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# CEDR Transnational Road Research Programme Call 2013: Roads and Wildlife – Cost Efficient Road Management

Austria, Denmark, Germany, Ireland,  
Norway, Sweden, Netherlands and UK



Conférence Européenne  
des Directeurs des Routes  
Conference of European  
Directors of Roads

## Procedures for the Design of Roads in Harmony with Wildlife

### Final Report

Deliverable B  
June, 2016

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# CEDR Call 2013: Roads and Wildlife – Cost Efficient Road Management

## Harmony Procedures for the Design of Roads in Harmony with Wildlife

### Final Report

Revision	Description	Made	Checked	Approved	Date
01	Draft final report	B. Corrigan, ROD-IS, S. MacGearailt, ROD-IS, C. Leahy, ROD-IS C. Carey, ROD-IS	GT, VTI; DW, BuWa; AW MTA	EOB, ROD-IS	15/06/16
02	Draft final report	C. Carey, ROD-IS	EOB, ROD-IS	ACO, ROD-IS	13/12/16

Due date of deliverable: 31/03/2016  
Actual submission date: 15/06/2016  
Revised and resubmitted on: 14/12/2016

Start date of project: 01/04/2014

End date of project: 31/03/2016

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## Executive Summary

This report addresses the following areas of the *Harmony* project:

- It provides guidance on how to put the outputs of *Harmony* project into practice;
- Outlines the dissemination of results to date and going forward;
- Summarises the consultation between the *Harmony* Project partners and road owners.

Guidance is provided for road owner as to how the results of the project can be implemented for their road networks. This will also serve as an introduction to the task of preparing an update to the COST 341 Handbook. The main findings and recommendations of the various deliverables undertaken are presented under the headings described below.

- Environmental Legislation and Guidelines;
- Project Appraisal;
- Maintenance;
- Procurement;
- Follow Up;
- KPI's.

The *Harmony* project is implementing an extensive plan to disseminate the project findings to the general public, research and technical communities and public and industrial sectors. The various strands of this dissemination plan are indicated and the tasks completed to date are outlined as well as dissemination which is still ongoing.

Extensive consultation with road owners was carried out to gather information for a number of the deliverables and to ensure the results were relevant to CEDR. This consultation involved meetings with the Programme Executive Board (PEB) of CEDR, ongoing dialogue with the CEDR Project Manager and data gathering from other road authorities around Europe. This consultation is described and the key findings of the PEB meetings noted.

# 1 Introduction

The Harmony project aims to provide guidance on how to best consider and mitigate against the negative effects of road infrastructure on wildlife in a balanced and cost effective manner. The project outputs have been developed from expertise gathered through stakeholder interviews, literature reviews and experimental work and are presented in the various deliverable reports available on the project website ([www.harmony-project.net](http://www.harmony-project.net)).

This document is the final report of the project and provides an overview and guidance on how to put the outputs of the *Harmony* project into practice. This report also provides information on the dissemination efforts of the project consortium and provides an update on the consultation between the *Harmony* project partners and road owners.

The main part of the report is Section 2, 'Guidance on Implementation of Results', which aims to guide interested parties through the execution of the *Harmony* recommendations. This section summarises the various outputs of the project, informing practitioners on cost effective measures to improve mitigation of the effects of road infrastructure on wildlife.

Section 3 of this report is a brief overview of dissemination activities. The final dissemination event was held in Cologne, Germany and was attended by the project coordinators of *Harmony*, as well as the other CEDR Call 2013: *Roads and Wildlife* projects: Saferoad, SafeBatPaths and ECOROAD.

Section 4 provides an update on the consultation between the *Harmony* project partners and road owners. This consultation has taken the form of direct contact with the PEB at various meetings as well as detailed written responses to comments on deliverables.

## 2 Guidance on Implementation of Results

This section of the report presents suggestions on how the results of the *Harmony* project can be best implemented.

### Input to an Extended COST 341 Handbook

The *Harmony* project is one of four projects funded under the CEDR 2013 Call: *Roads and Wildlife* along with Saferoad, SafeBatPaths and ECOROAD. The first three projects were underway simultaneously, and there is a degree of overlap. The 4<sup>th</sup> project, ECOROAD, was a dissemination project for the other three. The first three projects developed suitable content for a document to complement the COST 341 Handbook: *European Handbook for Identifying Conflicts and Designing Solutions*. At the time of writing, the ECOROAD project consortium is finalising the complementary Handbook, entitled the, *CEDR Roads and Wildlife Manual*. It will be available on the project website: [www.ecoroad-cedr.org](http://www.ecoroad-cedr.org).

The *CEDR Roads and Wildlife Manual*, which will be published in 2017, is to be used in conjunction with the COST 341 Handbook. The Manual will update certain aspects of the COST 341 Handbook using the science developed and experience gained over the past 13 years as well as providing guidance on other aspects absent from the COST 341 Handbook.

The Manual will reflect best practice in European road mitigation and management and will guide users through the implementation of an optimal strategy in the minimisation of impacts on wildlife and biodiversity in a cost-effective way. True to the philosophy of COST 341, the Manual will focus on practical recommendations that can be implemented on the ground.

### Summary of Main Findings and Recommendations

The following sections provide a summary of the main findings and recommendations of the various tasks undertaken and deliverables provided through the *Harmony* project. This will serve as an introduction to the task of preparing an update to the COST 341 Handbook task.

- Environmental Legislation and Guidelines;
- Project Appraisal;
- Maintenance;
- Procurement;
- Follow Up;
- KPI's.

