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

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

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Procedures for the Design of Roads in Harmony with Wildlife

Recommendations on Appraisal Process & Report on Consultations

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Roughan O'Donovan Innovative Solutions (ROD-IS)

Bureau Waardenburg (BuWa)

Swedish National Road and Transport Research Institute (VTI)

MTA Centre for Ecological Research (MTA)

Harmony

CEDR Call 2013: Roads and Wildlife – Cost efficient Road Management

Procedures for the Design of Roads in Harmony with Wildlife

Harmony

Recommendations on Appraisal Process & Report on Consultations

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Authors this deliverable: Sinead Gavin, ROD-IS, Ireland Barry Corrigan, ROD-IS, Ireland; Ciaran Carey, ROD-IS, Ireland, Mairead Ní Choine, ROD-IS, Ireland Dennis Wansink, BuWa, Netherlands.

PEB Project Manager: Vincent O'Malley

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Executive Summary

In order to comply with EU Environmental Impact Assessment Directive, the Habitats Directive and the Birds Directive; Environmental Impact Assessments and Appropriate Assessments (sometimes referred to as Habitats Directive Assessment) must be carried out. This report gives guidance on best practice and the consideration of all current and pending legislation in the compilation of these assessments. Further guidance is given on the inclusion of biodiversity in Project Appraisal, a requirement for projects that require government approval. The Harmony project is centred around the eight countries of Austria, Belgium, Norway, Hungary, Ireland, the Netherlands, Sweden, and the United Kingdom. As this report focuses on European Union legislation Denmark replaces Norway as a reference country. Greece is included with the reference countries in Section 2 as an example of a Mediterranean country while Germany is included in Section 3.

The report is divided into three main parts, corresponding to Tasks 4.1, 1.4 and parts of Task 0.2 of the *Harmony* project. Section 2 of the report deals with the compilation of Environmental Impact Assessments (EIAs) and Appropriate Assessments (AAs) specifically for road projects. The first part of the section focuses on EIAs. The EIA Amendment Directive 2014 (2014/52/EU) must be transposed into national legislation by May 2017 and affects various components of the EIA which are described, including: the production of a screening report, a mandatory minimum 30 day period for public consultation and clarification on the examination of alternatives. The Amendment also addresses the issue of cumulative effects and requires developers to monitor significant adverse effects. Other pieces of best practice not made mandatory in the Amendment that should be carried out are scoping and the monitoring of mitigation. Production of EIA chapters on biodiversity should take into account seasonal effects and the writing of these chapters and others should allow for the ability of the public to understand the information.

Part 2 of Section 2 deals with the Habitats and Birds Directives and the Appropriate Assessment that may arise due to these pieces of legislation. In gathering data for any portion of the procedure to fulfil the requirements of the directives, best practice is that the data should be interpreted by experts and be no older than 3 years. A good practice is to contact relevant nature conservation agencies at this stage as they may be able to provide valuable information on the area in question. When collecting data from the area it is best practice to use a method that can be repeated as the competent authority may request monitoring of the area. Any effects on the area, direct or indirect combined with effects from other plans or projects must be examined. If it has been identified that a plan or project will adversely affect the integrity of a site then mitigation should be considered with best practice including a plan for monitoring the mitigation. Compensation differs from mitigation and is only carried out after it has been established that there is no alternative and imperative reasons of overriding public interest exist.

The third Section investigates the current approach to Project Appraisal for national road projects for the eight reference countries as well as Germany. The assessment focuses on the inclusion of biodiversity, wildlife and habitat protection as well as other forms of environmental capital as considerations in Appraisal. Cost Benefit Analysis (CBA) is found to be the main form of appraisal used throughout Europe. This poses a challenge to the incorporation of environmental factors as CBA requires the monetisation of all impacts. Following the review of the approaches, the assessment

concludes that the Project Appraisal frameworks provided in the UK is the most suitable for adoption by other member states.

Section 4 of the report details the consultation between the project consortium and the Programme Executive Board (PEB) of CEDR which has taken the form of meetings with the PEB and continued contact with the project officer.

1 Introduction

The report is divided into three main parts, corresponding to Tasks 4.1, 1.4 and parts of Task 0.2 of the *Harmony* project. In the first part of the report (Section 2), existing and forthcoming legislation and guidance for road schemes across Europe are examined and guidance is provided based on the best practice that returns the greatest level of success and effectiveness. The Section is divided between Environmental Impact Assessments (EIA), made necessary under the EIA directive, and Appropriate Assessments required due to the Habitats and Birds Directives. The objectives of Section 2 are necessary in that no available European wide guidelines have been produced for the compilation of EIAs and Appropriate Assessments specifically for road schemes outside of COST 341. The countries whose national legislation and procedures were examined as a means to provide best practice guidelines are the eight reference countries of Austria, Belgium, Denmark, Hungary, the Republic of Ireland, the Netherlands, Sweden and the United Kingdom as seen in Figure 1 highlighted in purple as well as Greece, highlighted in blue.

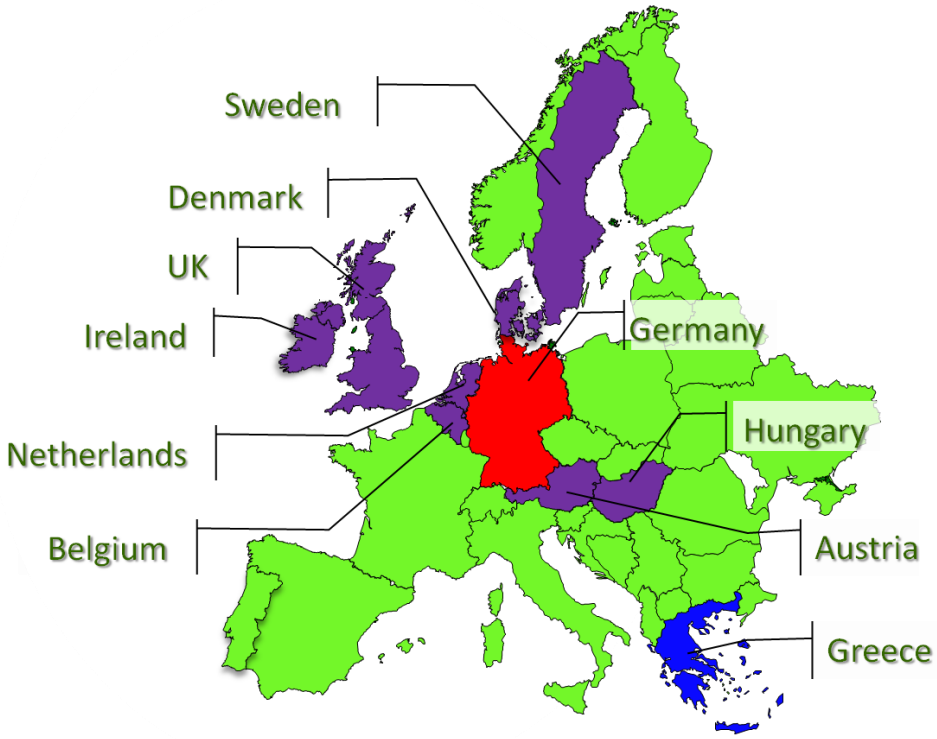

Figure 1 Countries with data included in this report

Section 3 of this report aims to give insight into the current approach to Project Appraisal for transport projects across Europe concentrating on national road projects. The nations considered in this section are the eight reference countries mentioned above as well as Germany. The section concentrates on how each country's Project Appraisal gives due consideration to biodiversity among the factors included in the Appraisal. The section then discusses the manner in which each nation strives to strike the balance between the requirements to protect wildlife and other factors such as economy, safety and society. The section concludes with a recommendation of the Appraisal Process which best encompasses biodiversity.

The final part of this document (Section 4) reports on the consultation with the Programme Executive Board (PEB) of CEDR. The section summarises the input given and decisions taken during the two meetings involving the PEB.

2 Update to COST 341 Handbook on Assessment and Legislation

2.1 Introduction

Development of road infrastructure has the potential to lead to considerable changes in land use. Road infrastructure has the potential to cause habitat fragmentation and ecosystem loss. Biodiversity and the impact incurred by road developments have become one of the central environmental issues when planning for road infrastructure. Planning processes seek to balance the need for transportation with the need to minimise environmental impact. Environmental Impact Assessments (EIA) and Appropriate Assessments (AA) are important elements in the planning process of many road projects. All European Union (EU) countries carry out Environmental Impact Assessments and Appropriate Assessments to comply with the EIA Directives, the Birds Directive and the Habitats Directive. The directives are transposed into each member state's national legislation; guidance is produced in order to provide a practical and systematic approach to carrying out assessment with the environment and biodiversity in mind.

2.2 EU Environmental Impact Assessment Directive

2.2.1 Introduction

The EIA (Environmental Impact Assessment) Directive 85/337/EEC has been in force since 1985 and has been amended three times (1997, 2003 and 2009); it is now codified into the EIA Directive 2011/92/EU. The directive was developed to cover a wide range of public and private projects and requires them to carry out an assessment of the potential environmental impacts. It is designed to ensure that projects likely to have significant effects on the environment are subject to a comprehensive assessment of environmental effects prior to development consent.

As part of the EIA reporting process a description of the aspects of the environment likely to be significantly affected by the proposed project needs to be provided, including baseline flora and fauna descriptions along with other associated environmental factors such as soil, water, climate, landscape and the interrelationship between these.

The likely effects on those environmental indicators are further detailed by a description of the project, its use of natural resources and the emission of pollutants, creation of nuisance and the elimination of waste.

Following on from a description of the baseline environment and the potential impacts, a description of the measures envisaged preventing, reducing and where possible off-setting any significant adverse effects on the environment is provided.

The EIA Directive identifies whether or not an Environmental Impact Statement (Environmental Impact Assessment Report) is a mandatory part of the planning

procedure. For major projects including roads, the mandatory requirements are identified within Annex 1 of the Directive and include:

- Construction of motorways and express roads,
- Construction of a new road of four or more lanes, or realignment and/or widening of an existing road of two lanes or less so as to provide four or more lanes, where such new road or realignment and/or widened section of road would be 10km or more in a continuous length.

Furthermore, Article 4(2) of the Directive requires member states to determine whether a road project not listed in Annex 1 shall be made subject to an environmental assessment based on case by case examination or thresholds set by each Member State.

A review of the EIA directive, its application and effectiveness was carried out by the European Commission in 2002 (European Commission, 2002). This report determined that the objectives of the EIA Directive are generally achieved by Member States. The principles of the Directive have been integrated into national EIA systems for Member States where they have established a comprehensive regulatory framework and implement the EIA in a manner which is largely in line with the directive requirements. In many cases throughout Europe, the member states have built on the minimum requirements of the directive and have gone beyond them. The majority of countries have developed guidance documents for producing EIA reports both generally for EIA and in many cases specifically for roads projects and in the absence of a member state's own guidelines, a neighbouring country's guidelines are applied.

The report determined that the EIS Directive provides significant benefit in terms of ensuring that environmental considerations are taken into account as early as possible in the decision making process and ensures involvement of the public. The procedures allow for transparency in environmental decision making and consequently social acceptance. Overall, the use of the EIA process results in improved project design and incorporation of environmental decisions.

However, the development of EIA is an evolving process and needs to reflect the enlargement of the EU along with other community and international policy and legal contexts. The review of the EIA Directive indicates that improvement is needed in areas such as screening, public participation, quality of the EIA, EIA transboundary procedures and coordination between the EIA and other environmental directives and policies, such as climate change and biodiversity.

As a result of the findings of the EIA review, on 12 March 2014, the European Parliament voted to adopt substantive amendments to the Environmental Impact Assessment ("EIA") Directive 2011/92/EU. These amendments made by EIA Amendment Directive 2014/52/EU will need to be transposed by the member states into national legislation by May of 2017.

It is considered that the amendments will strengthen existing legislation and therefore increase the level of protection of the environment and human health. The main areas of change for the EIA Directive include strengthening of topics such as screening, cumulative effects, alternatives and general quality and monitoring.

2.2.2 Using European Guidelines to minimise the impact of roads on wildlife

No available European wide guidelines have been produced for the compilation of EIA and AA specifically for road schemes outside of COST 341. It is the aim of this section to take the existing and forthcoming legislation and guidance for road schemes across Europe and provide guidance based on those measures that provide the greatest level of success and effectiveness.

The EIA process can be broken up into the following stages of assessment:

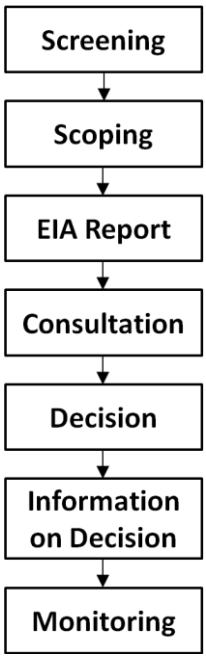

Figure 2 Stages of an EIA Assessment

The following sections provide guidance relating to the stages of an EIA shown in Figure 2.

2.2.2.1 Screening

Screening involves a process of determining whether an EIA is required for a project based on a list of Annex I and II projects as identified within the EIA Directive. Projects identified in Annex I of the Directive have a mandatory requirement for EIA while Annex II of the Directive requires the project to be screened for potential environmental effect to determine the need for EIA.

Annex III of the EIA Amendment Directive provides a list of criteria for screening (criteria to determine whether the projects listed in Annex II should be subject to an environmental impact assessment). This list of criteria can be seen in Table 1. As a result of the EIA Amendment Directive 2014, it is mandatory for a screening report to be produced for projects with potential significant environmental effects.

Table 1 EIA Amendment Directive 2014 Annex III

EIA AMENDMENT DIRECTIVE 2014
Annex III: list of criteria for screening (criteria to determine whether the projects listed in Annex II should be subject to an environmental impact assessment)

1. **Characteristics of projects:** The characteristics of projects must be considered, with particular regard to: (a) the size and design of the whole project; (b) accumulation with other existing and/or approved projects; (c) the use of natural resources, in particular land, soil, water and biodiversity; (d) the production of waste; (e) pollution and nuisances; (f) the risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge; (g) the risks to human health (for example due to water contamination or air pollution).

2. **Location of projects:** The environmental sensitivity of geographical areas likely to be affected by projects must be considered, with particular regard to: (a) the existing and approved land use; (b) the relative abundance, availability, quality and regenerative capacity of natural resources (including soil, land, water and biodiversity) in the area and its underground; (c) the absorption capacity of the natural environment, paying particular attention to the following areas: (i) wetlands, riparian areas, river mouths; (ii) coastal zones and the marine environment; (iii) mountain and forest areas; (iv) nature reserves and parks; (v) areas classified or protected under national legislation; Natura 2000 areas designated by Member States pursuant to Directive 92/43/EEC and Directive 2009/147/EC; (vi) areas in which there has already been a failure to meet the environmental quality standards, laid down in Union legislation and relevant to the project, or in which it is considered that there is such a failure; (vii) densely populated areas; (viii) landscapes and sites of historical, cultural or archaeological significance.

3. **Type and characteristics of the potential impact:** The likely significant effects of projects on the environment must be considered in relation to criteria set out in points 1 and 2 of this Annex, with regard to the impact of the project on the factors specified in Article 3(1), taking into account: (a) the magnitude and spatial extent of the impact (for example geographical area and size of the population likely to be affected); (b) the nature of the impact; (c) the transboundary nature of the impact; (d) the intensity and complexity of the impact; (e) the probability of the impact; (f) the expected onset, duration, frequency and reversibility of the impact; (g) the cumulation of the impact with the impact of other existing and/or approved projects; (h) the possibility of effectively reducing the impact.

In light of the criteria listed above it is important that the EIA screening procedure is kept simple and standardised across Europe while the approach taken by developers to enable the screening process is enhanced as much as possible.

The screening process should ensure that EIAs are carried out only if significant environmental effects exist and this must be duly justified. Where screening is determined as sufficient and EIA is not required, this needs to be justified in writing and made available to the public. The report should state the main reasons for not requiring assessment with reference to the relevant criteria listed in Annex III. In addition, the developer will state (if proposed) any envisaged measures to avoid or prevent (not reduce) significant adverse effects on the environment. The provision of

this condition allows mitigation by design or other measures to be introduced at an early phase of development so as to avoid significant environmental effects; this however results in the obligation by the developer to implement this design and/or these measures later on in the project. It is important to consider the impact of cumulative effects at the screening phase of a development as the effects of the proposed road in conjunction with existing or planned development may result in a potential effect on the environment. Figure 3 shows an example of a Screening Flow Chart, adapted from one developed by the National Roads Authority in Ireland.

