available. The recommendations are as follows.

Where government institutions do not cooperate well on issues of roads and wildlife, there may be a need for institutional change to allow for more effective work. More effective cooperation is considered in the quick wins section above, but will require more of a cultural step change in some countries. This is still recommended because it will lead to shared ownership of issues and a desire to resolve conflicts (which will minimise project delays).

CEDR member states should develop a sound understanding of the movements of key species (especially where these species are qualifying interests of Natura 2000 sites and where their conservation status in the Natura 2000 sites depends on landscape-scale movements, also nationally rare/declining species and large mammals which might pose road safety risks). Member states should develop a 'metric of fragmentation' specific to their country and the local situation. Ultimately, this knowledge will lead to savings in terms of time and money in road projects for reasons discussed below.

Government decisions to place an obligation on their administrations to address defragmentation can only be made through understanding whether there is actually a problem with ecological connectivity (on a national scale involving other sectors such as railways). Where it is demonstrated that there is a problem with ecological connectivity as a result of roads, consideration should be given to corporate social responsibility of the road administration in addressing this issue. The decisions would include whether to fund centrally appropriate actions and it is likely that without an obligation and specifically allocated resources with which to deliver the obligation, many road administrations will be unable to address ecological fragmentation.

Sound understanding of the issues is a tool that will allow 'hotspots' for defragmentation or road safety measures to be defined and is a prerequisite of an overall strategy for addressing ecological fragmentation, as it provides the baseline information on which assessments and decisions can be made.

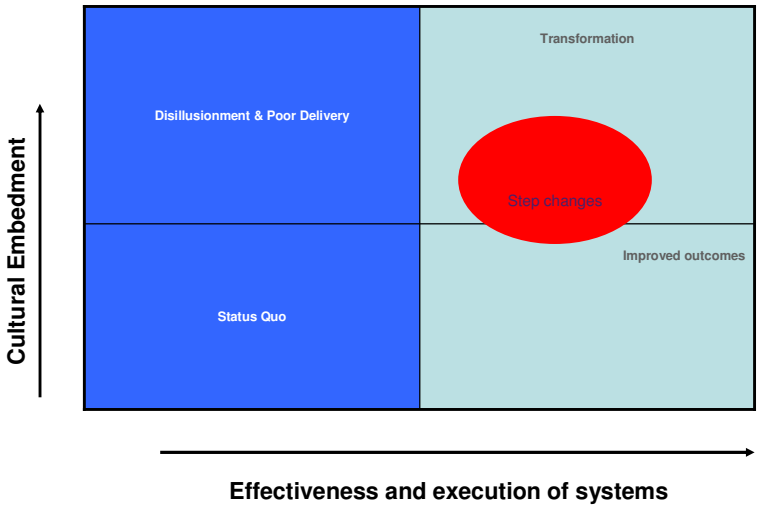
Significantly, it is clear that over-provision of defragmentation measures currently occurs in some countries and sound ecology underpinning planning/design decisions will reduce objections to projects as a result of poor understanding of the issues, as well as avoiding the costs of construction of expensive structures where they are not required.

It is clear that without a national ecological network that defines where significant ecological fragmentation would occur, there can be no standardised approach to this issue. Therefore a statutory national ecological network should be defined for use in spatial planning. The network should be based on the movement of key species (for instance those for which Natura 2000 sites have been designated (or regular routes used by large numbers of large mammals)) and should link up and complement existing designated sites. The national ecological network should be defined and agreed by ecologists from all stakeholder parties (nature conservation administrations, road administration, spatial planners, and other stakeholders).

Considering a national ecological network at the earliest stages of road projects will lead to avoidance of impacts wherever possible and costs for practical measures to consider fragmentation will be accepted and built in to project designs and embedded in budgets. This will mean less resistance to implementation of COST-341-type measures for cost reasons at project level in countries where they are currently not generally delivered (as is currently the case in England). In order to deliver maximum benefit (by gaining acceptance as the norm), defragmentation measures need to be considered as part of the package of what a project will deliver rather than as an extra item outside the normal requirements.