## 2.1 Environmental Legislation and Guidelines

*Harmony* Deliverable C analysed the current approach being used for Environmental Assessment in order to identify areas where commonalities and differences exist between countries and to identify where common guidelines are needed to promote a more standardised and effective approach throughout Europe. There were three main sections of the report consisting of reviews of the following processes:

- Environmental Impact Assessments
- Appropriate Assessments and
- Court decisions.

### Reviews Part A: Environmental Impact Assessments

This task examined the EIA process in ten countries across Europe. In order to do this, the relevant guidelines were analysed and comparisons were made between countries. Following on from this, a database of 102 EIS's across the ten European countries was analysed to identify the similarities and differences between countries in the implementation of the requirements of EU Environmental Legislation. As well as comparing approaches between countries, an audit was carried out to identify the degree of implementation on a 5 point scale under the headings of:

- Screening;
- Scoping;
- Identification of Habitats;
- Impact Assessment Methodologies;
- Mitigation Measures, and
- Monitoring.

It was found that the degree of implementation under these headings varies greatly between countries. A general trend was seen in most countries that EIS's appear to carry out little or no monitoring. When examining the results of this audit, it must be noted that it is somewhat subjective as the results depend on the expert opinion of several individuals that undertook the reviews. Nevertheless, some conclusions can be drawn:

- a) In general it was found that standardised guidelines are available for ecological assessment in most countries. However, guidelines dealing with specific habitats are less standardised across the countries considered. It is noted that in the UK there are guidelines available for certain species or habitats for non-road schemes; however, these are not specific to roads. This presents an opportunity to develop a more standardised approach to guidelines for specific habitats and species.
- b) The terminology used within the EIS guidelines needs to be standardised in some countries. For example, it was found that there is no clear definition given for short, medium and long term impacts in six of the eight reference countries' guidelines. There is scope for an EU standard for terminology in order to reduce the potential for different interpretations.
- c) The competency requirements of an ecologist set out in the guidelines varies from country to country. This also arose as an issue in the Pukaviken Swedish court case (see Part C below), where the appellant objected on the grounds that the Appropriate Assessment was not carried out by a suitably qualified professional (ecologist), although the court did not accept the argument. An EU standard for the minimum

competency requirements of an EIA/AA author would provide clarity and avoid such objections.

- d) A significant proportion of the EIS's examined did not use surveys carried out within the past two years. Field assessments are a fundamental aspect to any EIA and it is important that the information is up to date. Clear guidelines are required on timing of surveys for different species and habitats.
- e) Assessment of cumulative effects remains difficult for the developer as there is a great deal of uncertainty and a lack of guidance on how to properly assess the cumulative effect of a project, in particular when it is related to larger plans. While the provision of Strategic Environmental Assessment and Appropriate Assessment guidelines are available, they appear at times to be too high level and difficult to assess within the EIS as part of a cumulative effect. It is therefore recommended that clearer EU guidelines be developed to provide recommendations on how the cumulative effects of a project should be assessed.
- f) It was also found that a large proportion of the EIS's examined did not include an appropriate plan for monitoring. It was found that in general, although it may be included in the guidelines, it is not followed through as part of the EIA. It is concluded that clearer and more stringent guidance is required in this area.

#### **Recommendations for EIA Process**

- A1) Guidelines for a standardised approach for specific topics, habitats and species.
- A2) EU Standard for EIA terminology.
- A3) Strict application of the EIA Directive 2014/52/EU throughout all Member States.
- A4) EU Standard for competency requirements of an ecologist for EIA as per EIA Directive 2014/52/EU.
- A5) Guidelines for seasonal timing of surveys for different species and habitats in the various regions covering all EU Member States.
- A6) Guidelines for assessment of cumulative effects.
- A7) Guidance for Monitoring Plans and Enforcement Processes.



The *Harmony* documents relating to environmental legislation and guidelines are

1. Deliverable C 'Environmental Legislation and Guidelines' (Ni Choine et al. 2015)
2. Deliverable D, 'Recommendations on Appraisal Process & Report on Consultations' (Gavin, 2016)



## Reviews Part B: Appropriate Assessments

This task consisted of a review of AA reports across the eight reference countries and Germany.

On a negative note, most AA reports only describe the presence and distribution of habitat types and species and almost never describe the current state of the habitat type or species in the Natura 2000 site or the importance of the surrounding area for the habitat type or species. Furthermore, in some countries, the field studies do not comply with guidelines or general knowledge about the best practice survey methods (e.g. season, minimum number of visits, recommended instruments etc.). Moreover, sometimes it is not clear what the sources of information are or how old the information is. For the competent authority to decide about a permit it should be clear on what information the assessment is based. It is also noted that the cumulative effects are generally not properly assessed in the AA's examined, a finding that is consistent with the EIA reviews carried out.

This part of the report also showed that compensatory measures are sometimes described while alternatives and Imperative Reasons of Over-riding Public Interest (IROPI) tend not to be described in these AA reports and are included instead in Statement of Case reports. Compensatory measures are only needed when adverse effects on the integrity of a Natura 2000 site cannot be excluded and the effects cannot be diminished enough by mitigation measures. In that case, Article 6(4) takes effect and an initiator should first prove that no alternatives are available and explain the imperative reasons of overriding public interest that prevail to continue with the project or plan.

Continuing about mitigation, only the Swedish and Belgian AA reports reviewed, as well as a few Danish reports, include performance based mitigation measures. In recent years, many contracts for new road building and road upgrading (retrofit) are performance based. Therefore, it would be good to have the mitigation (and compensatory) measures prescribed as performance based. This requires a different approach from the AA authors and perhaps further training.