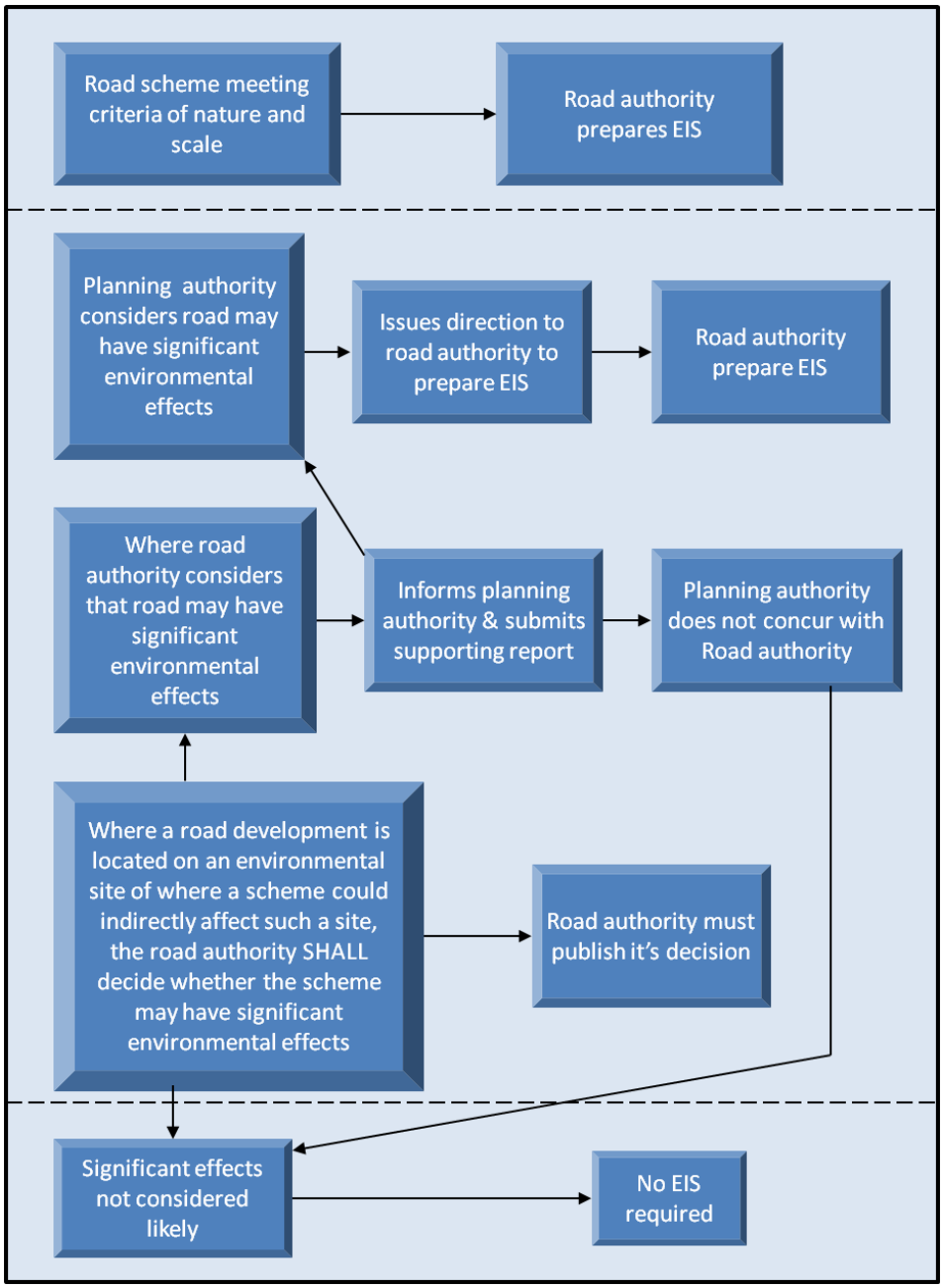

Figure 3 Screening Flow Chart based on Irish National Roads Authority (NRA, 2008)

2.2.2.2 Scoping

Scoping is the process of determining the content and extent of the matters to be covered in the EIA. It identifies the key issues that are specific to a project or its location and that are likely to be relevant to the project during EIA. In addition, those attributes that are not considered important can be eliminated at this stage. Scoping can be mandatory or voluntary but is generally carried out throughout Europe as best practice. The level of scoping varies between countries. For example, Belgium puts a strong emphasis on Scoping involving notification of the Governmental EIA Unit. A file is set up stating a description of the proposed project or plan and the likely effects, the projected content of the EIA and the envisaged methodologies. The actual EIA procedure can only start after the EIA Unit approves the proposed scope. Prior to making a decision and commenting on the notification file, the EIA unit consults all relevant authorities and public enquiries are held. The input of the EIA unit, the concerned authorities and the public diminishes the risk of unexamined effects and knowledge gaps at later stages. Other countries such as Germany and Ireland do not have a mandatory scoping procedure and there is no duty to organise a public enquiry at this stage. The European Commission provides guidance for scoping of EIA for all EIA projects. In addition, specific guidance for road projects can be found amongst member states.

Scoping is tremendously important as it can avoid delays caused by the requirement for additional information at later stages and provides an opportunity for the exchange of opinion at an early stage when the design is still flexible. Scoping is a reminder that there is a significant need to keep the EIS as comprehensive and tightly focused as possible.

Scoping at an early stage in the process is designed to ensure that the environmental studies provide all the relevant information on impacts of the project, alternatives of the project and any other matters. Member States may allow for developers to request a Scoping Opinion from the Competent Authority and other statutory bodies who will identify matters to be covered in the EIA. It is often practical that scoping will be carried out at the same time or in conjunction with the screening phase of development. However, Scoping does not end with the Scoping Report and there is always potential for the scope to be altered during the preparation of the EIS where new environmental sensitivities come to light or through ongoing consultation with organisations and the public.

An example of the stages of scoping, as outlined by the Chartered Institute of Ecology and Environmental Management, (CIEEM, 2006) can be seen in Table 2.

2.2.2.3 EIA Report

The EIA Report or the Environmental Impact Statement (EIS) is the primary document in the EIA process for decision making. Information to be contained in the EIA report is outlined in the EIA Directive 2011 and relevant member states' legislation and guidance documents. An overview of the Impact Assessment Methodology can be seen in Table 3. The following sections outline the requirements of an EIA.

Table 2 Stages of Scoping (CIEEM, 2006)

Proponent's ecologist to:

- Obtain information about the project from the proponent or their engineers/designers;
- Identify project activities likely to cause ecological damage, stress or disturbance. Obtain any available information about their spatial extent, timing, frequency and duration;
- Concurrently, identify opportunities for enhancing biodiversity and delivering biodiversity objectives;
- Identify stakeholders, consultees and all ecologists who should be involved and establish a consultation strategy;
- Produce a scoping report as a basis for further consultation with the competent authority, statutory consultees and others involved in the consultation strategy;
- Refine the scope of the assessment based on feedback on the scoping report;
- Continue to refine the scope - scoping out potential impacts that are no longer considered likely to be significant and addressing newly identified impacts that are likely to be significant.

The final scope provides the terms of reference for the remainder of the EIA.
The competent authority's ecologist may produce a scoping opinion.

Table 3 Impact Assessment Methodology

- Identification of existing flora and fauna to be reviewed in the impact assessment process;
- Screening of potential flora and fauna and biodiversity impact;
- Assessment of potential impacts on flora, fauna and biodiversity;
- Assessment of potential impacts and interactions with other environmental factors;
- Development of measures to mitigate negative impact and enhance positive impacts;
- Assessment of residual impacts on flora, fauna and biodiversity.

Describing the Baseline Conditions

The assessment of impact should be undertaken in relation to the baseline conditions within the zone of influence that are expected to occur if the development were not to take place ("do nothing" scenario). This should consider environmental trends e.g. climate change, combination effects such as other development which may affect the zone of influence in the future and any other projects for which planning consent has been granted.

Once activities that are likely to cause significant impact are identified, it is necessary to describe the resultant changes and assess the impact on the ecology of the site. This should be carried out with other specialist reports in mind such as noise, air quality, hydrology and water. All this should be carried out with strict regard for likelihood that a change will occur and the degree of confidence in the assessment of the impact on ecological structure and function. Certainty can be defined as a percentage range.

The impact assessment shall also include whether the impact is positive or negative, the magnitude of the impact, the extent of impact, the duration of the impact, the reversibility of the impact and the time and frequency of the impact.

Generally the EIA report should follow the following general format:

- **Scoping** allows for a refinement of the information needed to be brought forward into the EIA report. This will ensure an efficient and economic use of resources while gathering adequate information to fully inform the assessment of impacts on key ecological receptors. This process will ensure that a streamlined process is developed that provides a comprehensive yet concise ecological assessment that is accessible to the reader in a non technical manor where possible. Scoping will continue to take place throughout the EIA process and will inform the requirements for survey and assessment as the project is developed.
- **Identification of ecological resources** that are potentially impacted by the proposed road development. These resources should include designated sites, non-designated areas and rare and protected species which have been identified though desk top and literature review along with field assessment. A description of the site and the ecological resources that are present is also included. The findings of this assessment will result in a rating of the environmental resources present that are potentially impacted by the proposed road development. When identifying the ecological resources potentially impacted, it is important to consider all aspects of development including vegetation and soil clearance, blasting and noise impacts, construction of barriers, fences etc, drainage, site compounds and storage areas, access route and temporary roads, lighting, traffic use, waste management and maintenance operations. When considering scoping and identification of ecological resources, a zone of influence needs to be established. This zone of influence will vary from project to project based on ecological resources present, cumulative impacts of existing and planned projects and the scope of the proposed project.
- When putting together the body of the EIS it is beneficial to **assign values to ecological features** and resources, including those that have been designated for their nature conservation interest. It is important that a uniform approach is provided to allow for consistency in a national and European context. Generally, ecological assessment sets out categories of ecological value that relate to a geographical context such as international, national, local etc. However, a professional judgement approach is required when valuing a feature based on the available guidance and information along with advice from experts. Table 4 summarises an example of how the value of a resource can be determined within a defined geographical context (NRA, 2009).

Table 4 Geographical frame of reference for determining value (NRA, 2009)

- **International Importance** e.g. Natura 2000 sites, Ramsar, world heritage, biosphere reserves, and internationally significant populations of species protected under the Berne and Bonn conventions, designated salmonid waters.
- **National Importance** e.g. National Heritage Area (NHA), statutory nature reserves, national parks, populations at a national level of species protected under the wildlife act and relevant red data lists.
- **County Importance** e.g. Area of special amenity, area of tree preservation order, development plan sites, population of protected species/habitats of county level importance.
- **Local importance (higher value**) e.g. Locally important populations of protected species, Semi natural habitats with high biodiversity in a local context, important links for ecological corridors of higher ecological value.
- **Local importance (lower value)** e.g. Small areas of semi natural habitats that are of some local importance for wildlife, sites or features containing non native species that are of some importance in maintaining habitat links.

Determining the significance of impact/scoring the impact

The level of impact of a proposed road project is based on consideration of all elements of the development and should depend on the importance of the site. For example, any permanent impact on an internationally important site would be considered a severe negative impact; while on a site of county importance it would only be considered a severe negative if it impacts on a large part of this site. An example of a method to determine the significance of impact used by the Irish NRA can be seen in Table 5.

Quality of the EIA

The EIA Amendment Directive 2014 ensures an improvement in the overall quality of the EIA process and reports by demanding that only “competent experts” should write and review EIA reports.

The fundamental importance of quality control in reporting is well established. However, quality control is largely left up to each national competent authority. A difference in the quality of reporting both between different member states and within member states has been noted in a report carried out by the EU (European Commission, 2009).

EIA reports and in particular those chapters that deal with Flora and Fauna are frequently lengthy and technical. It is important that the EIS is made more understandable for the public, especially with regards to assessments of the current state of the environment and alternatives.

Table 5 Risk matrix for biodiversity impacts (NRA, 2011)

Score/ Impact	Internationally important	Nationally important	High Value Locally Important	Moderate Value Locally Important	Low Value Locally Important
Severe negative	Any permanent impact	Permanent impact on a large part of a site			
Major Negative	Temporary impact on a large part of a site	Permanent impact on a small part of a site	Permanent impacts on a large part of a site		
Moderate negative	Temporary impacts on a small part of a site	Temporary impacts on a large part of a site	Permanent impact on a small part of a site	Permanent impacts on a large part of a site	
Minor negative		Temporary impacts on a small part of a site	Temporary impacts	Permanent impact on a small part of a site	Permanent impacts on a large part of a site
Neutral	No impacts	No impacts	No impacts	No impact or temporary impact	Temporary impacts on a small part of a site
Minor positive				Permanent impact on a small part of a site	Permanent impacts on a large part of a site
Moderate positive			Permanent impact on a small part of a site	Permanent impacts on a large part of a site	
Major positive	Permanent beneficial impacts	Permanent beneficial impacts	Permanent impacts on a large part of a site		

(Source: Project Appraisal Guidelines, Unit 12.0 National Secondary Roads Projects, March 2011. Ireland)

It is also important that seasonal constraints are identified at an early stage of the EIA process. Certain specialist flora surveys may only be relevant at certain times of the year and sites may require survey during both summer and winter (Carroll & Turpin, 2002).

Alternatives

The EIA Amendment Directive 2014 requires that the examination of alternatives is a mandatory part of the EIA process. Article 5 (d) of the Directive requires the following information:

"a description of all reasonable alternatives studied by the developer which are relevant to the project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the project on the environment"

This stresses the importance of examining the design, location, size and scale of the proposed road project.

The European Commission's report 'On the application and effectiveness of the EIA Directive 85/337/EEC (European Commission, 2009) states that "The competent authorities and the public may also contribute to the selection of alternatives for assessment. The assessment of alternatives in EIA procedures is usually a difficult issue." The new directive addresses the issue of alternatives by requiring the assessment of alternatives including the "do nothing" scenario and the main reasons for the option chosen, taking into account the effects on the environment.

Cumulative Effects

When considering the impact on Roads and Wildlife, cumulative effects assessment is used to identify the total effects both direct and indirect on wildlife. This type of assessment considers additive effects (examining the magnitude of combined effects) and synergistic effects, which combined lead to an increased effect. Cumulative effects are frequently ignored by member states and problems remain when it comes to eliminating the practice of "salami slicing", especially for big investment plans. The 2014 Directive attempts to address this through a more rigorous screening methodology, involving a more detailed level of information provision and analysis, which examines the cumulative effects of a project with any existing or planned projects.

Annex IV of the Directive identifies the need to provide a description of likely significant effects of the project on the environment within the EIA Report, including 5(e):

"the cumulation of effects with other existing and/or approved projects, taking into account any existing environmental problems relating to areas of particular environmental importance likely to be affected or the use of natural resources".

2.2.2.4 Consultation and Public Participation

There is a lack of standard practice relating to public participation in the decision-making process across the EU. It is considered that the public must be given an early and effective opportunity to participate in the process. Time frames should be made reasonable and consistency is required throughout the EU. The Amended Directive (2014) addresses these issues by introducing timeframes for different stages of environmental assessment. A Screening decision should be taken within 90 days and pubic consultation periods should last at least 30 days.

2.2.2.5 Mitigation

Mitigation is defined as any process, activation or actions that avoids, reduces or remedies significant adverse environmental effects, likely to be caused by a road development. It is an integral part of the regulatory procedures and the EIA process.

Many Road Authorities throughout Europe now have environmental sustainability as one of their goals when planning for road development. Therefore the subject of Alternatives makes up a large component of mitigation, whereby a development is given consent only when all sustainable options are first examined. For example, in

Sweden, the overall objective of the Swedish transport policy is to safeguard a transport system that makes efficient use of public finance and is sustainable in the long term. This requires a thorough assessment of all sustainable options, including the 'Do Nothing' and 'Do Minimum' scenarios, along with those with the least environmental effect.

In general, it should be considered that Alternatives is the first point of mitigation, whereby options that have the least environmental effect will be considered in conjunction with the economic benefit while achieving the transport objectives identified for the project.

Project design is also a fundamental part of mitigation which prioritises avoidance over minimisation and finally restoration and compensation. Findings of the EIA process which identify potential impacts will then deal specifically with mitigation for these impacts. In recent years, there has been a push for more performance based specification of mitigation measures. In a performance based specification, a performance standard is specified rather than prescribing the actual mitigation measure itself. Using a performance based approach should ensure that the required outcome is met, while allowing the contractor to achieve this outcome in the most cost efficient manner. In order for the EIA to fully assess all likely significant impacts of a measure, an outline design for the mitigation measure should be prepared and assessed. This will ensure that all cumulative effects are considered and there are sufficient lands provided for the construction of the measure included within the scheme.

On the other hand, prescriptive based measures are considered failsafe in their design and provide a better guarantee of mitigation. However, in many cases they do not allow for new, improved or innovative construction and design measures that may be employed. It is considered preferable that a combination of both prescriptive and performance specifications are used when identifying mitigation.

Figure 4 uses standard principles of Avoidance, Reduction and Remedy when considering mitigation.

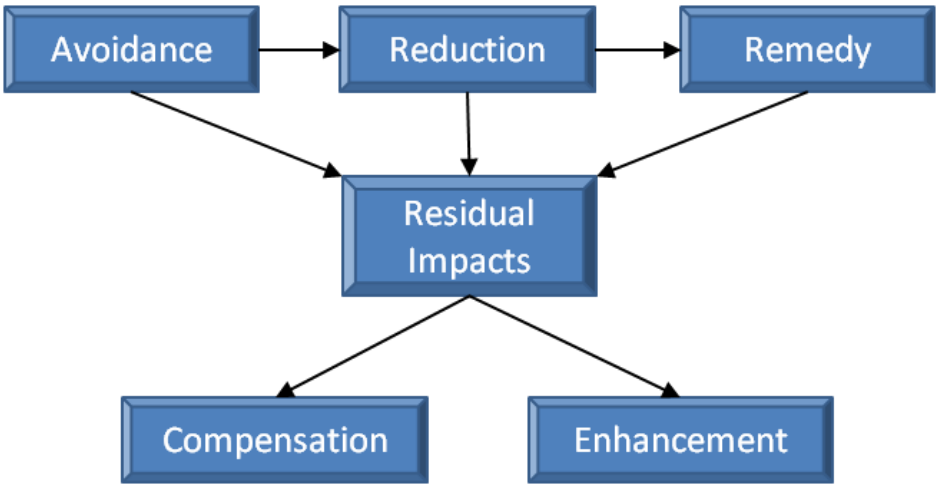

Figure 4 Standard principles of Avoidance, Reduction and Remedy for Mitigation

2.2.2.6 Monitoring

Prior to the implementation of the new EIA Directive (2014/52/EU), although monitoring was not a requirement of the EU directive (2011/92/EU), it was recognised as good practice in EIA, and has been adopted by some member states (European Commission, 2001). Belgium and the Netherlands currently recommend monitoring for all habitats and species groups as part of the EIA process. EIA reports should contain recommendations for monitoring and auditing during the operation of the road project to ensure conformation with requirements as well as accuracy of evaluation.