The planning framework should be adapted so that the ecological network is recognised in planning terms; this combination of a spatially defined element and statutory requirement to address fragmentation issues as a matter of course will act as a powerful driver in countries where no such arrangements exist at present. Ultimately, this will lead to a culture in the roads sector and beyond where the issue of defragmentation and roads is not novel, but a fundamental part of every project and a normal way of working, just like road safety.

The diagram below shows the location on the change grid that the strategy of step changes would achieve.



Action at European level

This section describes ways forward at European level. The main advantages to an international approach are that lessons learned in one country can be shared with others and this can lead to faster progress in countries where institutional arrangements are less well advanced (or where high-level issues are yet to be resolved). Another advantage is the standardised approach to the issues that would result across the EU/CEDR member states (for instance, in carrying out duties required by the EU Habitats Directive[12]).

A disadvantage of a European approach is that cooperation may be harder to realise than at a national level, for instance due to differing domestic arrangements. For this reason, a strong leader across the EU would probably be required to drive the process.

Another disadvantage of international effort is that it can impose another level of administration, and the support required would have budgetary and time implications. The recommendations are as follows.

In the absence (or ignorance) of European guidance on preventing institutional conflicts, there appears to be a role for an international organisation in delivering support to member states in addressing institutional issues. IENE is a possibility because it is a neutral organisation, whereas national road administrations and CEDR are not. The Hungarian National Infrastructure Developing Company noted that it has problems joining IENE or adopting its recommendations because it has no legal status, but it is nevertheless a well-respected organisation. There are various national working parties/platforms addressing ecological fragmentation as a result of roads and it would be beneficial if those countries involved could share their experiences in a suitable forum. A possible vehicle may be through active participation in PIARC. For example, recently the Technical Committee A1 Preserving the Environment has been carrying out a review of the environmental monitoring and evaluation and its report will be published by PIARC later this year.

Advice on dealing with ecological fragmentation issues and addressing collisions with wildlife is relevant to other sectors as well as the roads sector (e.g. nature conservation, land use, and safety). The role of an organisation as a vehicle for dissemination of the work being undertaken on roads should be explored. The COST 341 work is well regarded and CEDR could take advantage of this, for instance, through production of a topic briefing paper on institutional issues in relation to roads and wildlife.

[12] European Union (1992) Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora.

The role of the Natura 2000 network in ecological connectivity should be examined by an international panel from EU member states. The panel should investigate the extent to which Natura 2000 functions as a network with connections (which are relevant to connectivity) or as a patchwork of isolated sites. It may also be appropriate to lobby for LIFE funding to support work on connectivity and defragmentation as part of an approach that looks to complement or augment the Natura 2000 network with ecological features of the wider countryside/landscape.

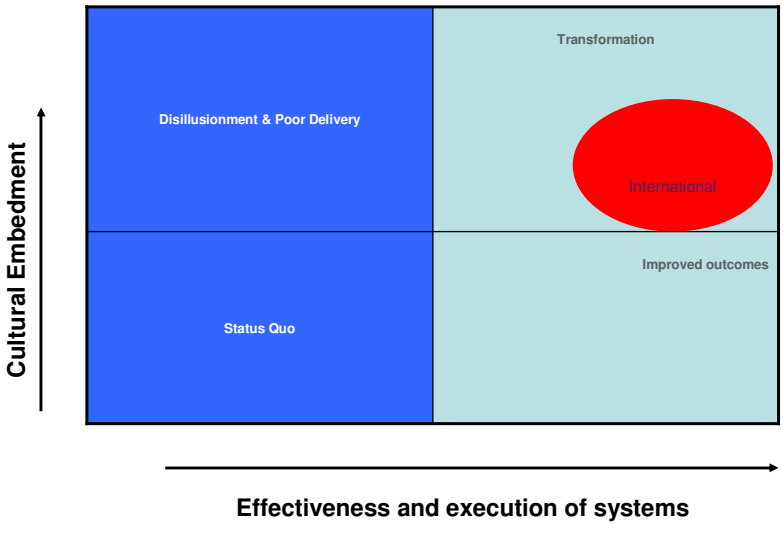
The interview panels in the Netherlands, England, and Catalonia all consider that a coordinated/cooperative research programme into ecological connectivity/fragmentation in relation to roads across the EU (involving universities and roads and nature conservation administrations) was desirable. This should be carried out with the aim of gaining an understanding of the ecology of fragmentation from all parts of the EU so that metrics of fragmentation and standard tools can be devised. The research should consider population-level effects and interactions with land use and should be used to underpin institutional arrangements such as policies/plans for defragmentation. This could be complementary to a national approach.