It is noted that there is a lack of proposals for monitoring in most AA reports. Monitoring of the effects or mitigation measures is not compulsory, but is advised by the EC and is a welcome inclusion in the EIA Directive 2014/52/EU. Monitoring will increase our knowledge of the (significance of) effects and of the effectiveness of mitigation measures. It is advised to add a chapter about monitoring to all AA reports.

### **Recommendations for AA Process**

- B1) Education and training about the benefits and implementation of performance based measures, including training for Competent Authorities.
- B2) EU Standard for competency requirements of an ecologist for AA.
- B3) More detailed guidance including possibly templates/examples of completed AA's for projects of varying complexity to ensure consistency of approach to AA.
- B4) Recommendations for EIA (A1-A7) are common to AA.

## Reviews Part C: Court Cases

The examination of nine court cases showed that the issue of proper designation of Natura 2000 sites may also arise during the application for development, highlighting shortcomings within the state authorities to properly designate Natura 2000 sites. This issue also considers the responsibility of the developer to sufficiently address how to properly deal with identification and impact on Annexed habitats or species in proximity to or in connection with a Natura 2000 site.

In examining the court cases, it was also found that cumulative effects need to be addressed more clearly in the guidelines to avoid a situation where the plan is appealed and brought to court on these grounds. Both of these issues are discussed in more detail below:

Overall the findings of the examined court cases are very broad and vary from country to county. However a number of issues are evident from examining the cases.

### 1. “Salami” effect and cumulative impact

The issues of assessment based on part of a project, without considering related road links or future development, frequently arises when seeking development consent and in the courts. For three of the eight examples examined, the Buitenring Parkstad from the Netherlands and the Pukaviken and Umeå cases from Sweden, the cumulative impact was not fully considered. Such issues regularly arise when considering the approval of road projects which are broken down into several sections. Assessment of cumulative effects remains difficult for the developer as there is a great deal of uncertainty and a lack of guidance on how to properly assess the cumulative effects of a project, in particular when it is related to larger plans. While the provision of Appropriate Assessment Guidelines are available, which should in theory fill this lacuna, they often appear to be high level and have limited practical mitigation measures that can be applied at project level.

### 2. Proper designation of a Natura 2000 site

Failure to properly designate a site is evident in the S18 Lake Constance dual carriageway case in Austria and is also noted in the Galway City Outer Bypass case in the Republic of Ireland, where an extension of the Natura 2000 site was made, based on information furnished to the state as a result of the road planning / appeals process. These court decisions suggest that a site not being designated as a Natura 2000 is not always a sufficient defence for developing a part of it. The conclusion is that greater certainty in planning routes will result from a clearly defined, well justified and complete list of Natura 2000 sites.

#### **Recommendations from Review of Court Cases**

- C1) Each NRA to circulate regular updates on recent European Court of Justice rulings with a non-technical summary of how they may affect project development and EIA/AA to ensure all project developers incorporate most recent developments.
- C2) Consideration should be given to the quality of the habitat to be impacted, regardless of the designation status as there have been cases where a Member State has failed to correctly designate an area/site.
- C3) Clear distinction is required between mitigation and compensation.
- C4) Clearer guidance on impacts on Annex and Priority habitats outside of designated sites but affecting the integrity of that site is required.

## 2.2 Recommendations for Project Appraisal

Most European countries use some form of Project Appraisal for Transportation projects to assist in the prioritisation of, or funding decisions on projects being progressed. Cost Benefit Analysis remains the main form of appraisal used throughout Europe. However the monetisation of all impacts is not always feasible and attempting to monetise the impacts of road projects on nature and biodiversity can be difficult. The lack of monetary estimates for biodiversity impacts does not mean that these impacts can be overlooked in the decision making process. Therefore, it is important for the appraiser to decide on a way to represent these qualitative impacts in conjunction with monetary appraisal.

Having reviewed various approaches in *Harmony* Deliverable D, it is the view of the authors that the Project Appraisal framework provided in both the UK and in Ireland are suitable for adoption by other Member States for the following reasons:

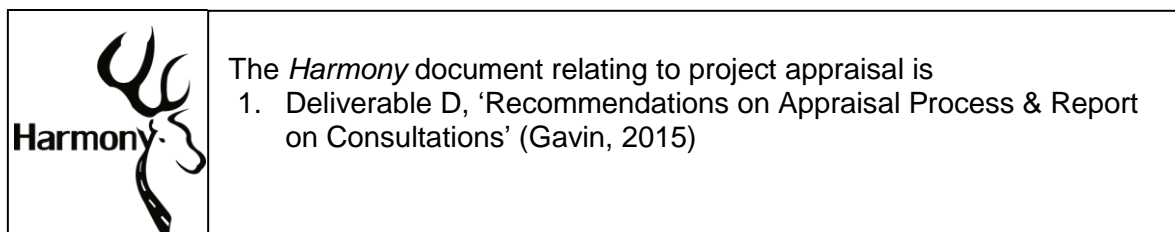
- a) Both the UK and Irish Guidelines provide clear and concise guidance that can be followed and adopted;
- b) The appraisal process for both is kept as simple as possible without providing or requiring a level of detail that becomes onerous and complex for the appraiser and decision makers;
- c) The introduction of a worksheet allows appraisal to be carried out at all stages of development and takes into account the level of detail made available to it at any one stage;
- d) The provision of a biodiversity impact appraisal table/Project Appraisal Balance Sheet should result in a more standardised and transparent system of project appraisal across European Member States.