The purpose of monitoring includes the following:

- Ensures the implementation of conditions attached to a decision and compliance with applicable environmental standards/requirements;
- Verifies that impacts are as predicted or permitted;
- Records effectiveness of the mitigation measures;
- Allows the developer/authority to take action to manage unforseen results.

Legislative requirements throughout Europe mean that mitigation or compensation measures are part of the planning conditions and should be implemented in full. The EIA Amendment Directive attempts to address the issues of monitoring by including new obligations whereby if projects entail significant adverse effects on the environment, developers will be obliged to monitor the effects using procedures determined by the Member States. Where development consent is granted, consideration must be given to whether any appropriate measures to monitor the significant adverse environmental effects of the project are required. The measures must be proportionate to the nature, location and size of the project.

2.3 EU Habitats and Birds Directives

2.3.1 Introduction

According to the European Commission the Birds and Habitats Directives are the cornerstones of the EU's biodiversity policy (ec.europa.eu). They enable all 28 EU Member States to work together, within a common legislative framework, to conserve Europe's most endangered, rare and representative species and habitat types across their natural range within the EU. The Habitats Directive protects a sub-set of circa 1500 species, as well as circa 230 habitat types whilst the Birds Directive covers all naturally occurring wild birds present in the EU, and also provides that Special Protection Areas be designated to protect Annex I and migratory species. The two directives require Member States to ensure that the listed species and habitat types "are maintained and/or restored to a favourable conservation status throughout their natural range within the EU. It is therefore more than just halting their further decline or disappearance; the aim is to ensure that the species and habitats recover sufficiently to enable them to flourish over the long-term" (Sundseth 2014).

The Birds Directive (Directive 2009/147/EC) is the EU's oldest piece of nature legislation. In 1979 the Members States adopted the directive unanimously. This was due to increasing concern about the effect of pollution, loss of habitats as well as unsustainable use, on declining populations of Europe's wild birds. It was also in

recognition that, as many wild birds are migratory, they are a shared heritage of the Member States and for conservation efforts to be effective required international co-operation. The Habitats Directive (Directive 92/43/EC) was adopted in 1992 by the 15 Member States at that time. The directive's main aim is to promote the biodiversity maintenance, considering economic, social, cultural and regional requirements. In the following years both directives were amended several times due to the accession of new Member States, as well as to the inclusion of marine habitats (ec.europa.eu).

To achieve their objective, the directives require two types of provisions (Sundseth 2014):

1. **"Species protection**. This involves the establishment of a general system of protection for all wild bird species in the EU and for species of special conservation interest listed in Annex IV and V of the Habitats Directive. In essence, they require Member States to prohibit:
   - all forms of deliberate capture or killing in the wild;
   - deliberate disturbance, e.g. during breeding, rearing, hibernation and migration;
   - deterioration or destruction of breeding sites or resting places;
   - deliberate destruction of nests or eggs, or the picking, collecting, cutting, uprooting or destruction of protected plants in the wild;
   - the use of all indiscriminate means of capture or killing capable of causing local disappearance and serious disturbance to populations of such species; and
   - the keeping, transport and sale of specimens taken from the wild."

   "Derogations are allowed in some circumstances (e.g. to prevent serious damage to crops, livestock, forests, fisheries and water) provided that there is no other satisfactory solution and the consequences of these derogations are not incompatible with the overall aims of the Directives. As an exception, some birds species listed in Annex II of the Birds Directive may be hunted, but such hunting must comply with certain rules. Further, the taking in the wild or exploitation of species listed in Annex V of the Habitats Directive may be subject to management measures" (Sundseth 2014).

2. **"Site designation and management measures**. This provision aims at conserving core areas for species listed in Annex I of the Birds Directive and regularly occurring migratory birds, including internationally important wetlands (Special Protection Areas - SPAs) as well as habitat types and species listed in Annexes I and II of the Habitats Directive (Sites of Community Interest – SCIs/Special Areas of Conservation (SACs)). Together these sites form the Natura 2000 Network. In Natura 2000 sites:
   - damaging activities must be avoided that could significantly disturb the species or deteriorate the habitats for which the site is designated; and
   - positive conservation measures must be taken, where necessary to maintain and restore the habitats and species present, taking account of the economic, social and cultural requirements and regional and local characteristics of the area concerned" (Sundseth 2014).

   So far, over 27,000 sites are included in the network. This totals almost a fifth of Europe's land area as well as an important part (4%) of the surrounding seas.

This makes it the world's largest coordinated network of conservation areas (Sundseth 2014).

Under Article 17 of the Habitats Directive and Article 12 of the Birds Directive Member States are called to regularly prepare and submit national reports on progress made in implementing the directives. Based on these reports the European Environment Agency assesses the status and trends for each species and habitat at EU level. The latest report covers the period 2007-2012 (Romão 2015).

2.3.2 Protection of Natura 2000 sites

In the Habitats Directive, Article 6 sets out provisions that govern the conservation and management of Natura 2000 sites, and hence applies also to SPAs of the Birds Directive. Of the 24 articles in the directive, Article 6 is one of the most important. It is the one that most determines the relationship between land use and conservation (European Commission 2000).

Article 6 has four main sets of provisions (European Commission 2000):

- Articles 6(1) and 6(2) make provisions for the maintenance and improvement of the Natura 2000 sites conservation objectives. Articles 6(1) makes provision for the establishment of the necessary conservation measures, and is focused on positive and proactive interventions. Article 6(2) makes provision for the avoidance of habitat deterioration and significant species disturbance. Its emphasis is therefore preventative. These articles apply to all Natura 2000 sites.

- Articles 6(3) and 6(4) come into play if a plan or project is proposed that is likely to have a significant negative effect on a Natura 2000 site, either individually or in combination with other plans or projects (seeTable 6).

That its outcome is legally binding on the competent authority and conditions its decision is an important aspect of the Article 6(3) permit procedure. This is unlike the impact assessments carried out under the EIA and Strategic Environmental Assessment (SEA) Directives. The findings merely have to be 'taken into account' under those directives. Thus, the Article 6(3) procedure is an assessment combined with a legally binding decision-making process; more than just an ecological assessment (Sundseth & Roth 2013). A flow-chart of the decision-making process is shown in Figure 5.

Table 6 Articles 6(3) and 6(4) of the Habitats Directive.

Article 6(3)

Any plan or project not directly connected with or necessary to the management of the site but likely to have a significant effect thereon, either individually or in combination with other plans or projects, shall be subject to appropriate assessment of its implications for the site in view of the site's conservation objectives. In the light of the conclusions of the assessment of the implications for the site and subject to the provisions of paragraph 4, the competent national authorities shall agree to the plan or project only after having ascertained that it will not adversely affect the integrity of the site concerned and, if appropriate, after having obtained the opinion of the general public.

Article 6(4)

If, in spite of a negative assessment of the implications for the site and in the absence of alternative solutions, a plan or project must nevertheless be carried out for imperative reasons of overriding public interest, including those of a social or economic nature, the Member State shall take all compensatory measures necessary to ensure that the overall coherence of Natura 2000 is protected. It shall inform the Commission of the compensatory measures adopted.

Where the site concerned hosts a priority natural habitat type and/or a priority species, the only considerations which may be raised are those relating to human health or public safety, to beneficial consequences of primary importance for the environment or, further to an opinion from the Commission, to other imperative reasons of overriding public interest.

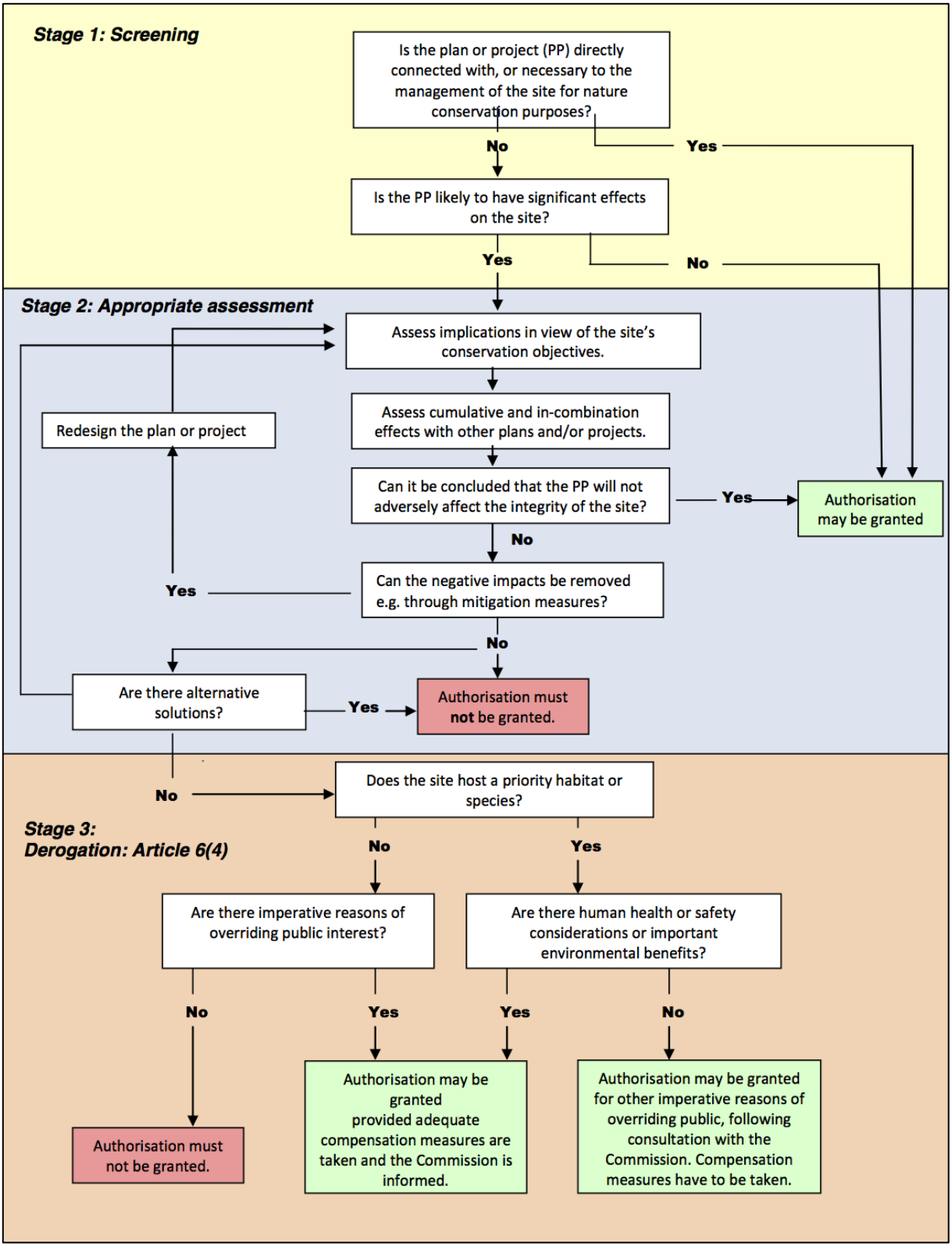

Figure 5 Flow chart of Article 6(3) and 6(4) procedure (Sundseth & Roth 2013, based on Methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, EC 2002).

2.3.3 Guidelines for the implementation of articles 6(3) and 6(4)

Road owners are faced with the Birds and Habitats Directives when management plans are designed for Natura 2000 sites (article 6(2) of the Habitats Directive) and when new roads are planned or existing roads are upgraded in or nearby Natura 2000 sites (article 6(3) of the Habitats Directive). In this section we give guidelines how to implement the provisions of articles 6(3) and 6(4). These guidelines are based on EU documents and on a study of the implementation of the Habitats and Birds Directives in relation to roads in eight EU Member States (CEDR 2013 call 'Roads & Wildlife').

A directive is binding as to the result to be achieved, but leaves a Member State some choice as to the form and methods of achieving that result. This becomes apparent when comparing the procedures Member States use to enforce the directives. All have transposed the provisions into national law, but the procedure to come to a decision if a project or plan is authorised, differs between the countries. For example in some countries the competent authority depends on the type of project or plan. Regional authorities are responsible for regional projects/plans, while national or federal authorities are responsible for national or interregional projects/plans. In Hungary and the UK, the competent authority is always the same, either a sector authority (HU) or the national authority (IE & UK). The UK and Ireland have set up independent statutory bodies for the authorisation of a project or plan under the Article 6(3) Habitats Directive. In Denmark, large infrastructural projects and plans must be authorised by the Parliament by ratification of a law. However, whatever procedure is used the process to come to the decision to permit a plan or project or not should always be transparent and be reasoned with the best available scientific knowledge. The following sections provide guidance relating to the stages of the decision-making process as shown in Figure 5.

2.3.4 Screening

The screening of a plan or project is the most important stage of the procedure. Here the competent authority has to clarify whether significant adverse effects of a plan or a project on the conservation objectives of a Natura 2000 site can be excluded. If not, then article 6(3) comes into play and an Appropriate Assessment has to be carried out, implying that besides its own effects also the effects of other plans and projects have to be considered and mitigation measures have to be invented. The application of the precautionary principle, which requires that the conservation objectives of Natura 2000 should prevail where there is uncertainty, is implicit in the Habitats Directive (European Commission 2002). It is therefore important to assess the possible effects of the plan or project in the screening stage as thoroughly as possible and avoid any uncertainty. It is also good and prudent practice to record the justification of the decision. The screening should include at least:

- The location of the plan or project relative to the Natura 2000 site
- The conservation objectives of the Natura 2000 site
- A description of the plan/project
- A description of the current state of habitats and species in the Natura 2000 site
- The identification of impacts
- The Assessment
- Statement of Conclusion

2.3.4.1 Location of plan or project

Impacts of road construction are not limited to direct impacts inside the Natura 2000 site, e.g. damaging a piece of a protected habitat type while building a new road. Changes in the groundwater level due to the construction of a new road outside a Natura 2000 site may have indirect impacts on the Natura 2000 site and should therefore be assessed as well. Figure 6 shows the relationship between an activity (as part of a plan or project) and a conservation objective (for which the Natura 2000 site was designated). Both the activity (e.g. traffic) and the conservation objective (e.g. number of breeding birds) may have an influence area outside the Natura 2000 site. Traffic for instance produces noise that may frighten breeding birds foraging outside the Natura 2000 site. The effect may be that the birds lose a feeding site and this may influence their breeding success, resulting eventually in a decrease of breeding birds in the Natura 2000 site.

2.3.4.2 The conservation objectives of the Natura 2000 site

For every Natura 2000 site, conservation objectives are given, such as 'no loss of area of habitat type or habitat of protected species', 'increase the number of a breeding bird species to a specific amount', 'no loss of the quality of a habitat type or habitat of a protected species', etc. To assess whether a project or plan has adverse effects on these conservation objectives it must be known what their current status is. Which method is best to collect this information differs per country. Carrying out a field survey is the best if no other sources are available, but in countries like the Netherlands where (online) databases exist with very detailed information about the presence of habitat types and species an extensive field survey is often not necessary. However, a short visit to the site is always useful; because information about the quality of habitat types and species' habitats is needed as well as what the function of the site for the protected species is (e.g. breeding, foraging, migration, hibernation etc.). Also, the study among eight EU Member States showed that, whatever method is used to collect the necessary data, ecological experts are always needed to interpret the data.

When choosing the survey method it is good practice to keep in mind that, when adverse effects are expected, the competent authority often recommends that the effects are monitored during construction and/or operational phase of the road. To be able to accurately assess effects good baseline data prior to the project is required. Hence it is wise to use a method that can be repeated later and delivers comparable data. In most countries best practice methods for field survey and monitoring exist and are accepted by the competent authority as such.

Another important aspect connected with the data collection concerns the age of the data. The assessment of effects should be based on the current state of the conservation objectives and thus the age of the data should not be too old. In five or more years time the state can change considerably, both in a negative or in a positive sense. Generally the information about the current state should not be older than three years.

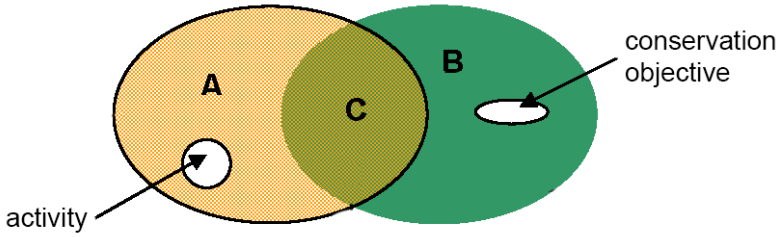

Figure 6 Example of indirect (external) effect. A: area of influence of activity; B: area of influence of conservation objective; C: area of external effect (source: Steunpunt Natura 2000, 2010).

2.3.4.3 Description of the plan or project

Each Natura 2000 site is different and may be influenced by a unique range of intrinsic and extrinsic factors. This means that a case-by-case approach is required in the impact assessment (Sundseth & Roth 2013). Therefore, it is important that every case is described and assessed properly to make a well-founded decision possible. This includes at least a thorough description of the project or plan and of the Natura 2000 site and the status of its conservation objectives.

Referring to the description of the plan or project one should bear in mind that impacts on Natura 2000 sites can occur during the construction phase and during the operational phase. Hence it does not suffice to describe the end product (the new or retrofit road), but also how the construction work is carried out, the machinery used, how much noise, nitrogen or dust is produced, when the activities will be carried out, where are the supply routes, does the work continue after dark and what kind of lights are used etc. Summing it all up will produce a long list, while not everything is necessary because it can be concluded beforehand that the habitat types and species concerned are not sensitive to certain impacts (see Section 2.3.4.4).