This research would also provide reference cases and examples of effectiveness of measures from all parts and eco-regions of the EU. In Catalonia, the value of monitoring in a coordinated manner was noted and it is recommended that some form of monitoring of all ecoducts/fauna passages should be carried out and reported to the relevant road administration (as described for the national level).

An internationally coordinated approach to European research into ecological connectivity and the effectiveness of defragmentation and road safety measures will provide a more powerful research tool and would prevent duplication of effort.

It seems that a companion or update to the COST 341 Handbook that reports on the success or failure of installed measures is required. The IENE initiative to set up a geo-database on the location and effectiveness of fauna passages is one such example that would go some way towards addressing the issues raised by this study. Demonstrating the effectiveness of the measures installed to address ecological fragmentation would reduce resistance to measures and blocks on funding for reasons of lack of evidence.

The diagram below shows the location on the change grid that the strategy of action at European level would achieve.



4. Comparisons of the possible ways forward

4.1 The do-nothing scenario

In light of the strong recognition of the issue of roads, wildlife, and fragmentation, a strategy of doing nothing has little to commend it. Good practice is identifiable, proven, and the barriers to transfer to other administrations for many actions appear surmountable. Therefore a failure in moving towards the adoption of this practice will lead for road directors to continued increased costs due to projects delays, reputational damage and, of course, will ultimately be to the detriment of wildlife.

4.2 Taking action at national level – quick wins

Action at national level that does not require significant institutional change is likely to encounter less resistance from the treasury (and possibly from administrations) than the implementation of step changes in institutional approaches to ecological fragmentation and roads.

National actions that can be achieved with small changes in institutional practice and structures (and whilst using existing administrative arrangements as much as possible) will deliver more ecological benefits across more of the EU than doing nothing and really only require organisations to implement their legislation, communicate, record their actions, and cooperate more effectively.

Most of the practical aspects relating to installation, maintenance, and monitoring of the effectiveness (in ecological and road safety terms) of practical measures can be addressed at this level.

4.3 Taking action at national level – step changes

The disadvantages of making step changes in institutional arrangements and the legislative framework and changing the spatial planning approach are that this requires significant investment in resources and in some cases a profound shift in working practices and approach. Nevertheless, once the change has been made, the benefits should be felt by practitioners at project level, hopefully leading to fewer conflicts and better cooperation. Budgets for individual projects will be informed by a scientific approach, which will determine a proportionate response to defragmentation issues and avoid over-provision of measures.

A spatial planning system that recognises an agreed national ecological network is the best outcome for sustainability/ecological reasons as it can coherently deliver the most effective and comprehensive approach to ecological defragmentation and roads.

4.4 Taking action at European level

Taking action at European level has the advantage that it can inform and guide the behaviour of EU member states by sharing and promoting good practice in addressing ecological fragmentation and safety issues of roads and wildlife. A member state acting alone would not benefit from this shared experience. The disadvantage is that it may take longer to reach a consensus or the differing requirements of the EU member states may result in compromises in approach, which mean the benefits may not be maximised.

The action at European level that this report recommends is largely in knowledge sharing, cooperation, and standardisation of approach and as such it is likely to be cheaper and require fewer resources than the national-level approaches considered in Section 4.3.

There are clear environmental and road safety benefits of coordinated and focused research and monitoring and of a standardised approach to infrastructure to address fragmentation issues across the EU, but there would also be feedback into more efficient engineering solutions.

5. Conclusions

The research carried out to inform this report has demonstrated that there are substantial differences in the approach to ecological fragmentation and roads across the EU and that these can be directly attributed to the institutional arrangements in place. Good practice is identifiable and proven. It appears that transferring this good practice to other administrations is achievable.