The UK Department of Transport document, *TAG Unit A3 Environmental Impact Appraisal Section 9*, sets out all of the steps to be followed with links to the Biodiversity Appraisal Spreadsheet as seen in Figure 1.

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/487684/TAG\\_unit\\_a3\\_envir\\_imp\\_app\\_dec\\_15.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/487684/TAG_unit_a3_envir_imp_app_dec_15.pdf)

The Irish NRA Project Appraisal Guidance (Figure 2 & Figure 3) may be found at:

<http://www.tii.ie/tii-library/strategic-planning/>



**TAG Biodiversity Impacts Worksheet**

Step 2		Step 3				Step 4	Step 5
Area	Description of feature/ attribute	Scale (at which attribute matters)	Importance (of attribute)	Trend (in relation to target)	Biodiversity and earth heritage value	Magnitude of impact	Assessment Score

Reference Sources

Summary Assessment Score

Qualitative Comments

**Figure 1 UK Webtag – Appraisal Worksheet for Biodiversity Impacts**

Project Appraisal Balance Sheet																	
Part B: Environment																	
NRA An tUdaráis um Bóithre Náisiúnta National Roads Authority																	
Air Quality & Climate	Climate - Carbon Dioxide (CO <sub>2</sub> )								Quantitative Statement Parameter								
	Tonnes of CO <sub>2</sub> produced in the Do Minimum Scenario?								0								
	Tonnes of CO <sub>2</sub> produced in the Do Something Scenario?								0								
	Ratio of CO <sub>2</sub> produced in Do Something Scenario to Do Minimum Scenario								0.00								
	Significance Criteria								Substantial Beneficial	Moderate Beneficial	Slight Beneficial	Negligible	Slight Adverse	Moderate Adverse	Substantial Adverse		
	Number of Sensitive Locations Experiencing Impacts That Are:								No.	No.	No.	No.	No.	No.	No.		
	Index of Overall Change in Exposure								Large Negative Index	Medium Negative Index	Small Negative Index	Small Positive Index	Medium Positive Index	Large Positive Index			
	Nitrogen Dioxide (NO <sub>2</sub> )								●	○	○	○	○	○	○		
	Particulate Matter (PM <sub>10</sub> )								●	○	○	○	○	○	○		
	Quantitative Statement		Qualitative Statement														
Highly Negative																	
Noise & Vibration	Sensitive Receptors								Quantitative Statement Parameter								
	Number of Sensitive Receptors Requiring Mitigation (i.e. the three conditions have been satisfied) Per Kilometre								No.								
	Number of Sensitive Receptors Requiring Mitigation (i.e. the three conditions have been satisfied), But It Is Not Feasible To Mitigate Noise To The Required Level Per Kilometre								No.								
	Quantitative Statement		Qualitative Statement														
Neutral																	
Waste	Unacceptable Material								Quantitative Statement Parameter No. (m <sup>3</sup> )								
	Quantity Of Unacceptable Material Class U1 To Be Disposed Of Off Site?								No.								
	Quantity Of Unacceptable Material Class U2 To Be Disposed Of Off Site?								No.								
	Quantity Of Contaminated Land/Hazardous Waste To Be Left In Situ?								No.								
Quantitative Statement		Qualitative Statement															
Neutral																	
Landscape & Visual Amenity (incl. Light)	Landscape & Visual Amenity (incl. Light)								Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
	Number of Impacts That Are:								No.	No.	No.	No.	No.	No.	No.	No.	
	National Landscape Designation / Listing								County Landscape Designation / Listing		Other Areas of Significant Landscape Value/Amenity						
	Number of Profound / Significant Impacts On Sites Of								No.		No.						
	Quantitative Statement		Qualitative Statement														
Neutral																	
Biodiversity - Flora & Fauna	Impact on Ecological Receptors								International Importance	National Importance	County Importance	Local Importance (higher value)	Local Importance (lower value)				
	Number of Significant Positive Impacts On Ecological Receptors Of:								No.	No.	No.	No.	No.				
	Number of Significant Negative Impacts On Ecological Receptors Of:								No.	No.	No.	No.	No.				
	Quantitative Statement		Qualitative Statement														
Neutral																	
Agriculture	Impact on Agriculture Holdings								Major Positive Impact	Moderate Positive Impact	Slight Positive Impact	Neutral Impact	Slight Negative Impact	Moderate Negative Impact	Major Negative Impact		
	Impacts On An Agricultural Holdings That Are:								No.	No.	No.	No.	No.	No.	No.		
	Quantitative Statement		Qualitative Statement														
Neutral																	
Non-Agricultural Properties	Impact on Non-Agriculture Properties								Significant Positive Impact	Moderate Positive Impact	Slightly Positive Impact	Imperceptible Impact	Slightly Negative Impact	Moderate Negative Impact	Significant Negative Impact	Profound Negative Impact	
	Number of Impacts That Are:								No.	No.	No.	No.	No.	No.	No.		
	Quantitative Statement		Qualitative Statement														
Neutral																	
Architectural Heritage	Impact on Architectural Heritage								Significant Positive Impact	Moderate Positive Impact	Slightly Positive Impact	Imperceptible Impact	Slightly Negative Impact	Moderate Negative Impact	Significant Negative Impact	Profound Negative Impact	
	Number of Impacts That Are:								No.	No.	No.	No.	No.	No.	No.		
	Number of Impacts On Sites Of National Importance That Are:								No.	No.	No.	No.	No.	No.	No.		
Quantitative Statement		Qualitative Statement															
Neutral																	
Archaeological & Cultural Heritage	Impact on Archaeological & Cultural Heritage								Significant Positive Impact	Moderate Positive Impact	Slightly Positive Impact	Imperceptible Impact	Slightly Negative Impact	Moderate Negative Impact	Significant Negative Impact	Profound Negative Impact	
	Number of Impacts That Are:								No.	No.	No.	No.	No.	No.	No.		
	Number Of Impacts On Sites Of National Importance That Are:								No.	No.	No.	No.	No.	No.	No.		
Quantitative Statement		Qualitative Statement															
Neutral																	
Soils & Geology	Soils & Geology								Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
	Number of Impacts That Are:								No.	No.	No.	No.	No.	No.	No.		
	Quantitative Statement		Qualitative Statement														
Neutral																	
Hydrology	Hydrology								Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
	Number of Impacts That Are:								No.	No.	No.	No.	No.	No.	No.		
	Quantitative Statement		Qualitative Statement														
Neutral																	
Hydrogeology	Hydrogeology								Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative
	Number of Impacts That Are:								No.	No.	No.	No.	No.	No.	No.		
	Quantitative Statement		Qualitative Statement														
Neutral																	
Overall Scale of Impact					Amended Scale of Impact												
Neutral																	