2.3.4.4 Impact assessment

A long list of possible impacts during the construction and operational phases of a road can be made. If every competent authority or consultant were to prepare this list themselves, screenings (and Appropriate Assessments; see Section 2.3.5) of projects and plans would not be comparable and possible impacts could be omitted. From the study among eight EU Member States it was noted that in five countries lists of possible impacts are available, saving time and discussion about what impacts to assess. It was also noted that the lists closely resemble each other. It appears that whatever the geography of the country, the possible impacts of road construction and retrofit are largely similar.

In the Netherlands the list with potential impacts also mentions which habitat type or species is susceptible to the impacts (Figure 7), facilitating the screening process. However, with progressing knowledge it is always good to use these kinds of lists with extra thought and consideration.

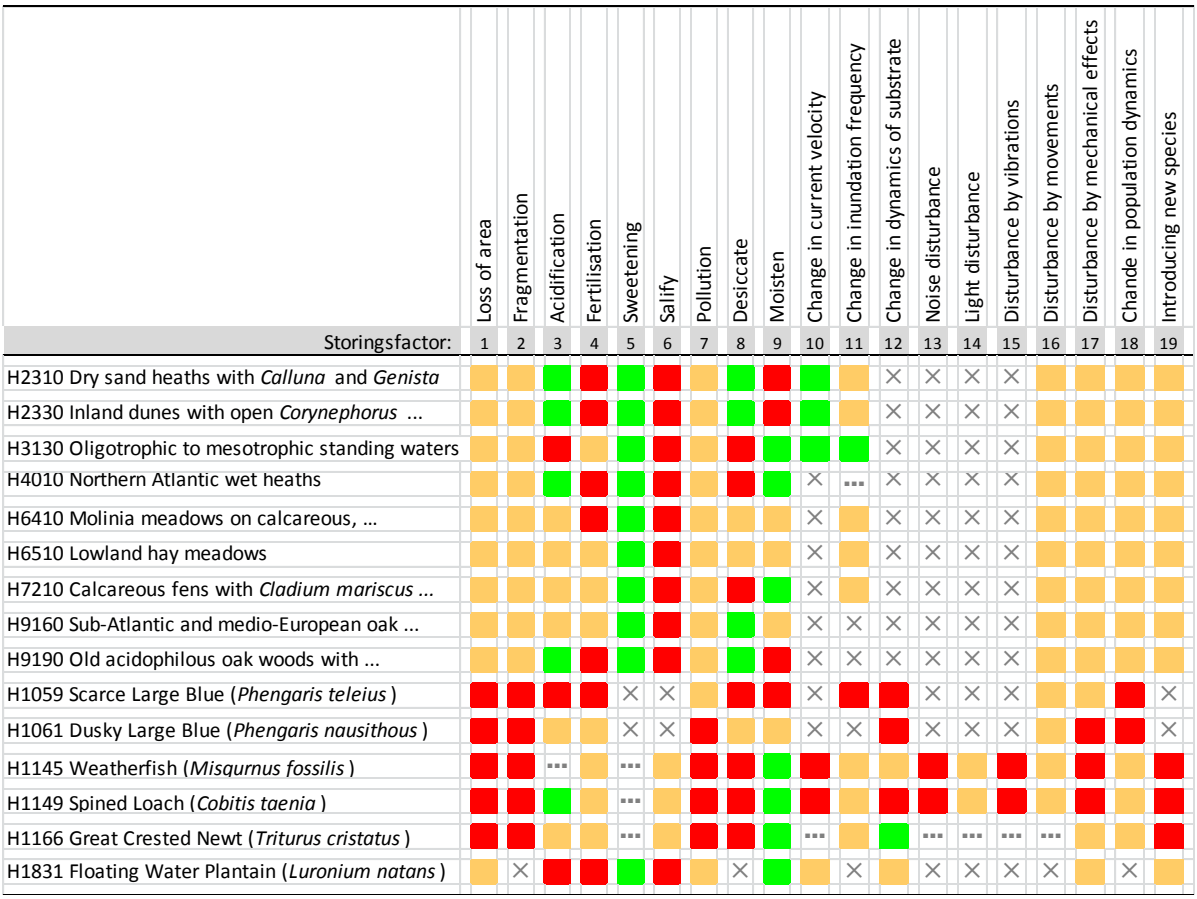

Figure 7 Example of the matrix showing the susceptibility of habitat types of Annex 1 and species of Annex 2 for 19 different impacts (Red: very sensitive, orange: sensitive, green: not sensitive, X: not applicable, …: unknown)

It must be noted that impacts can occur during the construction and during the operational phase of a project (see Section 2.3.4.3) and thus both phases must be assessed. Also effects may be short lasting, long lasting or even permanent. Impacts during the construction phase are often short-term, for example, disturbance by workmen and vehicles. On the other hand, the loss of a piece of habitat type is a long-term and usually permanent impact. In the assessment a clear distinction between these two must be made.

Assessing the impacts of a project or plan on a Natura 2000 site must be objective and reasoned with the best available scientific knowledge. However, because the scientific knowledge about the impacts of a development on flora and fauna is still not extremely detailed, this is not an easy task. Therefore it is very important to explicitly clarify in the impact assessment the reasoning, for example what data or criteria are used.

The conclusions of the impact assessment will be:

a. no adverse effects are expected;
b. adverse effects cannot be excluded, but they're not significant;
c. significant adverse effects cannot be excluded.

If b is the conclusion, the screening does not finish yet. The project or plan may not have significant adverse effects by itself, but it may be significant in combination with impacts from other projects and plans.

2.3.4.5 Cumulative effects

If a project or plan does have an adverse effect on a Natura 2000 site but by itself this effect is not significant, the effect may be significant in combination with impacts from other projects or plans in or nearby the Natura 2000 site. To assess this is not an easy task, because one has to know which projects are carried out or planned. It is the duty of the competent authority to keep an overview of the projects and their impacts on the Natura 2000 sites.

Where impacted areas interact it should be noted that cumulative impacts could result. An example given in European Commission (2002) of this "would be where a proposed project is likely to reduce water levels in a Natura 2000 site. While that resource reduction in itself may not be significant, where there are existing fertiliser and pesticide residues reaching the site from nearby intensive farming, the lower water levels may mean higher concentrations of pollutants when run-off occurs, to an extent that the combined effect becomes significant"

In the Methodological guidance to Article 6(3) and 6(4) of the Habitats Directive the European Commission advises to take the following steps to assess cumulative effects (EC 2002; Table 7).

Table 7 Cumulative Assessment

Steps in the assessment	Activity to be completed
Identify all projects/plans which might act in combination	Identify all possible sources of effects from the project or plan under consideration, together with all other sources in the existing environment and any other effects likely to arise from other proposed projects or plans.
Impact identification	Identify the types of impacts (e.g. noise, water resource reduction, chemical emissions, etc.) that are likely to affect aspects of the structure and functions of the site vulnerable to change.
Define boundaries for assessment	Define boundaries for examination of cumulative effects; note these will be different for different types of impact (e.g. effects upon water resources, noise) and may include remote (off-site) locations.
Pathway identification	Identify potential cumulative pathways (e.g. via water, air, etc.; accumulation of effects in time or space). Examine site conditions to identify where vulnerable aspects of the structure and function of the site are at risk.
Prediction	Prediction of magnitude/extent of identified likely cumulative effects.
Assessment	Comment on whether or not the potential cumulative impacts are likely to be significant.

2.3.5 Appropriate Assessment

If adverse effects of a project or plan on the integrity of a European Site in the context of its conservation objectives cannot be excluded an Appropriate Assessment (AA) must be carried out. The decision for the need of an Appropriate Assessment lies with the competent authority, who bases its opinion on the report describing the screening methods, data used and impacts assessed.

Because the screening showed which effects cannot be excluded the AA can be limited to these effects. For the AA the same information is needed as for the screening, but to assess the significance of an effect more detailed information may be necessary. The screening may for example be based on existing data about habitat types and species, for the AA these data may not be detailed enough and thus extra fieldwork will be needed.

The important difference with stage 1 (screening) is that in the AA it is allowed to propose mitigation measures to prevent adverse effects or to diminish them to a level that they are not significant anymore. It must be remembered that, to ensure the assessment is as objective as possible, the competent authority must first consider the project or plan in the absence of mitigation measures that are designed into a project. Effective mitigation of adverse effects on Natura 2000 sites can only take place once those effects have been fully recognised, assessed and reported. It will then be for the competent authority, on the basis of consultation, to determine what type and level of mitigation are appropriate.

2.3.5.1 Significance

The assessment of significance of adverse effects is the most delicate part of an AA. Essentially, the assessment of the significance is a judgement based on a number of factors. The assessment of significance may be made more objective with the use of criteria and standards. However, from the study among eight reference countries, it was noted that none of the countries have scientifically agreed thresholds or criteria for determining significance. Nevertheless, thresholds to assess the significance of effects are used, for example, for the effect of noise on birds or the effect of nitrogen deposition on habitat types and species. In relation to the latter, many countries have developed critical loads for habitat types and protected species (Whitfield & McIntosh, 2014). When the nitrogen deposition exceeds these critical loads, adverse effects cannot be excluded. However there is still a lot of debate about the magnitude of the threshold that is considered safe. Also, in many Western European countries the nitrogen deposition due to existing factories, traffic and agriculture already exceeds the critical loads of many habitat types implying that new developments near Natura 2000 sites with these habitat types are never possible or have to wait till the background deposition decreases (e.g. due to cleaner cars or removal of farms). Only when the nitrogen deposit by these new developments is extremely low can they continue.

Also the thresholds used to assess the effects of noise on birds are not generally accepted. Thresholds are often based on research on one or a few bird species in a specific environment. It is unknown if these results can be extrapolated to other bird species and other environments, though this is done in many AAs.

The judgement can also be made more objective when information from previous similar projects is used. This could be a good method if the impacts of a project or

plan on Natura 2000 sites are monitored since more would be known about their (adverse) effects and a well-substantiated statement about their significance would be possible.

The review of AAs in the eight reference countries showed that most assessments are based on expert judgements aided with information from quantitative models and direct measurements (Ni Choine *et al*. 2015). This implies that the way the expert judgement is carried out and the data upon which it is based must be well described in the AA report, for the competent authority to take a well substantiated decision.

2.3.5.2 Mitigation

When adverse effects cannot be excluded it is good practice to consider changes in the project or plan to prevent these effects. If this is not possible then diminishing the effects by mitigation is the next step to consider. Compensation is the next step in the sequence: first try to prevent impacts, if not possible mitigate the effects and lastly, if effects remain, compensate.

Prevention -> Mitigation -> Compensation

Zijlmans & Woldendorp (2014) state "If a plan or project may adversely affect the integrity of a Natura 2000 site, Article 6.4 of the Habitats Directive must be applied. This provision imposes strict conditions for authorising a plan or project that may adversely affect the nature values of a Natura 2000 site (see Table 1). In this context the obligation to take compensation measures is the *ultimum remedium*. Initiators of a plan or project try to avoid the application of the strict conditions of Article 6.4 by mitigating the effects of their plan or project so that the conclusion of the Appropriate Assessment on the basis of Article 6.3 of the Habitats Directive will be positive." Apart from the classic mitigation measures several creative solutions have been proposed, such as nature inclusive design and netting (see textbox overleaf). It must be noted however that the line between mitigation and compensation can be very thin. In the nature inclusive example in the textbox the European Court of Justice concluded that only diminishing adverse effects on the spot where they occur is considered mitigation. Measures taken at other places are considered compensation (Case C521/12 Briels and others, May 15, 2014). The place where the effect takes place is very important, because in the Case 201309630/1/R6 (October 29, 2014) the High Court in the Netherlands concluded that the verdict of the ECJ did not apply. The case is about oystercatchers. The project destroys foraging habitat of the species outside the Natura 2000 site. The effect will be that the number of breeding birds in the Natura 2000 site decreases. To prevent this from happening, the proponent will create new foraging habitat outside the Natura 2000 site but nearby the old foraging habitat. Because the effect in the Natura 2000 site (on the spot) after creating the new foraging habitat is nil (no decrease in breeding bird numbers) the measure can be consider mitigation, instead of compensation.

Nature inclusive design and netting
'Nature inclusive design' means that the objectives of the plan or project include nature protection measures. For example, if, after implementing all kinds of mitigation measure to diminish the adverse effect on the quality of a habitat type, some effects remain, an extra measure is proposed at another place in the Natura 2000 site to increase the surface of this habitat type. It must be clear from the project proposal that this extra measure is really going to be implemented as part of the project. In other words, 'nature inclusive design' implies that social, economic and nature conservation objectives are integrated in one project.

Netting or balancing of effects means, briefly, that a project with adverse effects for a Natura 2000 site is licensed because another license is withdrawn, so that, on balance, no significant adverse effects occur. For example, the increase in nitrogen deposits caused by a cattle farm can be balanced by the reduction in nitrogen deposits as a result of the withdrawal of one or several licenses for (an)other cattle farm(s). The granting and withdrawal of licenses must be directly linked and the balancing is only allowed as far as the same habitats of species or habitat types in the same Natura 2000 site are concerned or, depending on the specific circumstances, even the same location thereof in the Natura 2000 site.
(Source: (Zijlmans & Woldendorp 2014).

From the above it is clear that for effective mitigation measures that are legally accepted as well as accepted by other stakeholders a lot of creativity is sometimes needed. Creativity comes when more people can think about the problem and when the preconditions are not too strict. This is one of the reasons why more and more the requirements for mitigation measures are performance based rather than prescriptive. For example, instead of giving the exact dimensions of a fauna passage in a performance based approach the requirement would be defined as, for example, enabling the target species to cross the road daily without the risk of being hit by a car. The contractor can think of solutions and consult others (biologists, engineers) to help. This may lead to a proposal that the relevant roads authority did not think about. Of course the roads authority must have enough knowledge about the species-specific requirements to judge the solution(s) the contractor proposes. Also the performance based approach is not without any requirements at all. The requirements are less detailed but still precise enough to judge the effectiveness of the proposal by the contractor (Figure 8).

The performance based approach may lead to different solutions for the same problem and thereby increasing our knowledge about the effectiveness of different mitigation measures (if the effectiveness is monitored). Also, when the requirements are not too strict the contractor can develop solutions that will fit better to the local circumstances.

During the construction of the A74 in the Netherlands a large underpass with a walking strip at the top was planned at the height of a natural steep slope. Target species were serotine bat, small mustelids, badger, reptiles and amphibians. The relevant functional requirements were as follows.

- Ecological connections should carry and guide fauna.
- The fauna passage for small wildlife should connect the areas on both sides of the main roads for small mustelids, badger, reptiles and amphibians at the locations 'Underpass Steep Slope', 'Transition Ulingsheide' and 'Fauna strip Parallel to Highway 74'.
- Under 'Viaduct Steep Slope' the steep slope of 'Underpass Steep Slope' should be protected against erosion; design and materials of the protection shall be such that the image of an intact, natural, uninterrupted steep slope is maintained as much as possible.
- The steep slope of 'Underpass Steep Slope' under 'Viaduct Steep Slope' should be attractive and walkable for badger, small mustelids, reptiles and amphibians.
- East of the Wilderbeek and at the foot of the steep slope 'Underpass Steep Slope' should have along the entire length of 'Viaduct Steep Slope' a row of tree stumps with a width and height of at least 1 and at most 1.5 meters.
- Slopes connecting the ends of the walking strip in 'Underpass Steep Slope' at the top of the steep slope under 'Viaduct Steep Slope' with the surrounding environment should not exceed 1: 4.

Many of these requirements were too abstract to incorporate in a design drawing. The contractor used the systematics of Systems Engineering to turn these abstract requirements into requirements with a level of detail that made execution possible. This was determined by the NRA during process tests and informal feedback by the contractor towards the roads authority.

The picture shows the result. Among others it shows:

- When removing the vegetation from the slope, the contractor left large tree stumps in their place that can serve as shelters and guiding lines.
- The slope is covered with jute, which is easily walkable and has a natural look.
- In addition to the row of tree stumps at the bottom of the steep slope tree stumps and sausages made of willow branches are also placed on the slope serving as guiding lines and shelter.
- The tree stumps and sausages are positioned to form guidance both from the high plateau (top of the steep slope), as well as from the centre plateau (underside steep slope).

Figure 8 Example of performance based contract requirements for a mitigation measure under a new highway (Loehr 2013).

2.3.6 Alternative solutions or compensation

If, after implementing mitigation measures, adverse effects of a project or plan, either alone or in combination with other projects or plans, on the integrity of the Natura 2000 site cannot be excluded, then the next stage of assessment comes into play: "Are alternative solutions available?" Only when no alternatives exist, that have no or less adverse effects on the Natura 2000 site, can the project or plan proceed. However, there is another condition that must be fulfilled before the plan or project can proceed. It is necessary to consider whether imperative reasons of overriding public interest exist. Only when this is the case can the project or plan proceed. If the Natura 2000 site hosts a priority habitat or species then only human health or safety considerations or important environmental benefits flowing from the plan or project are accepted as imperative reasons of overriding public interest (IROPI). But other IROPI may be used after consulting the European Commission.

If it is decided that no alternatives exist and that imperative reasons of overriding public interest apply then the remaining adverse effects of the project or plan must be compensated. Compensatory measures are a last resort attempt to maintain the overall coherence of the Natura 2000 network as a whole. It is therefore of considerable importance to critically assess the proposed compensatory measures. They should (European Commission 2002):

- be appropriate to the site and the loss caused by the project or plan;
- have the ability to maintain or enhance the overall coherence of the Natura 2000 network;
- be feasible;
- be operational by the time the damage to the site is occurring.

Proposing compensatory measures is the last step in the assessment process when all other measures to prevent or mitigate adverse effects do not suffice. Interestingly, in a survey of Appropriate Assessment reports from eight reference countries several times compensatory measures were proposed, while the absence of alternative solutions for the project or plan and imperative reasons of overriding public interest were not addressed. There are two possible explanations for this inconsistency:

1. the project/plan does have significant effects and compensation is needed. In this case the executer of the AA made a mistake by not treating alternatives and overriding public interest and by including compensatory measures in the AA Report rather than in the Article 6(4) Report.
2. the executer of the AA confused mitigation with compensation.