The countries that seem to be most effective in addressing the issues are those that have had a long history of dealing with ecological fragmentation as a result of road infrastructure development (and this is often as a result of significant drivers to consider ecological fragmentation). This means that the road sector understands the issues and is accepting of the need for practical measures. Furthermore, its action forms part of a wider national strategy involving all sectors.

Another key factor for success is where ecological understanding has been used to define the scale of the ecological fragmentation issue in a country, and this has resulted in an overall strategy based on a national ecological network that is recognised as material in spatial planning. This means that project-scale issues are avoided or reduced (because they have been addressed or funding has been justified at the strategic level), resulting in fewer conflicts.

Countries where there are lots of measures such as ecoducts may not be the most successful at addressing ecological fragmentation because this may indicate over-provision of measures (and the extra financial costs associated with this) rather than well-focused ecological mitigation/compensation.

There are a range of ways and scales with which to address institutional issues associated with roads and wildlife. These range from relatively easy things to achieve, such as better coordination, cooperation, and communication, to changes in the ways in which governments address the issue at the highest level and cooperate with other EU countries.

Underpinning the whole issue is the need for governments to have an understanding of whether there is a significant problem with ecological fragmentation (involving Natura 2000 sites or other habitats and species) as a result of roads in their country/region and this can only be defined by ecological investigation.

Once the scale of the issue has been defined, an effective driver for inclusion of measures to address fragmentation is required. This can often be political, and the role of the public (and consequently the political pressure it can apply) has resulted in incorporation of defragmentation measures in several projects across the EU and should be considered a powerful driver.

A high-level government desire to deal with the issue of ecological fragmentation as a result of roads across its administrations is required to provide funds and resources to most effectively address the issues, and road safety is a key consideration when looking at these issues. When several administrations work together on these issues, a culture of acceptance can begin to develop and the potential for conflicts between administrations is reduced.

A country can be most successful in addressing the issue of defragmentation and roads when a problem with fragmentation issues has been defined and a mechanism (such as a national ecological network, which is material in spatial planning) has been implemented to deliver the necessary measures in road projects.

6. Proposal/recommendation and consequences for the directors of roads

It is the intention that this report feeds into the CEDR task group 7 final report and as such, the group will take those recommendations forward that best fit with the overall themes the group wishes to address. For this reason, this report only provides brief proposals/recommendations based on Chapters 4 and 5.

We do not recommend the do-nothing approach. The research clearly shows that there are valuable lessons in best practice that could be shared and would deliver wide-ranging benefits to road directors and wildlife.

We recommend that directors of roads implement the actions termed quick wins on a national basis. Such action would signal that the issue of wildlife was being addressed in a concerted manner. Implementation is largely about improved process, but it would also be the beginning of a change in culture. From this demonstration of attention to wildlife issues receiving greater attention from road directors there would flow reputational benefits.

We recommend that directors of roads support the implementation of the actions at European level, which will lead to a standardised approach across the EU. These actions are largely in knowledge-sharing, cooperation, and standardisation of approach and avoid duplication of effort in research. Opportunities should be sought and taken to embed the consideration of wildlife issues within the formulation of other strategies such as road safety and maintenance.

We recommend that directors of roads reconsider the state of the art in their country/region and in particular, whether there is an understanding of whether ecological fragmentation as a result of roads is an issue. Where there is little understanding of the scale of the issue, there would be great reputational benefit in road directors initiating the debate about such collaborative research with other organisations. This would allow directors of roads to have greater confidence that the actions that they were funding were effective. More widely, without such understanding there is the potential for countries to fail in their obligations to enact the EU Habitats Directive or to halt biodiversity losses.

Where step changes in the administrative arrangements are required in order to effectively deal with fragmentation issues, the directors of roads should request that their governments seek changes in the cross-administration arrangements or spatial planning framework that are needed to address the issues most effectively. A spatial planning system that recognises an agreed national ecological network is the best outcome for sustainability/ecological reasons, as it can deliver the most effective and comprehensive approach to ecological defragmentation and roads. Considering ecological fragmentation in this way would lead to fewer conflicts and better cooperation (and thus fewer delays). If budgets for individual projects are informed by a scientific approach, a proportionate level of defragmentation measures can be provided which will avoid over-provision of measures.

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