Figure 2 Irish NRA Project Appraisal Worksheet including highlighted section on Biodiversity

Project Appraisal Balance Sheet				NRA An tÚdaráis um Boithre Náisiúnta National Roads Authority			
Part D: PABS Summary Table							
Project Title		PRD Reference Number	Project Description		Scheme Cost (€m)	Date	
0		0	0		€ 0.00	12/12/2013	
Criteria	Quantitative Statement	Summary of Keys Impacts (Qualitative Assessment)			Quantitative Assessment	Monetised (€m over 30 yrs)	
Environment	Air Quality and Climate	Highly Negative	0			Additional CO <sub>2</sub> (Tonnes) 0 Ratio of CO <sub>2</sub> Do Min/Do-Some 0.00 Index of Overall Change in Exposure NO <sub>2</sub> Large Negative Index Index of Overall Change in Exposure PM <sub>10</sub> Large Negative Index Sub Ben. Mod Ben. Sig Ben. Negligible Sig Adv. Mod Adv. Sub Adv. No. No. No. No. No. No. No.	Value of Change in Emissions (€m) €0.00
	Noise and vibration	Neutral	0			Number of Sensitive Locations Experiencing Impacts That Are Number of Sensitive Receptors Requiring Mitigation No Number of Sensitive Receptors Requiring Mitigation (Not Feasible) No Unacceptable Material/Contaminated Land/Hazardous Waste to be ...	
	Waste	Neutral	0			Disposed of Off Site U1 [m <sup>3</sup> ] U2 [m <sup>3</sup> ] Left in Situ (m <sup>3</sup> land waste) No No. No. No.	
	Landscape & Visual Amenity (Incl. Light)	Neutral	0			PP Sig P Mod P Sig P I Sig N Mod N Sig N PN No. No. No. No. No. No. No. No. No.	
	Biodiversity, Flora & Fauna	Neutral	0			National No. County No. Other No. II NI CI LI(H) LI(L) Number of Positive Impacts No. No. No. No. No. Number of Negative Impacts No. No. No. No. No.	
	Agriculture	Neutral	0			Impact on Agricultural Holdings that are Maj P Mod P SP N Sig N Mod N Maj N No. No. No. No. No. No. No. No.	
	Non-Agricultural Properties	Neutral	0			Impact on Non-Agricultural Properties Sig P Mod P Sig P I Sig N Mod N Sig N PN No. No. No. No. No. No. No. No.	
	Architectural Heritage	Neutral	0			Number of Impacts That Are Sig P Mod P Sig P I Sig N Mod N Sig N PN No. No. No. No. No. No. No. No.	
	Archaeological and Cultural Heritage	Neutral	0			Number of Impacts That Are Sig P Mod P Sig P I Sig N Mod N Sig N PN No. No. No. No. No. No. No. No.	
	Soils & Geology	Neutral	0			Number of Impacts That Are PP Sig P Mod P Sig P I Sig N Mod N Sig N PN No. No. No. No. No. No. No. No.	
	Hydrology	Neutral	0			Number of Impacts That Are PP Sig P Mod P Sig P I Sig N Mod N Sig N PN No. No. No. No. No. No. No. No.	
	Hydrogeology	Neutral	0			Number of Impacts That Are PP Sig P Mod P Sig P I Sig N Mod N Sig N PN No. No. No. No. No. No. No. No.	
	Safety	Accident Reduction	Neutral	0			
Security		Neutral	0				
Economy	Transport Efficiency and Effectiveness		0				Commuting Business Other Value of Change €0.0 €0.0 €0.0 €0.0
	Wider Economic Impact	Neutral	0				PSP Indirect Tax Rel. Value €0.0 €0.0 €0.0 €0.0
	Funding	Neutral	0			Neutral Expected Percentage of Non-Exchequer Funding Neutral	
Accessibility and Social Inclusion	Deprived Geographic Areas	Neutral	0			Impact on Identified CLAR or RAPID Areas Neutral	
	Vulnerable Groups	Neutral	0			Impact on Access to Employment or Vital Infrastructure Neutral	
	Transport Integration	Neutral	0			Neutral	
	Land-Use Integration	Neutral	0			Neutral	
Integration	Geographical Integration	Neutral	0			Neutral	
	Integration with Other Government Policies	Neutral	0			Neutral	
Overall Scale of Impact	Environmental	Neutral	Accessibility & Social Inclusion	Neutral	Summary of Benefits		
	Safety	Neutral	Integration	Neutral	Present Value of Benefits (PVB)	Net Present Value (NPV)	
	Economy	Neutral			€0.0	€0.0	
					Present Value of Costs (PVC)	Benefit to Cost Ratio (BCR)	
					€0.0	0.00	