The mistakes show that the assessment procedure is not yet clear to everybody or that the difference between mitigation and compensation is not clear. In both cases it is clear that more guidance is needed, either by the national government or the European Committee.

2.3.7 Monitoring

Monitoring of effects or effectiveness is not mentioned in Article 6 of the Habitats Directive. However, monitoring is recommended by the European Commission in their Methodological Guidance on the provisions of Article 6(3) and (4) of the Habitats Directive (European Commission, 2002). The reason is that, although in theory a mitigation or compensatory measure should work or in practise has been successful on projects in the past, it is not always certain that it will achieve 100% of their objectives at the proposed site and is reliant on good construction practices.

Therefore, as a conservative approach, a proposal to monitor the ability of the measures to achieve their objectives should be an integral part of the AA report, as well as an explanation of the steps that will be taken to address and rectify failures.
.
Monitoring the effects and effectiveness will increase our knowledge, which will improve future assessments and measures to prevent adverse effects.

2.3.8 A road map to prevent delays

For the assessment of possible effects of road building and retrofit on Natura 2000 sites many guidelines and courses exist. But most important is that the assessment is considered at the earliest possible stage which would ideally be Concept / Feasibility Stage, even before route options are considered. Starting the assessment, including all the needed fieldwork, at this stage will not lead to avoidable delays. This can be prevented by incorporating a check about nature laws and regulations in an early stage of the road building process (the concept phase). As is shown above developments in or nearby Natura 2000 sites are possible when appropriate precautions are taken. The intention of the EU legislative on nature is to prevent loss of biodiversity, but at the same time it doesn't prevent economic development. Problems (delays and extra costs) only arise when the obligations flowing from nature laws are not addressed on time.

To prevent delays it is good practice to discuss the project or plan, its possible effects and options for mitigation with the competent authority at different stages of the project. The competent authority is aware of the national and EU jurisprudence on nature laws and can advise about the aspects that are important to get permission to execute the development. Consulting local stakeholders (civilians, landowners, NGOs) also helps to design plans that will be accepted more easily. Consultation with relevant nature conservation agencies and the public is part of the Appropriate Assessment, but instead of waiting with the consultation until the report is written, it is wise to consult them in the earliest stages of the project. Quite often local or national NGOs have detailed information about the natural values in or around the project area. Making use of this knowledge in the development phase will diminish the chance of comments at public hearings or appeals after the Appropriate Assessment is carried out.

Taking the obligations of the Habitats and Birds Directives into account is all about planning. The earlier the presence of Natura 2000 sites is checked, and which conservation objectives apply, the less cumbersome the process will be and the more successful the project will be.

3 Project Appraisal

3.1 Introduction

The objective of this report is to provide insight into the current approach to Project Appraisal for transport projects and specifically national road projects being used across a range of European countries. Based on these findings, there is a discussion on the appraisal processes that best encompass biodiversity considerations into the overall assessment process, concluding with a recommendation for those processes that could best be adopted by other Member States.

The Harmony project focuses on the eight reference countries; these are Ireland, United Kingdom, Netherlands, Belgium, Sweden, Norway, Austria and Hungary. In this report Denmark has replaced Norway and Germany has been added because it is a large country and there was nothing substantive to report from Belgium.

Project Appraisal for transport infrastructure is the process of assessing whether capital expenditure is justified for a project and ensuring that it is allocated to the best transport solution to achieve the objectives of that project whilst complying with planning policy and national and EU legislation. The process allows decision makers to ensure that the best alternatives are selected whilst delivering value for money to the taxpayer on all national road projects. It also assists in the prioritisation of projects that require public funding.

The Irish NRA Project Appraisal Guidelines Unit 14: Non-Major Schemes defines transport appraisal as "*a process to establish the merits of a proposed intervention in the transport system. Sound governance requires that the probable impacts of the proposed scheme need to be assessed, both relative to other options for addressing the same problem ("is this the best solution?") and relative to other proposals, addressing different objectives, that are competing for public funds ("is this a priority for funding ?").*"

The assessment aims to identify whether decisions for road development across Member States are giving due consideration to the important balance between the requirements to protect wildlife and other factors such as economy, safety and society. This report aims to compare methodologies used in the selected countries.

3.2 Project Appraisal for Transport Infrastructure

Transport Project Appraisal is carried out to enable analysts to build evidence to support a business case and to inform investment funding decisions. In many European countries, Project Appraisal is a requirement for all projects that require government approval. Transport appraisal is about options generation, development and evaluation of impacts of the project from inception to tender stage. Overall the aim of project appraisal is to prevent decision makers from making subjective or risky decisions at an early stage of assessment and throughout the process of development.

Project appraisal in the form of Cost Benefit Analysis has historically been used throughout Europe by decision makers for major infrastructural projects. However it is difficult to provide monetary estimates for specific environmental topics such as biodiversity. The lack of a monetary estimate does not mean however, that those impacts can be overlooked in a decision-making process. In order to ensure the inclusion of the non-monetised impacts, the analyst has to find a way of representing these non-monetised impacts in, or alongside, the cost benefit analysis (Bickel et al 2006).

Through the provision of the European Structural Fund and Cohesion Fund, guidance has been set that can form a basis for appraisal of all significant infrastructure projects throughout the European Union. The EU Cohesion Policy requires a Cost Benefit Analysis of all major investment projects applying for assistance from the funds. In order to assess funding allocations from a number of differing governmental systems, a consistent approach is required. This allows decision makers within the funding authority to allocate funds and prioritise projects. Sound and consistent incentive mechanisms for project evaluations need to be made in order to overcome the structural information asymmetry; thereby agreeing harmonised rules on the calculation of some key performance indicators to use them to steer the decision making process.

In Europe the IPA Implementing Regulation 718/2007 (Article 157(f)) and General Regulation (EC) No 1083/2006 (Cohesion Regulations) Article 40(f) requires an analysis of the environmental impact to be included in the application to the authority. The guidance documents note that this should in particular consider the effect on European (Natura 2000) sites, RAMSAR sites and other sites of international importance.

When considering project appraisal on a national level for member states within Europe the appraisal practice is not standardised and there is great variation in terms of impacts that are monetised and those which tend not to be monetised (e.g. environmental impacts). Countries generally use one or more methods of analysis such as Multi Criteria Analysis or Cost Benefit Analysis (CBA) with or without the inclusion of environmental considerations such as biodiversity.

CBA is one of the most frequently used methods of assessing the impacts of roads projects. It generalises the classic criterion of financial gain by also considering the market effects as well as the non market effects of the decision, positive and negative, and bringing these to a monetary value. While CBA is used to some extent in most countries it may not be the deciding factor when deciding to go ahead or prioritise a project. CBA usually does not take into account ecological/biodiversity

impact appraisal and in most cases environmental considerations are limited to noise pollution, air pollution and global warming impacts.

In addition to Cost Benefit Analysis some form of environmental appraisal that considers the impact of a project for project appraisal purposes should be carried out. The provision of a synchronised methodology throughout Europe that can easily be carried out and be incorporated into the overall project appraisal process is considered beneficial to all member states and the protection of nature sites and species across the European Union.

It is also necessary to consider the level of project appraisal applied to projects. It is not considered appropriate that all projects require the same level of detail and assessment. This is reflected in the Irish NRA PAG Unit 12.0 Low Volume National Secondary Roads Projects which states "*On the principle that all appraisal should be proportionate to the scale and likely impact of the project being proposed, this unit describes methods that are applicable to this type of scheme. Similar methods are likely to be appropriate for assessing proposed upgrades to rural regional roads, or upgrades to sections of single carriageway national primary route in more remote rural areas.*"

3.3 Review of Project Appraisal Approaches

The following section provides a summarised description of the approach to Project Appraisal in each of the 9 countries and considers the level of consideration afforded to biodiversity in that methodology. The assessments are presented in the following order:

1. Austria
2. Belgium
3. Sweden
4. Netherlands
5. Denmark
6. Germany
7. United Kingdom
8. Ireland
9. Hungary

3.3.1 Project Appraisal in Austria

Project appraisal in Austria is based on using interdisciplinary estimates and their categorisation. The following aspects are considered when assessing transport infrastructure:

- transport;
- humans, habitats and environment; and
- cost.

The three main criteria are subdivided into several topics such as nature conservation, ecology and water which include further criteria (e.g. animals, plants and their habitats) and indicators. This is shown in Table 8

In a given case, the actual indicators and criteria (Table 8) need to be defined according to the strategic objectives of the project and it is possible to add certain additional criteria for specific projects.

There are a number of different methodologies that are used at different stages of project appraisal in Austria including:

- Impact Analysis (IA): Qualitative and quantitative impacts and their evaluation.
- Cost Benefit Analysis (CBA), Benefit-Value Analysis (BVA) and Cost Effective Analysis (CEA) all of which attempt to monetise impacts. These methods do not always include assessment of biodiversity.
- Cost Benefit Assessment: combination of all four analyses provides a summary of the assessment.

Impact Analysis (IA) is most relevant to the process of appraising biodiversity impact. It is always used in preliminary stage assessment and project stage and is also used in strategic transport investigations and environmental impact assessments throughout the project phase. IA makes up part of the overall Cost Benefit Assessment.

Table 8 Project appraisal evaluation system in Austria

Quality criteria	Topic area	Criteria	Indicators
Transport	Accessibility/ reach	Transport time (person, freight)	Problem specifically identified
	Vehicle operating cost	material, energy, personal	
	Transport safety	Frequency of accidents	
		Seriousness of accidents	
Humans, habitats, environment	Humans, habitats, environment	Noise	
		Vibration	
		Air pollution substances	
	Climate	Global climate	
		Local climate	
	Economy and urban areas	Land demand	
		Social separation impact	
		Cultural and material value	
		Urban landscape	
		Leisure and recreation	
		Agriculture and forestry	
		Hunting, fishery	
	Natural areas and ecology	**Animals and their habitats, plants and their habitats (including the fragmentation effects)**	
	Water	Surface water	
		Ground water (including water use)	
Costs	Investment	Investment costs	
	Additional costs	Construction and maintenance costs	

3.3.2 Project Appraisal in Belgium

Project appraisal for transport infrastructure in Belgium is carried out largely in terms of cost benefit analysis with no appraisal of nature or biodiversity. However the Belgian authorities are currently in the process of modifying their appraisal guidelines and hope to incorporate nature into their new system of appraisal.

3.3.3 Project Appraisal in Sweden

In Sweden all proposed road development for national transport investment must be accompanied by a 'Summary Table of Impacts' (STI). This system of assessment provides the following within its report:

- Presentation of the project and its stage of development;
- Effects on the environment;
- Description of the need for the project;
- Status of planning (early idea stage or late stage);

- CBA results; and
- Non monetized effects.

All major national transport investments are evaluated using a standardized CBA framework with the use of the ASEK guidelines (Swedish: *Arbetsgruppen för samhällsekonomiska kalkyler*; the working group for cost-benefit analysis). One of the main purposes of the ASEK guidelines is to make sure that transport investment CBAs are comparable and that they can be used to prioritise projects. The impact on biodiversity is not assessed as part of the CBA.

Environmental Assessment is examined as part of the assessment of non monetised effects. The non monetised effects which are included in the STI are described quantitatively or qualitatively. For example, distribution effects as well as effects on the natural and cultural landscape are usually described in qualitative terms.

The STI addresses the national transport policy objectives of functionality as well as those of health, safety and the environment. The STI comprises various types of analyses of positive and negative impact or alternative changes to the transport system. The different types of STI analysis are presented in a single summary document which contains:

- A description of the project;
- A description of the impacts of the project;
- The results of the CBA of the project;
- An analysis of the contribution of the project to the policy objectives;
- An identification of possible conflicting interests.

The STI approach always takes three analytical perspectives:

- Efficiency;
  - monetized impacts (CBA);
  - non-monetized impacts (including natural heritage);
- Equity/Fairness;
- Transport policy objective;
  - effectiveness concerning objective achievement;
  - sustainability.

3.3.4 Project Appraisal in the Netherlands

The Netherlands has a long history of using cost-benefit analysis (CBA) and multi-criteria analysis (MCA) in the appraisal of transport infrastructure. All large infrastructural projects require a cost benefit analysis which is carried out according to the 'OEI- Guide'. The decision to go ahead or not go-ahead with a project considers the societal cost benefit analysis (SCBA) in its appraisal. In an SCBA, project or policy alternatives are compared based on their consequence for the welfare of society as a whole. In an SCBA all advantages and disadvantages of a project are quantified and if possible expressed in monetary units. In terms of environmental impact and biodiversity, the SCBA is based on the information provided in the EIA (where available).

Quantifying impact in terms of wildlife or biodiversity can be difficult however. Some effects are considered easy to quantify and transfer into a monetary value e.g. cost of clearing a forest can be equivalent to the cost of replanting this forest elsewhere. However the value to citizens living near the forest is more difficult to quantify. No national standard exists for the assessment of the value of nature or the best method

to evaluate the willingness of citizens to pay for nature. However, guidelines exist (*Wever & Rosenberg, 2012*) as described below.

The quality of nature can be described as:

- the area of protected nature sites (e.g. Natura 2000 sites);
- the area of non-protected nature sites (other sites of ecological value that are not designated);
- populations of protected and threatened species;
- populations of non-protected and non-threatened species.

The key element of the appraisal is a table of project impacts, with scores allocated to the different criteria. Scores that cannot be monetised are given a + and – sign (these are qualitative items and cannot be inserted in the CBA). They include:

- Soil and water;
- Nature;
- Landscape, Archaeology and Culture; and
- Spatial Quality.

Two types of welfare effects can be distinguished:

- non-use value of nature: size and quality of biodiversity and the appreciation by humans for its persistence;
- use value of nature: welfare effects related to changes in size and quality of ecosystem services.

The approach depends on the type of effect – Table 9

Table 9 Assessment of Welfare Effects

Aspect	Welfare effect	Appraisal method
Non-use value	Changes in size and quality of biodiversity	CVM (Contingent Valuation Method)
Use value	Changes in ecosystem services; production, regulation, cultural.	TEEB (Economics of Ecosystems and Biosystems), hedonic prices etc.

Methods to measure welfare effects

<u>The non-use value of nature</u>

Nature Points Method

To determine the welfare effect in the form of changes in the non-use value (size and quality of biodiversity) it is advised to use the nature points method. The nature points method can be considered as an intermediate step to a final monetary valuation. The following methodology is applied:

1. Determine the size and qualitative impact of the intervention on nature. Use information from the EIA and/or use the judgement of experts. The purpose of this exercise is also to determine whether further investigation is worthwhile, in other words to determine whether the effects on nature are marginal or significant. This assessment is based on expert judgment.
2. If the physical nature effects are marginal it is sufficient to describe the impact, based on the EIA and/or expert judgement. If the effects are significant then the use of the nature points method is advised. This will provide insight into the differences between project alternatives and baseline alternatives (Do something and do nothing).

3. If possible, and depending on the context, perform a translation of nature points into Euros, for example on the basis of costs of preventive measures, with the same impact in terms of nature points.

Nature points method
The nature points method expresses the effects on acreage and quality of ecosystems in a single indicator value. This method produces points and not monetary values. To apply the method knowledge about the extent, nature and quality of natural aspects before and after the development is needed. The reliability of the results of the method is strongly dependent on the accuracy with which these factors can be measured and (especially) predicted. The natural value of an area can be determined by summation of the specific natural values of the area. In addition, a weighting factor is applied to incorporate differences in ecological importance (e.g. in respect of shortages or degree of endangerment). The individual nature values are determined by multiplying the area (ha) by the average quality (in %). The quality is determined by the completeness of the species composition relative to what is expected in the area (100% of the characteristic species occurs). The method can be used at different confidence levels, based on expert judgment (global assessment of the quality before and after the development) for a detailed quantitative study of changes in incidences of species through measuring and predicting changes in ecosystem characteristics, site conditions and ecological relationships. The indicator is a systematic, uniform and reproducible parameter which makes possible a comparison of effects on biodiversity due to different alternatives within a project, but also between projects. This way relative gain and/or loss of nature can be set against economic costs and benefits of a project.

Contingent Valuation Method (CVM)
The nature points method does value the preference of people, but describes the physical change in terms of quality and uniqueness of nature. The CVM does consider preferences and transfers them to monetary units. CVM should only be applied in exceptional cases, especially if the non-use values are expected to be large and distinctive among project alternatives. Three options are considered for translation of physical effects into a monetary value:

1. Assess the non-use value as last value in the SCBA. Start with determining the use value of nature and all the other benefits of a project. Next, determine how much money is needed to reach the breakeven point of the SCBA (in case of a negative balance). By dividing this negative SCBA balance by the number of households it can be verified at which value the SCBA balance is positive. On the basis of indices and observed consumer behaviour about expenditures per household for similar goals or on the basis of CVM valuation indices, it is possible to assess whether the calculated amount is reasonable or not. The method works only if the non-use value is the only balancing item under investigation in the SCBA. In case of several items being under investigation such an approach is not possible.
2. Key index approach: Not strictly implementing a CVM, but estimating the non-use value based on reference projects (whether or not CVM). In addition, it must be assessed case by case whether the reference project upon which the key index is based, can be used for the current SCBA and whether indices can be adjusted for significant environmental variables (for example, using the benefit transfer method).
3. Perform a CVM study.

The contingent valuation method involves conducting an interview survey with the public as to how much they would be willing to pay for specific environmental services. In some cases, people are asked for the amount of compensation they would be willing to accept to give up specific environmental services. There are a number of drawbacks:

- The population surveyed in CVM studies are usually large (e.g. a cross section of a nation), while one would prefer to know the preferences of the people living near the development;
- People are not always honest in their answers or have a broader interpretation of the value of nature than the non-use value;
- This methodology is difficult to apply in a pan European context; this assessment is considered onerous and not likely to provide a consistent approach throughout Europe.

The use value of nature

To determine the use value of nature it is advised to apply the European TEEB (The Economics of Ecosystems and Biosystems) approach. TEEB is based on the ecosystem services provided by nature to man. Roughly four ecosystem services are distinguished, with several sub-services:

i. Production Services - Food, raw materials, water, medicine;
ii. Regulating services - Climate and air quality, carbon fixation, protection against extreme natural disasters, water purification, prevention of erosion and maintenance of soil fertility, pollination of food crops, biological control;
iii. Cultural services - Recreation and mental and physical health; tourism, appreciation and inspiration for culture, art and design, spiritual experience and sense of place;
iv. Habitat for plants and animals and support services - This one actually considers the non-use value of nature, which is treated in the previous paragraph.

For the appraisal of the use value the following steps should be undertaken:

- Make a determination based on the nature or biodiversity present at the project location, which ecosystem services it provides and who profits from it. It is helpful here to use for information purposes the classification of eco-services on www.teebweb.org. If, for example, examining the natural resource that is impacted no food is produced, this resource service may be left out of further consideration;
- Check whether the project leads to a significant change of the ecosystem services. Then identify the top 3, 4 or 5 ecosystem services which are expected to change. Ecosystem services where no change or only a marginal change is expected due to the project may also be disregarded;
- Subsequently, estimate the effects in physical terms (ha, turnover, etc.) and in quality. The EIA can provide the necessary information or expert judgement that is required.
- Determine, as far as possible, the monetary value of the physical effects. Indices for ecosystem services are available from the Ministry of Economic Affairs and the European TEEB programme. The European TEEB programme has developed a valuation database of monetary values of ecosystem services. The database provides over 1310 values of ecosystems throughout

the world which can be used for appraisal in CBA. For example swamps and marshes in Europe are given a total economic value of €4129 /ha/year.

3.3.5 Project Appraisal in Denmark

The state-owned road network in Denmark is managed by the Danish Road Administration with no regional road administrations. For the state-owned road network, the continual road-planning process is as follows:

1. Preparatory investigations and strategic analyses;
2. Initial studies;
3. Environmental Impact Assessment;
4. Investment decision by the Danish Parliament in the form of a law.

Currently, there is an Infrastructure Fund the origin of which is a political agreement on "A Green Transport Policy" between seven political parties at national level taken in 2009.

The preparatory investigations will screen all possible investment suggestions against the long-term transport demand and suggest solution models that contribute to the National Transport Policy. The result of the screening will form the basis for the political decision process to follow. In addition to the Infrastructure Fund, special infrastructure investments can be funded by means of user funding, e.g. through a toll. Examples are the new bridge crossing Roskilde Fjord, the large international and national bridges between Denmark and Germany, between Denmark and Sweden and connecting Sjælland and Fyn as well as the Metro City Ring around Copenhagen.

The Danish Road Directorate provides a yearly report describing the status of the state-owned road network concerning traffic, congestion, accidents, etc. Generally, the way to the political decision on an individual large road investment by Parliament is prepared through a political process in which a collection of political parties sharing a common interest have come to a formal agreement to vote for the law in Parliament.

The SEA and EIA processes in Danish road planning follow the corresponding EU directives. If the competent authority decides that the project will have significant environmental effects, the proponent has to prepare an EIS. The decision is to be based having consideration for the following:

- the characteristics of the project (dimension, cumulative effects, pollution, consumption of natural resources, etc.)
- localization (current land use, characteristics of the natural resources, carrying capacity of the environment affected)
- characteristics of the environmental effects

The EIA shall describe the effects of the project on:

- humans, the flora and the fauna
- soil, water, air, climate and landscape
- property, environmental resources and the cultural heritage
- the interplay between these factors

For the economic assessment of road projects, a calculation model named Teresa is used (Transportministeriets Regnearksmodel for Samfundsøkonomisk Analyse). The Road Directorate submits proposals of road investments to the Danish Ministry

together with the results of cost—benefit analyses, EIS, suggested mitigation measures, results of public hearings, risk analyses, external quality assurance and other kinds of decision-making material. The ministry passes the proposal to Parliament which may or may not follow the proposal. In addition to the economic assessments, the EIS, etc., a range of political aspects such as regional development and prioritization of selected population groups, influence the decision of the Parliament. This is the Danish equivalent of Project Appraisal which is made at Ministry level without any formal evaluation system and therefore there are no road Project Appraisal Guidelines in Denmark.

3.3.6 Project Appraisal in Germany

The federal government of Germany is responsible for laws and basic principles of planning and construction related to federal roads, railways and inland waterways. For this objective the German Government periodically issues the Federal Transport Infrastructure Plan with lists of prioritised projects. On this basis the German Federal Parliament adopts requirement plans for federal roads and railways as a law. The core of project appraisal in transport infrastructure planning is a cost benefit analysis that is complemented by non-monetary aspects such as spatial impact assessment (SIA) (including impacts on urban development) and an environmental appraisal. Concerning the environmental aspects there are both monetary criteria (change of noise and NOx emissions, emissions of other substances (carcinogenic substances, CO/CO_2, SO_2, etc.) and non-monetary criteria (e.g. nature conservation areas, fragmentation, water protection areas, UNESCO world heritage sites, etc.). Part of the environmental appraisal includes the basis of an appropriate assessment (AA) for European sites called Habitats Directive Assessment (HDA), which resembles the screening stage that is performed to assess whether AA is required. All these environmental aspects are part of the Environmental Impact Assessment (EIA). Accordingly, a standardised project appraisal approach was developed which combines cost-benefit, multi-criteria and qualitative assessment elements.

The first part of the qualitative environmental assessment of projects is a sifting phase in which projects are selected for which the EIA and HDA are deemed necessary. This is carried out by the Federal Agency for Nature Conservation. The potential impacts of projects are scored based on the protection category of sites potentially impacted, how severely natural conservation areas would be affected by them (e.g. severance, skirting >10km distance) and the type of the project (upgrade, new build). As a result, projects are assigned one of four score classes (low to high) and ranked for each federal state. EIA consists of spatial analysis to determine the sensitivity of sites (four classes from low to very high), an assessment of degree of pressure from projects (five classes from very low to very high) and a classification of the environmental risk by overlaying both parts (five classes from very low to very high). Criteria for spatial analysis are the protected status of sites, land cover/land use type, whether sites are of national or international significance and regional planning objectives. (See Table 10 and Table 11) The project impacts are classified according to type of project (new construction or upgrade), size of project and traffic volume. The classification of projects is then finally based on the combined environmental risks and the share of areas affected by the project. The final project evaluation includes verbal descriptions of critical issues and planning instructions.

The purpose of the HDA is to evaluate potential impacts on Natura 2000 areas (European Sites), but does not replace a more detailed Habitats Directive

(compatibility) assessment of projects at later planning stages. The HDA takes a verbal argumentative form and classifies projects into three evaluation levels based on whether adverse impacts on the conservation objectives for Natura 2000 sites are probable, cannot be ruled out or can be ruled out.

Table 10 Fauna and flora/flora species and biotopes

Fauna and flora / flora species and biotopes

Criteria/ indicators	Relevance	Sensitivity against	Protection areas and planning objectives	Main sources
• Biotope types • Plant communities • Species (target species) • Population quantity, frequency, spatial distribution • Habitat networks	• Endangerment • Representative-ness • Naturalness • Biodiversity • Habitat limiting factors • Regeneration • Frequency, rareness	• Change of site conditions (e.g. water balance, climate, eutro-phication) • Changes in the composition of fauna communities • Fragmentation • Island building, reduction of habitats	• Announced or designated protection areas under international law • Protection areas under nature conservation law • Areas of nation-wide importance • Valuable areas due to official surveying and mapping • Protected biotopes of particularly protected species under nature conservation law (§ 20c and e) and /or regulations of the federal states • Priority habitats and frequency of priority species under the Habitats and the Birds directive • Forest areas designated for the protection of objects of nature history, science and culture	• Topographical maps • Special protection programmes for species and biotopes • Mapping of biotopes, official surveys and mappings • Landscape (master) plans • Forest function maps • Nature protection authorities • Forest and hunt authorities • Nature protection organisations • Own inquires

Table 11 Fauna and flora / fauna species and habitats

Fauna and flora / fauna species and habitats

Criteria/ indicators	Relevance	Sensitivity against	Protection areas and planning objectives	Main sources
• Biotope types • Species and groups of species (target species) • Population quantity, frequency • Habitat quantity spatial distribution • Areas/ corridors of dispersal, action radii, partial habitats	• Substitutability/ regeneration • Endangerment • Rareness • Representative-ness • Variety • Habitat limiting factors	• Island building, reduction of habitats • Fragmentation, barrier effects, cut off of exchange relations • Change in the formation of plant communities • Trouble effects (noise, visual irritation)	• Announced or designated protection areas under international law • Protection areas under nature conservation law • Areas of nation-wide importance • Valuable areas due to official surveying and mapping • Protected biotopes and habitats of particularly protected species under nature conservation law (§ 20c and e) and /or regulations of the federal states • Priority habitats and frequency of priority species under the Habitats and the Birds directive • Forest areas designated for the protection of objects of nature history, science and culture	• Topographical maps • Special protection programmes for species and biotopes • Mapping of biotopes, official surveys and mappings • Landscape (master) plans • Forest function maps • Nature protection authorities • Forest and hunt authorities • Nature protection organisations • Own inquires

3.3.7 Project Appraisal in the UK

The Department for Transport, UK provides guidance on appraising the impact of transport proposals on the environment through WEBTAG (Web based Transport Appraisal Guidelines). TAG Unit A3 of the guidance includes Chapter 9, which

appraises costs and benefits of a proposed road project in terms of its effect on biodiversity.

WebTAG uses an environmental capital approach where a set of environmental resources are qualitatively assessed. Environmental resources include for example landscape, historic features, biodiversity and water, which can be interlinked. The appraisal can be used at any stage of the development of projects from options stage to detailed design appraisal. Excessive detail should be avoided in the appraisal with no more than is required for a robust decision to be taken.

A five step approach is used for assessment:

Step 1: Scoping and identification of the study area;

Step 2: Identifying key environmental resources and describing their features;

Step 3: Appraise environmental capital;

Step 4: Appraise the proposal impact;

Step 5: Determine the overall assessment score.

Step 1: Scoping and identification of the study area

Scoping allows for a determination of the study area and identification of the key environmental resources in the area that may be affected. The zone of influence for environmental resources may vary from one environmental topic to another. Scoping should be agreed with the Department of Transport (DoT) before a full appraisal is undertaken. Based on the findings of Step 1 (and agreement with the DoT) the key environmental resources will be identified and steps 2 to 5 can be completed.

Steps 2 to 5 are addressed within the TAG Biodiversity Impact Worksheet (Appendix A).

Step 2: identification of Key environmental Resources

- Area: Identify all key biodiversity resources affected or potentially affected including designated and non-designated sites, protected species, and Natural England's Natural Area profiles.
- Description of Feature: A description of the biodiversity that exists and discernible trends which would lead to the degradation or loss of those features in the absence of the proposal. A key environmental resource may have more than one feature, in cases when different features lead to different assessment scores they should be entered on different lines on the Worksheet and appraised separately. When this is not the case, it is sufficient to group and describe the features on a single line.

It is noted that it is only necessary to appraise key environmental resources potentially affected by the road development.

Step 3: Appraise Environmental Capital

This involves appraising the environmental capital for each feature against the list of indicators shown below:

- Scale: International, national, regional or local;
- Importance: Descriptive assessment of the important values (See Table 12) (e.g. High importance: something that is nationally rare);

- Trend: In relation to a target level. Abundance of the habitat or feature relative to its target level (where appropriate) and its trend where known.
- Substitution Possibilities: Take into account the fact that the loss of an irreplaceable natural feature is often more significant than one that is replaceable.

Table 12 UK TAG Unit A3 Chapter 9 (their Table 9)

Table 9 Guidance on Describing the Biodiversity and Earth Heritage Value of Features

Value	Criteria	Examples
Very high	High importance and rarity, international scale and limited potential for substitution	Internationally designated sites
High	High importance and rarity, national scale, or regional scale with limited potential for substitution	Nationally designated sites Regionally important sites with limited potential for substitution
Medium	High or medium importance and rarity, local or regional scale, and limited potential for substitution	Regionally important sites with potential for substitution Locally designated sites
Low	Low or medium importance and rarity, local scale	Undesignated sites of some local biodiversity and earth heritage interest
Negligible	Very low importance and rarity, local scale	Other sites with little or no local biodiversity and earth heritage interest

Table 13 provides a provisional categorisation based on statutory or local designations, or Biodiversity Action Plan objectives. This can be used as a broad guide for determining biodiversity and earth heritage value, but it is only a starting point. The four indicators described above should be considered in making the overall judgement.

Table 13 UK TAG Unit A3 Chapter 9 (their Table 10)

Table 10 Guide to Biodiversity and Earth Heritage Value
International designations – very high value
Ramsar Sites (Convention on Wetlands of International Importance Especially Waterfowl Habitat 1971)
World Heritage Sites (Convention for the Protection of World Cultural & Natural Heritage, 1972)
Biosphere Reserves (UNESCO Man & The Biosphere Programme)
European Sites (EC Habitats Directive 1992 & UK Habitats Regulations 1994):
Special Areas of Conservation (SACs)
Special Protection Areas (SPAs)
Sites of Community Importance (SCIs)
Possible / Candidate SACs and potential SPAs
Undesignated sites hosting habitats/species of (European) Community interest (annexes 1 & 2, Habitats Directive, 1992)
Undesignated sites hosting significant species populations under the Bonn Convention (Convention on the Conservation of Migratory Species of Wild Animals, 1979)
Undesignated sites hosting significant populations under the Berne Convention (Convention on the Conservation of European Wildlife and Natural Habitats, 1979)
Biogenetic Reserves under the Council of Europe
European Diploma Sites under the Council of Europe
National designations – high value
Sites of Special Scientific Interest (SSSIs; Wildlife & Countryside Act 1981 as amended and National parks and Access to the Countryside Act 1949)
Sites with Limestone Pavement Orders (Wildlife & Countryside Act 1981)
Nature Conservation Review Sites (NCR)
Geological Conservation Review (GCR) sites
Marine Nature Reserves (MNRs; Wildlife & Countryside Act 1981)
Areas of Special Protection for Birds (ASPs; Wildlife & Countryside Act 1981)
Undesignated sites hosting Red Data Book species
Undesignated sites hosting species not covered by the Berne Convention but in schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981
Regionally important and locally designated sites – medium value
Local Nature Reserves (LNRs; National Parks and Access to the Countryside Act 1949)
Sites of Importance to Nature Conservation (SINCs) / County Wildlife Sites (CWSs) / other local designations
Regionally Important Geological Sites (RIGs)
Important 'inventory' sites (e.g. ancient semi-natural woodland, and grassland, inventories)
Other undesignated sites (not described above) with Biodiversity Action Plan (BAP) priority habitats/species
Other natural / semi-natural sites of significant biodiversity importance, not referred to above (e.g. sites relevant to local Biodiversity Action Plan / Natural Area objectives)
Other sites with local conservation interest – low value
Sites not in the above categories, but with some biodiversity or earth heritage interest.

Step 4: Appraise the Proposal Impact

The magnitude of the impact is based on the findings of Steps 2 and 3. The criteria for determining the magnitude of the impact can be seen in Table 14. It must also be noted whether the impact is direct or indirect; individual or cumulative; temporary or permanent; harmful or beneficial.

Table 14 UK TAG Unit A3 Chapter 9 (their Table 11)

Table 11 Criteria for Determining the Magnitude of the Impact	
Magnitude	**Criteria**
Major negative	The proposal (either on its own or with other proposals) may adversely affect the integrity of the key environmental resource, in terms of the coherence of its ecological structure and function, across its whole area, that enables it to sustain the habitat, complex of habitats and / or the population levels of species of interest.
Intermediate negative	The key environmental resource's integrity will not be adversely affected, but the effect on the resource is likely to be significant in terms of its ecological objectives. If, in the light of full information, it cannot be clearly demonstrated that the proposal will not have an adverse effect on integrity, then the impact should be assessed as major negative.
Minor negative	Neither of the above apply, but some minor negative impact is evident. (In the case of Natura 2000 sites a further appropriate assessment may be necessary if detailed plans are not yet available).
Neutral	No observable impact in either direction.
Positive	Impacts which provide a net gain for wildlife overall.

Mitigation, if available, should also be included in the appraisal.

Step 5: Overall Assessment Score

The overall assessment score is estimated using Table 15 and can be written as:

- Biodiversity Value x Magnitude of Impact

It must be noted that where more than one key biodiversity resource is involved, an appraisal category is needed for each and is summarised on the Appraisal Summary Table. Where a project affects more than one key biodiversity resource, determining the overall summary score is more complex since different scores for each key resource need to be weighted and combined in an overall summary score.

Table 15 UK TAG Unit A3 Chapter 9 (their Table 12)

Table 12 Estimating the Overall Assessment Score					
Magnitude of impact	**Biodiversity and earth heritage value**				
	Very high	**High**	**Medium**	**Lower**	**Negligible**
Major negative	Very Large adverse	Very Large adverse	Moderate adverse	Slight adverse	Neutral
Intermediate negative	Large adverse	Large adverse	Moderate adverse	Slight adverse	Neutral
Minor negative	Slight adverse	Slight adverse	Slight adverse	Slight adverse	Neutral
Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Positive	Large beneficial	Large beneficial	Moderate beneficial	Slight beneficial	Neutral

Schemes in the 'very large adverse' category are likely to be unacceptable on nature conservation grounds alone (even with compensation proposals). There should be a strong presumption against schemes in the 'large adverse' category, with more than 1:1 compensation (net gain within the Natural Area) for the very occasional cases where development is allowed as a last resort. Schemes in the 'moderate adverse' category should include at least 1:1 compensation (no net loss within the Natural Area) if the development is allowed.