Figure 3 Irish NRA Project Appraisal Summary Sheet including highlighted section on Biodiversity

## 2.3 Recommendations for Maintenance

Roads and their components can fulfil ecological functions for wildlife and possibly reduce the negative effect on the biodiversity in the region. Despite its dangers (e.g. wildlife vehicle collisions) and detrimental effects on their well-being, animals venture near roads to eat, sleep, mate or even spend their whole lives there. A policy needs to be established as to whether this is to be encouraged, facilitated or actively discouraged.

To be effective in the long run in achieving its goal, a verge habitat has to be maintained. The maintenance regimes (e.g. mowing frequency) should not be the same everywhere but should be tailored to the established policy and to the local species composition. In addition, regular inspection of mitigation measures and other road components is needed to verify if the ecological functions are still being met. Based on the findings of *Harmony* Deliverable G, the following summarises the key recommendations for implementing a more effective maintenance strategy.

### Organisation / management

Effective maintenance takes time. Enough budget should be set aside for a long period. Failure to take maintenance seriously will lead to badly functioning mitigation measures that result in high costs for repair or replacement and may even endanger traffic.


- More intensive exchange of experiences will result in better recommendations and guidelines for maintenance and this will result in cost-savings.
- An institutional memory should be established, e.g. a database with locations of the mitigation measures and experiences with maintenance techniques and methods.
- To reduce costs, combine the maintenance of overpasses and verges with the maintenance of the surrounding landscape, where possible. For example, this can be done by involving the landowners or NGOs who own the land next to the road.

### Design

Cost-efficient maintenance starts with a good design of the road component or mitigation measure. It must be clear from the beginning which species are to be supported by wildlife-friendly design and maintenance. It is important to involve biologists in the early stages of a project to identify the requirements of the species and which functions the road component or mitigation has to fulfill for these species. Many maintenance costs can also be diminished by consulting maintenance companies during the concept and design phase of a project to achieve designs which are easily maintained.

### Maintenance Practices

The guidelines in the Maintenance Handbook (Deliverable G – Part B) can be used to develop a maintenance strategy which is appropriate for the target species. The maintenance of both verges and mitigation measures is addressed and the required tasks (e.g. cleaning, mowing, repairs) and the frequency at which they should be performed, are specified for various species and mitigation measures.

	<p>The <i>Harmony</i> documents relating to maintenance are</p> <ol style="list-style-type: none"> <li>1. Deliverable F part A 'Ecological functions of roads' (Wansink, 2016)</li> <li>2. Deliverable G part B, 'Cost-effective maintenance to support the ecological functions of roads' (Wansink et al. 2016)</li> <li>3. Deliverable G part B, 'Final Maintenance Handbook' (Carey et al. 2016)</li> </ol>
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## 2.4 Recommendations for Procurement

The procurement process is discussed in *Harmony* Deliverable E and the key findings are presented here.

### 2.4.1 Contracting Authority Lead Role

- The Contracting Authority needs to have appropriate ecological expertise, with an appropriate allocation of time, to advise and inform project management personnel of how best to implement the statutory obligations for wildlife protection. This role will enable suitable provisions for wildlife protection to be included in model contract procurement documents, as well as to undertake reviews of individual schemes at various stages of implementation.
- At Project level the Contracting Authority should have ecological expertise. For environmentally sensitive areas in particular, such personnel may be engaged in a monitoring role throughout the life of the project, including an extended monitoring phase after completion of construction. The requirements for monitoring should be tailored to the needs of the target species and to the measures in question. This role can then be amalgamated in the network management process alongside routine operations and maintenance functions.

### 2.4.2 Procurement Strategy

- The ability of Contracting Authorities to achieve optimal outcomes is constrained by EU Procurement rules – in particular the restriction to consider past performance at tender stage. It is recommended that consideration be given to removing this restriction, at least for Maintenance Contracts where track record is an important consideration to have confidence that the required outcomes have reasonable prospect of being achieved.
- There would be environmental advantages to increased use of Quality Assessment in the procurement process and to include ecological requirements within the Quality Assessment – in particular where there are environmental sensitivities – e.g. proximity to a Natura 2000 site.
- There is a need to engage specialist ecologists in both implementation and monitoring roles in the preparation and procurement of large Works and Maintenance Contracts.

### 2.4.3 Contracting Strategy

The review of international procurement practice has indicated particular advantages and disadvantages to the various existing practices for some forms of procurement options which provide an inherent performance monitoring function. Those forms of procurement which provide an inherent performance monitoring function appear to be better suited to actual achieving desired outcomes. The other forms of procurement require



complementary actions by the Contracting Authority to achieve the same outcome for wildlife protection as noted for each below.

The selection of a particular procurement model will usually be decided by matters other than ecology and wildlife protection, and therefore it is important that the contractual mechanisms for wildlife measures in any of the procurement models are robust and effective. Nevertheless this review has established a preference for a performance and outcomes based approach which may be best achieved under Options 3 and 4 below, where the road builder often has a long duration involvement in the operation of the completed road project and can be effectively incentivised to ensure that wildlife measures operate satisfactorily:

Option 1: Employer Designed:

- In this model all responsibility for wildlife protection rests with the Contracting Authority which will require to engage a full suite of expert ecological services for the design and monitoring of wildlife protection over the full life of the project.

Option 2: Design & Build:

- In this model the performance requirements of the wildlife measures are determined by the Contracting Authority. The design of the wildlife measures are undertaken for the Contractor by suitable ecologists. Monitoring of the works may also be undertaken by the Contractor for the initial performance period prior to handover to the Contracting Authority for ongoing maintenance and associated monitoring and remedial actions.

Option 3: Design, Build & Maintain:

- The wildlife measures identified at the Employer Planned stage need suitable ecological expertise for proper transfer to the next stages of Contractor Design/ Contractor Construction/Contractor Maintenance.
- The Contracting Authority is required to provide an ecological supervision role to monitor compliance at all stages including appropriate actions during the operational phase in response to Contractor monitoring.

Option 4: Early Contractor Involvement (ECI)

- Contractor Planned - Contractor Designed - Contractor Constructed - Employer Maintained Contract. This is similar to Option 2 in terms of the role of the Contracting Authority in the Maintenance stage.
- A further variant is Contractor Planned - Contractor Designed - Contractor Constructed - Contractor Maintained Contracts. This model places the least demand on the Contracting Authority in terms of ecological expertise although the procurement of the Contractor and tender evaluation to ensure relevant experience and capabilities would require greater ecological input that would normally be expected.
- An ECI Contract may operate on a target cost basis and would include consideration of Maintenance arrangements from the outset. This “Engineering – Construction – Operation [ECO]” Contract may or may not include a financing element.

Option 5: Maintenance Contract:

- The wildlife measures have previously been installed by other forms of construction contract, including legacy assets completed sometime in the past,

and the asset is then maintained by a new Contractor with particular targets for management of the wildlife infrastructure amongst other duties.

- Condition Assessment of the infrastructure is undertaken at the outset to identify defects and needs for enhancement.
- Retrofit measures may be ordered,
- The Contracting Authority is required to provide an ecological supervision role to monitor compliance at all stages including appropriate actions during the operational phase in response to Contractor monitoring.
- This form of contract may have greatest application and value on a network management basis for cumulative ecological outcomes. It also provides a direct and effective means for management of the asset with suitable emphasis on the ecological functions.
- The financial value of the ecological management tasks will be more significant in a relatively small value Maintenance Contract than in a much larger construction contract, and therefore the financial incentive to ensure suitable performance is more likely to be effective

## **2.5 Recommendations on Follow Up**

The following outlines the key recommendations on follow-up from *Harmony* Deliverable E.

- The international evidence suggests that follow-up is rarely undertaken where there is no particular requirement for maintenance. Therefore, greater use of Maintenance Contracts will lead to increased maintenance and better environmental outcomes.
- A tool or guidelines would help in the implementation of legislation, to ensure standardised and regular follow-up.
- The *Aarhus Convention* commits the public authorities in the member states of the European Union to publish all environmental information. A unified database for information retrieval would help implement this in practice, increasing access to the information.
- Both Maintenance Contractors and Contracting Authorities should have access to ecological expertise, either in-house or engaged, to ensure the environmental objectives of projects are achieved.
- Contracting Authorities need to be adequately resourced in order to undertake follow-up measures. Follow-up actions including supervision should be undertaken by specialist personnel with the appropriate training to ensure that environmental measures are correctly implemented and maintained.
- Contracts should include some performance based criterion, such as the achievement of a CEEQUAL award, for the project to focus the Contractor on environmental performance throughout the construction life of the project.
- In respect of existing roads, there are clear advantages to the procurement of maintenance contracts, as it increases the focus of both the Maintainer and the Contracting Authority. Further study may be warranted to understand the relative costs of public and private sector maintenance.

The adoption of the ECO Contract Model, outlined above, addresses the maintenance needs of major road schemes from the outset, in turn ensuring a medium to long term view on the effectiveness of landscaping features and ecological performance.

## 2.6 Recommendations on KPI's


Indicators for wildlife mitigation projects should be aligned with the following points, as discussed in *Harmony* Deliverable E:

- Indicators should be easy to measure, comparable and reproducible.
- Indicators to be measured have to take the Environmental Impact statement (EIS) into account.
- It is important to establish a baseline beforehand, on which the indicator(s) will be modelled. This necessitates the availability of sufficient base data.
- The indicators should already be considered during the procurement process.
- Indicators should reliably show if a mitigation structure is functioning as planned.
- In the specific case of mitigation structures such as wildlife bridges, the indicator(s) used should be able to document 'negative' outcomes as well, e.g. when a structure is not used by the target species.
- The indicators used should include a 'positive' element, i.e. preferably include an incentive that reliably leads to the outcome planned. This could be, for example, an economic benefit for the contractor when performing well.
- Indicators have to consider that different species might be measured. This might necessitate the use of a different (kind of) indicator.

In general, indicators will have to be adapted specifically for each project. However, based on the underlying research for this chapter, we recommend the following two indicators for use in mitigation of wildlife in road projects:

- Road kill (according to a pre-specified process of measurement); and
- Usage of crossings (using a pre-defined method of measurement and a pre-specified target species list/formula).

Care has to be taken that indicators will not be used solely as *performance* measures, e.g. by a subcontractor. This might otherwise lead to an incentive to fulfil certain ecologically relevant obligations irrespectively of the actual need, leading to so-called *unintended consequences* (in the sense of Merton, 1936). In the worst case, there is a risk that wrongly interpreted indicators – if they are designed mainly as *economic* incentives – can become so-called *perverse incentives*. These kinds of incentives result in undesirable outcomes, which are contrary to the original intention to establish such an incentive. The consequences of perverse incentives have been especially problematic in biodiversity conservation (Gordon et al., 2015), which is directly related to the topic of wildlife mitigation discussed here.