Positive impacts should be considered to be of lower value if the gains are clearly evident but not significant in terms of the conservation objectives of the Natural Area. Positive impacts should be classed as medium value if they deliver significant gains to the Biodiversity Action Plan objectives in the Natural Area, and as major value if they deliver positive gains of national or international importance.

The Biodiversity Appraisal Worksheet is included in Appendix A and can be found at the following link: https://www.gov.uk/government/publications/webtag-environmental-impacts-worksheets.

3.3.8 Project Appraisal in Ireland

As part of the project appraisal process in Ireland the NRA have developed a Project Appraisal Balance Sheet (PABS). The PABS reports on all of the impacts of the project under the Government's five criteria one of which has Environment and Ecology as a sub criterion. It contains a mixture of quantitative indicators and qualitative statements and provides a concise summary of all of the aspects and impacts of the project. The aim of the PABS with regard to biodiversity is to highlight the number of sites of ecological value affected by the road and to determine the potential for significant positive or negative impact on these sites.

There are three separate units of the Project Appraisal Guidelines that provide guidance for appraising the ecological impact of a roads project, depending on the

size of the project. These units are as follows and are described in more detail in the following sections:

- Unit 7.0 – Project Appraisal Balance Sheet (Motorway & National Primary Road Projects
- Unit 12.0 – Low Volume National Secondary Roads Projects
- Unit 14.0 – Non-Major Schemes

Project Appraisal Guidelines: Unit 7.0

Unit 7.0 of the Project Appraisal Guidelines deals with the Project Appraisal Balance Sheet (PABS) for motorway and national primary road projects. PABS summarises the expected impact of the proposed investment and provides a mechanism for prioritising schemes for investment.

The balance sheet provides for a qualitative and quantitative evaluation of criteria and elements. An automated spreadsheet is provided by the Irish National Roads Authority (NRA) that has a number of questions which quantify the impact of the road on each element. The PABS should be completed throughout development of the scheme from route selection, design stage, statutory procedures, construction documents and at tender award.

The PABS is broken into 4 sections:

Part A: Brief project description, funding, project costs and management information.
Part B: Environmental Impact to provide a rating for each environmental category.
Part C: Assessment of Safety, Economy, Accessibility and Integration.
Part D: Summary Sheet.

Part B of the PABS contains different sections for all the relevant categories, including biodiversity. The aim of this section of the balance sheet is to quickly highlight the number or sites of ecological value which may be affected. The full description of all of the environmental information presented in Part B is provided below, however the table requires just two biodiversity questions to be answered for each project: The number of significant negative impacts and the number of significant positive impacts on sites of ecological importance.

***"Part B:** This section deals only with the environmental impacts of the project. The assessment is broken down into 12 categories, reflecting the NRA Environmental Assessment and Construction Guidelines (NRA EACG). The environmental assessment for the project should be used to assist in quantifying the required environmental impacts. A summary rating of the scale of impact on each of the environment elements should be proposed by the Appraisal Team (AT)/environment expert. This rating needs to be supported by the AT in the Business Case and be closely aligned to the information used to populate the spreadsheet. At the end of the spreadsheet, a summary ranking for the Environment section is automatically generated based on the individual scales presented for each element. The AT is invited to add additional comments on the appraisal, these comments as well as the ranking are then automatically carried through to the PABS in Part D;"*

The 12 environmental categories along with all of the other criteria and elements considered in the Project Appraisal Balance Sheet (PABS) are provided in Table 16.

Table 16 Criteria and elements for appraisal of road projects (Ireland)

Environment	Air Quality and Climate Noise and Vibration Landscape and Visual (including light) Biodiversity – Flora and Fauna Waste Soils and Geology Hydrology Hydrogeology Architectural Heritage Archaeological and Cultural Heritage Non-agricultural properties Agriculture
Safety	Accident reduction Security
Economy	Efficiency and effectiveness Wider economic impacts Funding impacts
Accessibility	Deprived geographical areas Vulnerable groups
Integration	Transport integration Land use integration Geographical integration Other Government policy integration

The sites which experience impacts are broken down into sites of different geographical scale according to the NRA Guidelines for Assessment of Ecological Impact on National Road Schemes (2009), as summarised in Table 17.

Table 17 Geographical Scales for Valuation of sites (Ireland)

International Importance e.g. Natura 2000 sites, Ramsar, world heritage, biosphere reserves, and internationally significant populations of species protected under the Berne and Bonn conventions, designated salmonid waters.
National Importance e.g. Natural Heritage Area, statutory nature reserves, national parks, populations at a national level of species protected under the wildlife act and relevant red data lists.
County Importance e.g. Area of special amenity, area of tree preservation order, development plan sites, population of protected species/habitats of county level importance.
Local importance (higher value) e.g. Locally important populations of protected species, Semi natural habitats with high biodiversity in a local context, important links for ecological corridors of higher ecological value.
Local importance (lower value) e.g. Small areas of semi natural habitats that are of some local importance for wildlife, sites or features containing non-native species that are of some importance in maintaining habitat links.

A quantitative statement is provided from Highly Negative to Highly Positive as seen below:

1. Major or highly negative;
2. Moderately negative;

3. Minor or slight negative;
4. Not significant or neutral;
5. Minor or slight positive;
6. Moderately positive;
7. Major or highly positive.

A qualitative summary is also provided in order to demonstrate justification of the decision and provide any additional information considered necessary.

One of the objectives of a national road project in terms of protecting the biodiversity of the receiving environment is to avoid impacts on European (Natura 2000) Sites.
In the PABS as set out in accordance with the "*NRA Guidelines for Assessment of Ecological Impacts of National Road Schemes" (Revision 2, 1st June 2009) an adverse effect on the integrity of a European site will be expressed as a significant impact on an ecological resource of international importance.... In such a case the scheme project can only proceed where, inter alia, there is an "absence of alternative solutions" and "imperative reasons of overriding public interest" exist. The presence of a significant impact on an ecological resource of international importance will, therefore, operate as a warning flag*" (NRA, Unit 7.0 Project Appraisal Balance Sheet) in terms of the selection of that route option or scheme.

A sample Project Appraisal Balance Sheet is included in Appendix B.

Project Appraisal Guidelines: Unit 12

Unit 12 of the PAGS is used for the assessment of National Secondary Road schemes and regional road schemes that are over €5m in value.

This unit does not assign a monetary value but provides a table for scoring an impact based on a risk approach and considers the importance of the site based on the degree of legislative protection (EU, National, etc), the proportion of the site likely to be impacted and whether impacts are permanent or temporary. It also considers previous experience of similar designated areas. Unit 12 identifies the requirement for expert judgement by a suitably qualified ecologist. The appraisal score should also reflect the outcome of the AA process. This appraisal should make clear if mitigation is considered and the associated costs.

It is suggested that a rating of severe negative impact should in most cases result in the option being removed from future consideration.

The appraisal scoring is outlined in Table 18(8 point score):

Table 18 Risk Matrix for Biodiversity Impacts (Terrestrial Sites, Ireland)

Score/ Impact	Internationally important	Nationally important	High Value Locally Important	Moderate Value Locally Important	Low Value Locally Important
Severe negative	Any permanent impact	Permanent impact on a large part of a site			
Major Negative	Temporary impact on a large part of a site	Permanent impact on a small part of a site	Permanent impacts on a large part of a site		
Moderate negative	Temporary impacts on a small part of a site	Temporary impacts on a large part of a site	Permanent impact on a small part of a site	Permanent impacts on a large part of a site	
Minor negative		Temporary impacts on a small part of a site	Temporary impacts	Permanent impact on a small part of a site	Permanent impacts on a large part of a site
Neutral	No impacts	No impacts	No impacts	No impact or temporary impact	Temporary impacts on a small part of a site
Minor positive				Permanent impact on a small part of a site	Permanent impacts on a large part of a site
Moderate positive			Permanent impact on a small part of a site	Permanent impacts on a large part of a site	
Major positive	Permanent beneficial impacts	Permanent beneficial impacts	Permanent impacts on a large part of a site		

(Source: Project Appraisal Guidelines, Unit 12.0 National Secondary Roads Projects, March 2011. Ireland)

Project Appraisal Guidelines: Unit 14 Non-Major Schemes

Unit 14 addresses PABS for non-major road schemes (costing under €5m). As for Unit 12, Unit 14 also provides a simplified summary of the merits of the project based on Multi Criteria Analysis, with a short qualitative statement describing each impact and a quantitative indicator where is it considered possible. Each impact is scored on the 1 – 7 scale, as discussed above in Unit 7.0 of the guidelines.

Unit 14 should only be used for assessment when considering where there are no designated sites within a 1km radius of the scheme and the impacts can be rated as neutral. If there are designated sites within a radius of 1k of the scheme then the procedures in Unit 12 National secondary roads should be followed.

3.3.9 Project Appraisal in Hungary

National Roads Authority system of Hungary

The development, design and building of Hungarian roads are coordinated by several state companies.

Design and maintenance of roads in Hungary

In Hungary the design and the maintenance of roads is separated between two state companies.

The National Infrastructure Developing Ltd. - NID Ltd. (Nemzeti Infrastuktúra Fejlesztő Zrt - NIF Zrt.) has been responsible for the design of highways, public roads and every railway line since 2007. All EU granted development of infrastructure (both reconstruction and new building) is also managed by the NID Ltd. This company controls the project documentations, not only the construction plans, but also the environmental impact assessments (EIA).

The state roads - not only highways but also every more minor public road - are managed and maintained by the Hungarian Public Road Non-profit Ltd. (Magyar Közút Nonprofit Zrt). The state roads include state-owned national roads and municipality-owned local roads. The company has an independent directorate in each county of Hungary. This company is also in charge of tolls along the entire Hungarian public road, motorway and expressway network, comprising over 8,000 km of roads.

Laws and regulation of planning, building and maintaining of roads in Hungary

The Hungarian legal framework includes several European Union regulations, which is identical or almost identical to the original European Union legislation. The investigation of environmental impacts in Hungary is regulated by the 2011/92/EU which will be modified by 2014/52/EU () Directive when implemented. The investigation of significant negative impacts of biodiversity and their avoidance also originates from general biological diversity-related regulations of the United Nations as well as the European Union, including the halt of biodiversity loss and ecosystem service degradation.

In Hungary there is no specific project appraisal guidelines for linear infrastructure investments, the Hungarian experts use the EU frameworks and directives. The Hungarian government has modified the regulation of preparation of building linear infrastructure several times over the last five years. The aim of the changes is that they create a special category of investments, the so called emphasized governmental investments which are exempted from a range of investigations.

The Hungarian road project appraisal regulations are based again on several national and international laws, the 1995/LVII law on water management, the 1996/LIII law on nature conservation, the 2014/52/EU guideline modifying the 2011/92/EU guideline on the investigation of the effects of community and private projects on the environment, the 147/2010 (IV. 29) Governmental Decree determining the general rules on the use and protection of waters.

According to the 324/2005 Governmental Decree, the impacts of the construction or upgrading of linear infrastructure on the environment, namely the soil, air, water, wildlife and vegetation, built environments including historic buildings, areas and archaeological sites, and the structure and functioning of environmental elements,

specifically landscape and settlement structure, climate, and ecosystems has to be assessed (Table 19). Besides, changes caused by these impacts on the health status and life quality of the local population, its social structure and economic status together with potential land use should be evaluated.
The national law determines four categories of Hungarian protected areas: national park, protected area, nature reserve area, natural monument. Besides the international laws and conventions define three categories of protected areas in Hungary:

- **international importance**: Natura 2000 sites, Ramsar, world heritage, biosphere reserves, and internationally significant populations of species protected under the Berne and Bonn conventions,
- **national importance**: statutory nature reserves, national parks, protected areas, populations at a national level of species protected under the wildlife act and relevant red data lists and locality of ex-lege protected nature and culture areas (springs, marsh, cairn, saline lake, motte, swallet)
- **local importance** e.g. Area of special amenity, area of the tree or botanical garden preservation order, development plan sites, population of protected species/habitats of county level importance and several types of natural monument (e.g. caves).

Table 19 Investigated environmental elements in project appraisal in Hungary

Investigated environmental element	Soil	Air	Water	Wildlife	Built environment	Landscape	Settlement	Climate	Ecosystems
Structure and quality of environmental elements	X	X	X	X	X				
Functioning of environmental elements						X	X	X	X

The general environmental content of the project appraisal documentation can be found in Appendix 6 of the 324/2005 Governmental Decree. Those linear infrastructure sections that can be used independently from neighbouring stretches of, for example, the same road, can undergo an independent appraisal process, in case they can be built further without serious environmental or nature conservation-related conflicts along the adjacent sections of the route on the basis of the documentation presented.
If the planned road prevents the realisation of the good environmental status determined in the National Environmental Programme or any environmental or nature conservation duties of Hungary according to international treaties, the project proposal has to be rejected.

Hungarian evaluation criteria
In Hungary route selection for roads is made on the basis of the environmental impact assessment and the integrated environmental clearance Act (314/2005 (XII. 25.)). It

lists several criteria to be taken into consideration. Impacts have to be analysed separately but an integrated analysis is also necessary to carry out. Impacts to be taken into consideration are environmental elements (soil, air, water, flora and fauna, man-made environments, including the impacts on monuments, historic sites and archaeological heritage must be given in detail). In projects which affect NATURA 2000 sites (275/2004 government regulation) the impact on the area, habitat and wildlife need to be examined.
It is necessary to summarise the impacts of the different processes but no scale is applied for summing up the different impacts as e.g. in Ireland.

When analysing individual impacts the following aspects should be taken into consideration:

- the strength, durability, reversibility, spatial extent and temporal distribution of each impact and their favourable and unfavourable nature,
- can these impacts be additive,
- the protection status of the different environmental component or systems, changes in the environment, including their nature conservation and landscape protection functions,
- changes in the characteristics of settlements along the route (structure and function)
- changes in landscape, land use, landscape structure,
- rarity and replaceability of threatened, probably damaged or definitely destroyed natural and man-made values,
- how can threatened or probably destroyed natural resources be replaced,
- chances for environment damage avoidance and mitigation

In the case of NATURA 2000 sites the tasks and criteria of impact assessment of building investments is determined in the 92/43/EEC policy. According to this, the cumulative impacts have to be estimated. Steps of the estimation:

- determination of all projects and plans, the impacts of which can be summarised,
- determination of damaging factors,
- determination of spatial limits of the impact assessment,
- determination of transmitting medium (air, water)
- prediction,
- impact assessment

In case of investments falling within the scope of government regulations (road investments), the appropriate sectorial administrative bodies individually analyse the different areas they are responsible for (waste, water, air, noise, natural environment, land). An important aspect here is that if mitigation is needed, the application of BAT (Best Available Technology) is requested to get the most favourable result. Authorities investigate economical issues only to a certain extent, for example in waste management (transport routes, distance of landfills, re-use of waste). Hungarian EIA legislation is very strict in terms of what to investigate as well as what to include in the documentation to be submitted. Therefore, if authorities would assess projects with such a wide focus as in Ireland, they would violate laws, which would result either in new procedures ordered by the higher authority or they would even face lawsuits against their decision.

As such, within project appraisal a description and evaluation of the individual projects should clearly specify the direct and indirect effects of the individual projects on the following

a) human population and health,
b) biological diversity with special emphasis on habitats and species listed in the 92/43/EEC and the 2009/147/EU guidelines,
c) land, soil, water, air and climate,
d) economic values, cultural heritage and landscape,
e) interactions among elements listed under a)–d).

The appraisal should also include estimates for large accidents and/or catastrophic events.

Within NATURA 2000 sites the appraisal should also focus on NATURA 2000 habitats and species. However, no exact values are listed in the Hungarian regulations; it depends on the expert opinion of the specialists making the appraisal. In practise, it resulted in a three level scale. The project may not have an impact on the given object; it may have a moderate (positive or negative) or a significant (positive or negative) impact.
Task of government authorities

Step 1 - Planning process
The designer company must have references in the field of environmental impact assessment and the designer team must include a certificated expert in this field. The National Infrastructure Developing Ltd. is responsible also for giving advice during the planning process and expertise of the submitted designs.

Step 2 - Permission of the Environmental Authority
The finished Environmental Impact Study and Natura2000 Impact Estimation have to be submitted for permission to the Environmental Authority. If the Authority finds that the route does not have negative impacts, or the impact mitigation measures are effective, it gives the environmental permission for the plan, with the necessary conditions and prescriptions.

Step 3 - Building permission and construction plan
These prescriptions and mitigation measures have to be taken into consideration later in the building permission plans. If the project gets also the building permission, then the construction plans have to be made.

Step 4 - Operation
At the start of the operation the Environmental Authority can control, whether its conditions and prescriptions are met. Prescriptions of the environmental permission can concern also for the operation a form of monitoring. However, this is already the responsibility of the operator Hungarian Public Road Nonprofit Ltd.

It is important to note, that there is different permission process for EU and national funded projects. In case of EU funded projects a more detailed investigation has to be carried out and the approval of the National Park concerned is always necessary.

3.4 Discussion on the Approaches to Project Appraisal

As can be seen from the analysis in the preceding sections of this report, some form of Project Appraisal is used across most Member States in the study. 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 Netherlands, Germany, Sweden, the United Kingdom and Ireland all consider biodiversity as part of their Project Appraisal although not all in the same manner. It is clear that in mainland Europe there are a number of different methods of assessment including Spatial Impact Assessment and Societal CBA, IA, BVA, CEA and Cost Benefit Assessment. However the most clearly defined approach for the consideration of biodiversity in transport project appraisal is in the UK and Ireland which follow clearly defined guidelines.