	<p>The <i>Harmony</i> documents relating to procurement, follow-up and performance indicators are:</p> <ol style="list-style-type: none"> <li>1. Deliverable E part A 'Report on Procurement, Follow-up and Performance Indicators' (Tschan et al. 2016a)</li> <li>2. Deliverable E part B, 'Handbook on procurement and follow-up (incl. performance indicators)' (Tschan et al. 2016b)</li> </ol>
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## 3 Dissemination Plan

The *Harmony* project is implementing an extensive plan to disseminate the project findings to the general public, research and technical communities and public and industrial sectors. This plan has a number of strands and media forms as summarised below:

### 3.1 Websites

The *Harmony* team will publish all of the project deliverables, once approved by the PEB, on the *Harmony* website (<http://www.harmony-project.net/>). Links to the web page for each uploaded deliverable will be sent out to relevant websites such as those hosted by:

- Infra Eco Network Europe (IENE),
- the Australasian Network for Ecology and Transportation (ANET)
- International Conference on Ecology & Transport (ICOET),
- CEDR

### 3.2 Social Media

All of the published reports which are approved by the PEB will be circulated to the professional industry using established professional accounts on social media, linking readers back to the above websites. The social media proposed will include:

- Twitter
- LinkedIn

The twitter accounts will include the harmony account and the accounts of the partners within the *Harmony* Consortium.

### 3.3 Conferences and Workshops

#### **Final Dissemination Event**

The final dissemination event for the CEDR Call 2013: *Roads and Wildlife* projects was held in Cologne on November 7<sup>th</sup> and 8<sup>th</sup> 2016. The event, organised by CEDR and the ECOROAD Project, was attended by the project coordinators of *Harmony*, *Saferoads*, *SafeBatPaths* and *ECOROAD*. The project coordinators presented the main findings and recommendations of their respective projects in the context of members of various European Road Authorities.

#### **Netherlands – National Road Authority Conference**

On October 27<sup>th</sup>, BuWa presented the results of *Harmony* (legislation, procurement, maintenance etc.) at a meeting of the authorities involved in the Dutch Multi-year Defragmentation Programme. Present were representatives of the Dutch NRA, the Provinces and the National Railway Company.

#### **Ireland – TII Conference**

ROD-IS were invited to make a presentation at the TII National Conference in Ireland in September 2016. This presentation focused on best practices for procurement of road mitigation measures of most relevance to the audience. The title was “*Procurement of wildlife measures in contract documents*”.

### **IENE 2016**

ROD-IS director Eugene OBrien was the chair of the session “Vision 2050: Ecologically Sustainable Transport System” at the 5<sup>th</sup> IENE Conference on Ecology and Transportation, where he also made a presentation on the work in the *Harmony* Project.

### **Hungary – MTA Conference**

MTA organised a conference in Budapest where they disseminated the findings of the project. MTA held this conference in Budapest Zoo on 4<sup>th</sup> of May, 2016.

### **TRA – Warsaw, April 2016**

A poster paper entitled “*Procedures for the Design of Roads in Harmony with Wildlife*” was published and presented at this conference by Eugene OBrien. The paper gives a general summary of the research conducted as part of the *Harmony* project and presents the key findings.

### **ICOET – North Carolina, September 2015**

Dennis Wansink (BuWa) presented a poster on the *Harmony* project at ICOET 2015. The poster presented the results of *Harmony*'s examination of EIAs across the reference countries.

### **IENE – Malmo, September 2014**

The *Harmony* consortium was involved in two workshops at the IENE Malmo conference. The first workshop, entitled, '*I have a Dream*', explored the needs of practitioners to be able to establish cost-efficient mitigation strategies and maintenance practices. The second workshop, entitled, '*Road maintenance practices to improve wildlife conservation and traffic safety*', explored maintenance practices as perceived by experts from different countries and discussed how this may contribute to the development of guidelines for Best Maintenance Practices (BMP's).

## 4 Consultation with Road Owners

As part of the *Harmony* project, the consortium carried out consultations with the various National Roads Authorities in the reference countries to gather information for a number of the deliverables.

In addition, three consultations have occurred to date with the Programme Executive Board (PEB) of CEDR. The first consultation occurred in June 2014 in Vienna and the second consultation occurred in September 2014 in Malmö. Both of these consultations were covered in Section 4 of *Harmony* Deliverable D “Recommendations on Appraisal Process & Report on Consultations“. As the final formal consultation between the PEB and *Harmony*, project coordinator Eugene OBrien was invited to the PEB meeting in Bristol on May 7<sup>th</sup> 2015.

The main recommendations to come out of the Bristol meeting were in relation to the *Harmony* website. The suggested changes have been made and are detailed below:

- A link to the SafeRoads website was added;
- A site visit counter now displays the number of website hits;
- The website was updated with the latest project news and photographs.

As well as the PEB meetings, there has been a very productive dialogue between the *Harmony* partners and the project manager Vincent O’Malley and colleagues through the revisions of each *Harmony* Deliverable.

## 5 Acknowledgement

The research presented in this deliverable was carried out as part of the CEDR Transnational Road Research Programme Call 2013. The funding for the research was provided by the national road administrations of Austria, Denmark, Germany, Ireland, Norway, Sweden, Netherlands and UK.

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