When considering the use of Project Appraisal for road projects and biodiversity it can be seen that there is a broad and varied system of appraisal ranging from no biodiversity considerations to detailed appraisal. Overall the consideration of roads and biodiversity for project appraisal must ensure that the risk to the project is clearly identified and avoided, reduced or minimised with consideration of legal obligations for the protection of biodiversity and the potential economic cost incurred as a result.

In general the appraisal process for biodiversity should be continuous with consideration of impacts from inception (ideas stage) to construction phase. Appraisal should be possible at any stage in the development of road plans and projects, all of which should have a proportionate level of detail adopted for that stage. In all stages it is important to keep in mind that the purpose of assessment is for appraisal and to keep it as simple as possible. Only the amount of detail required to make a decision for appraisal purposes is necessary; separate environmental assessments and Appropriate Assessments are required at planning stage.

However, the level of detail which is available for project appraisal is dependent on what phase of development the road project is at. As development progress the role of EIA and HDA (Appropriate Assessment) in the process will become more important as tools to inform the appraisal process.

In appraising the impact on the environment it is recommend that the assessment is carried out by appropriately qualified environmental practitioners that allows for expert opinion in the field of biodiversity.

3.4.1 Environmental Impact Assessment and Environmental Appraisal

There is a distinct difference between the function of Environmental Impact Assessment and the Project Appraisal for Environment. EIA is a requirement of the EIA Directive (as amended) for all major road projects and for many non major road projects with likely significant effects on the environment. Environmental impact appraisal is the process of developing environmental impact assessment information for inclusion in a transport appraisal. This appraisal uses baseline data and EIA outputs where available. The Appraisal is not an alternative to or a replacement for EIA but complements that work and is generally consistent with the EIA. The scope of assessment is dependent on the stage reached in the transport appraisal process. At options stage, the EIA information is limited and likely to be restricted to scoping

which examines the risks associated with options. This type of information should be sufficient to allow a decision to be made for the appraisal of the project; however, as the project progresses through the phases, the appraisal should have more detailed impact assessment available.

3.4.2 Environmental Capital

The landscape, biodiversity and heritage impacts are generally assessed in a qualitative or descriptive way, sometimes with the use of a scoring scale. The approach across Europe is that expert judgement based on a case by case assessment is the most credible way to handle these impacts. However, recent considerations examine how an ecosystem services approach, based on the services provided by the natural environment and how they might be affected by transport schemes, may be considered. This can be seen in the Netherlands where there is an attempt to put a value on the ecosystem service. Ecosystem Services focuses on the essential services provided by the environment that underpin people's economic, social and personal well-being.

3.4.3 Recommended Approaches

The objective of this report is that following the review of approaches to the application of biodiversity appraisal, recommendations are made as to the most suitable process or elements of a process that can be followed within any project appraisal system throughout Europe. In considering the most suitable methodology, the following are repeated as the core principles of an effective Project appraisal system:

- The appraisal process for biodiversity should be continuous from inception (ideas stage) to construction phase.
- The appraisal should have a proportionate level of detail adopted for that stage.
- The appraisal should be simple and mindful of its purpose i.e. in deciding the priority or continuation of the scheme.
- It is considered that a simple worksheet which identifies the primary baseline and constraints and assesses their impacts with a scoring system is the most user friendly appraisal tool.

Having the above key principles in mind the UK Guidelines for appraisal of biodiversity impacts as described in Section 3.3.7 is considered the most suitable for application as a standard Biodiversity appraisal tool across all Member States. It is a comprehensive system that can simply be applied and included in any project appraisal for road schemes. It requires a clearly set out five step approach for assessment:

Step 1: Scoping and identification of the study area;

Step 2: Identifying key environmental resources and describing their features;

Step 3: Appraise environmental capital;

Step 4: Appraise the proposal impact;

Step 5: Determine the overall assessment score.

It also provides a clear and relatively straightforward Biodiversity Appraisal Spreadsheet as included in Appendix A. 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: https://www.gov.uk/government/publications/webtag-tag-unit-a3-environmental-impact-appraisal-november-2014.

3.5 Conclusion

Most European countries use some form of Project Appraisal process 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. However 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 the approaches presented earlier in this report it is the view of the authors that the Project Appraisal framework provided in the UK is suitable for adoption by other Member States for the following reasons:

- Provides clear and concise guidance that can be followed and adopted;
- The appraisal process 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;
- 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;
- The provision of a biodiversity impact appraisal table should result in a more standardised and transparent system of Project appraisal across European Member States.

4 Report on Consultation with Road Owners

4.1 Introduction

As part of the overall management of the Harmony project the consortium is carrying out consultations with the various National Roads Authorities in the reference countries. In addition, two 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.

4.2 Initial Consultation

The first consultation with the Programme Executive Board occurred on the 3rd June 2014 in Vienna. During the meeting various issues relating to the Harmony project were discussed and the PEB provided advice to the Harmony consortium. A summary of the main decisions taken at the meeting can be found below:

1. PEB emphasised that the ability to immediately implement the research results is very important. This research is complementary to H2020 and is intended to be more applied.
2. The PEB felt that a review of example projects that are 15 years old is inappropriate as a lot has changed in recent years. They suggested that 7 years should be the upper limit. It was suggested that projects should be found elsewhere if not enough recent examples can be found.
3. The German delegate suggested that Germany should be included in the Environmental Impact Assessment (EIA) studies. Lars Nilsson suggested that this might not be much work (and might not require additional funding). Albert Daly said that the formal procedure is that the PEB should write to the Harmony consortium informing us about what they want and then the consortium should formally reply indicating if additional funds are required.
4. It was agreed with the PEB that the Mediterranean country should be Greece.
5. The project officer (Vincent O'Malley) should be invited to at least part of future management meetings of the consortia. It was also decided that the consortium should make a presentation to him on our progress and he will report progress to the PEB.
6. The PEB have a template that should be used, where possible, for all deliverables.
7. The final report may need to be translated to French but CEDR have a budget for this.
8. Regarding overlaps between Harmony and SAFEROADS, the consortia are 'urged but not obliged' to collaborate. Joint report(s) from the two groups would be very welcome.

4.3 Mid Stage Consultation

The second consultation with the PEB occurred on the 15th September 2014 in Malmö. For this consultation, the project officer, Vincent O'Malley, attended the 6 monthly consortium meeting to provide input and advice for the project.

1. It was proposed that the EIAs should be taken from the period between 2005 and 2012 as there have not been sufficient projects in recent years due to the recession. Vincent O'Malley brought this proposal to the PEB and it was subsequently approved.
2. The consortium enquired as to whether regional roads can be included in the study. Vincent O'Malley suggested that ideally it should be a national road but regional roads are acceptable if there is a particular reason for including them.
3. It was enquired as to whether it was acceptable to have 12 Hungarian EIAs and 8 Austrian EIAs. Vincent O'Malley agreed this was acceptable.
4. Vincent O'Malley suggested that Pat Maher should be contacted in the Irish NRA network operations to answer the maintenance questions.

4.4 Future Consultation

Going forward, there will be one more official consultation with the PEB to ensure the project is addressing the research issues appropriately.

5 Conclusions

Section 2 of this report examines existing and forthcoming European legislation, as well as guidance for road schemes, and outlines the steps to be taken to achieve the greatest level of success and effectiveness in the compilation of Environmental Impact Assessments and Appropriate Assessments. In addition, the section uses the legislation and approaches of individual countries as a means to providing guidance on best practice in the assessment of environmental impact. The main pieces of relevant legislation are the EIA directive; the Habitats directive; and the Birds directive all of which are amended with each expansion of the Union.

The first part of Section 2 deals with the EIA directive and the Environmental Impact Assessments that arise as a consequence of the legislation. The directive was amended in 2014 and EU member states must transpose the amendment into national legislation by May 2017. The EIA Amendment Directive 2014 impacts the various stages of an EIA. It provides a list of criteria for screening and makes the production of a screening report for projects with potential significant environmental effects mandatory. A more rigorous screening methodology allows the amendment to address the issue of cumulative effects being ignored. The amendment demands that EIA reports should be written by “competent experts”. The examination of alternatives becomes mandatory under the Amendment with the alternatives including the “do nothing” scenario. It also takes into account the importance of public consultation by introducing minimum consultation periods of 30 days. Finally, where projects entail significant adverse effects on the environment, the EIA Amendment Directive obliges developers to monitor the effects using procedures determined by the Member State.

A stage of the Environmental Impact Assessment not directly impacted by the Amendment is scoping which is not mandatory in all countries. Scoping is carried out throughout Europe as best practice as it can help avoid delays and provides an opportunity at an early stage for input of opinion. Scoping is generally carried out at an early stage in the process, following the screening stage. Another factor to be taken into consideration at an early stage is seasonal constraints as specialist flora surveys may only be relevant at certain times of the year. The chapters dealing with flora and fauna are often technical but best practice is that the EIS be more understandable for the public. It is also important that the public understands all of the alternative options. Alternatives should be the first point of mitigation of adverse effects. It is preferred that a combination of both prescriptive and performance specifications are used when identifying mitigation. A final piece of good practice to be implemented in the EIA is monitoring which has already been adopted by some member states.

The second part of Section 2 deals with the Habitats and Birds directives and the steps to be taken to enforce the directives. As well as being amended due to the accession of new Member States, the directives have been amended to include marine habitats. In contrast to the impact assessments carried out under the EIA directive, if the plan or project comes under Article 6(3) of the Habitats directive the assessment carried out is combined with a legally binding decision making process. Although the result to be achieved is binding, the Competent Authority in the Member States generally use the judgement of experts aided with information from quantitative models and direct measurements (Ni Choine et al. 2015) rather than a standardised methodology to make a conclusion It is important that the decision to permit a plan or project should be transparent and make use of the best available

scientific knowledge. Transparency is also important when screening is being carried out and it a justification of the decision made must be recorded. It is also important in the screening that methods used in the construction are made clear. The screening of a plan or project is the most important stage of the procedure. It is important that indirect adverse effects and direct adverse effects in combination with other plans or projects are accounted for. When gathering data on the site in question, best practice is to use a method that can be repeated during construction as the competent authority may require monitoring. It is good practice to consult with relevant nature conservation agencies and the public at an early stage as they may have information about the natural values of the relevant area. Any data gathered should be interpreted by experts and should be no older than three years.

Data gathered at the site is used to determine the significance of the effects by examining thresholds; although none of the countries have scientifically agreed thresholds. If adverse effects cannot be excluded then good practice is to consider changes in the project or plan to prevent these effects. If this is not possible, then the next step to consider is mitigation. Requirements for mitigation measures can be performance or prescriptive based but best practice is that the effects of the mitigation be monitored. If significant effects cannot be excluded after mitigation, and the project or plan has no alternative while an imperative reasons of overriding public interest exists, then compensation may be needed. It is crucial that the difference between mitigation and compensation be understood.

The report's third section investigates the approach to Project Appraisal for National Road projects for countries across Europe. Nine countries are considered in all with the aim of identifying whether due consideration is given to the balance between biodiversity protection requirements and other factors such as economy, safety and society. Of the nine countries examined the United Kingdom, Sweden, the Netherlands, Ireland, and Germany consider biodiversity as part of their Project Appraisal.

Of the methods used, Cost Benefit Analysis is the most common form of appraisal used throughout Europe. An issue with this approach is that it can be difficult to monetise the impacts that road projects have on nature and biodiversity. It is important that the appraisal of the impact on biodiversity is carried out by appropriately qualified experts. Expert judgement should be used in the fields of landscape and heritage also. The level of detail given in the appraisal is dependent on the stage at which it is carried out.

The Project Appraisal framework provided in both the United Kingdom and Ireland is identified as suitable for adoption by other member states. The reasons for this recommendation include the clear, concise guidance as well as the simplicity of the process. Also important were the provision of a biodiversity impact appraisal table/balance sheet and the introduction of a worksheet. In adopting such processes, Project Appraisal across Europe would become more standardised and transparent.

The fourth section of the report gives an account of the regular communication with the Programme Executive Board (PEB) of CEDR. This was carried out through meetings with the PEB and as well as the inclusion of the project officer at consortia management meetings. This ensures that the project remains focused and achieves the desired results of the funding organisation. To make sure the project is addressing the research issues appropriately there will be one more official consultation with the PEB.

6 Acknowledgement

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Appendix A Biodiversity Appraisal Worksheet. UK, Transport Analysis Guidance.

Department for Transport

Biodiversity Impacts Worksheet

TAG Reference

TAG Unit A3 - Environmental Impacts

Version Control

Date	Description
Jan-14	Definitive release
17/10/2013	Release of restructured guidance

Contact

Transport Appraisal and Strategic Modelling (TASM) Division
Department for Transport
Zone 2/25 Great Minster House
33 Horseferry Road
London
SW1P 4DR
tasm@dft.gsi.gov.uk
Tel 020 7944 6176
Fax 020 7944 2198

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

Appendix B Irish NRA Project Appraisal Balance Sheet

Project Appraisal Balance Sheet

Part A: Project Context

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Date	**12/12/2013**
Version No.	**0**

Project Title	
PRS Reference Number	
Project Phase	**Phase 2: Route Selection**
National Roads Office	
NRA Project Manager	
Project Description	
Scheme Cost €m (TSB)	**€0.00**
What Are The Likely Sources of Non-Exchequer Funding	
NRA Growth Scenario	**NRA Medium Growth**
Appraisal Team Author	
Design Team Reviewer	
NRA Engineering Inspector	
External Auditor	
Modelling Base Year	
Scheme Opening Year	
Reference Number of Nearest NRA Traffic Monitoring Unit(s)	

Note - This PABS should be completed with reference to the latest version of NRA PAG Unit 7.0. Users should always check that the correct version is followed prior to undertaking the PABS.

Project Appraisal Balance Sheet

Part B: Environment

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Air Quality & Climate

Climate - Carbon Dioxide (CO_2)	Quantitative Statement Parameter
Tonnes of CO_2 produced in the Do Minimum Scenario?	0
Tonnes of CO_2 produced in the Do Something Scenario?	0
Ratio of CO_2 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_2)	◉	○	○	○	○	○
Particulate Matter (PM_{10})	◉	○	○	○	○	○

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^3)
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	

Project Appraisal Balance Sheet

Part B: Environment

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.	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.			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							

Project Appraisal Balance Sheet

Part B: Environment

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.	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.	No.
	Number of Impacts On Sites Of National Importance That Are:	No.	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.	No.
	Number Of Impacts On Sites Of National Importance That Are:	No.	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.	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.	No.	No.
	Quantitative Statement	Qualitative Statement								
	Neutral									

	Hydrogeology	Profound Positive	Significant Positive	Moderate Positive	Slightly Positive	Imperceptible	Slightly Negative	Moderate Negative	Significant Negative	Profound Negative

Project Appraisal Balance Sheet

Part B: Environment

Hydrogeology	Number of Impacts That Are:	No.	No.	No.	No.	No.	No.	No.	No.	No.
	Quantitative Statement	Qualitative Statement								
	Neutral									

Overall Scale of Impact	Amended Scale of Impact
Neutral	

Project Appraisal Balance Sheet

Part B: Environment

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Project Appraisal Balance Sheet

Part C: Economy, Safety, Accessibility and Social Inclusion and Integration Input Sheet

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Safety

Accident Reduction

	Total Accident Reduction	Casualty Reduction			Value Of Accident Reduction (€m)
		Fatal	Serious	Minor	
What Is The Accident/Casualty Reduction Over 30 Years?	0	0	0	0	€ 0.0

Quantitative Statement	Qualitative Statement
Neutral	

Security

	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
What Is The Expected Impact Of The Project On The Security Of Road Users?	○	○	○	○	◉	○	○	○

Quantitative Statement	Qualitative Statement
Neutral	

Safety - Overall Scale of Impact	Safety - Amended Scale of Impact
Neutral	

Project Appraisal Balance Sheet

Part C: Economy, Safety, Accessibility and Social Inclusion and Integration Input Sheet

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Economy

Efficiency and Effectiveness

	Commuting (€m)	Business (€m)	Other (€m)	PSP Impact (€m)	Indirect Tax (€m)	Residual Value (€m)	Total Benefits (€m)
What Are The Benefits Of The Scheme?	€ 0.0	€ 0.0	€ 0.0	€ 0.0	€ 0.0	€ 0.0	€ 0.0

Quantitative Statement

Wider Economic Impacts

What Impact Will The Project Have On….	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Increase Competition In Markets?	○	○	○	○	◉	○	○	○
Lead To Efficiencies In Clustering Of Economic Activity? (Agglomeration Benefits)	○	○	○	○	◉	○	○	○
Attract Inward Investment?	○	○	○	○	◉	○	○	○
Expand Local Labour Supply?	○	○	○	○	◉	○	○	○
Contribute To Urban Regeneration	○	○	○	○	◉	○	○	○

Quantitative Statement	Qualitative Statement
Neutral	

Funding Impacts

What Impact Will The Project Have On….	Don't Know / NA	None	< 10%	10%-30%	> 30%
What Percentage Of Non-Exchequer Funding Is The Project Expected To Receive?	○	◉	○	○	○

Quantitative Statement	Qualitative Statement
Neutral	

Economy - Overall Scale of Impact	Economy - Amended Scale of Impact
Neutral	

Project Appraisal Balance Sheet

Part C: Economy, Safety, Accessibility and Social Inclusion and Integration Input Sheet

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Accessibility and Social Inclusion	Deprived Areas	What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
		Identified CLAR or RAPID Areas?	○	○	○	○	◉	○	○	○
		Quantitative Statement	Qualitative Statement							
		Neutral								
	Vulnerable Groups	What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
		Access To Employment or Vital Infrastructure?	○	○	○	○	◉	○	○	○
		Quantitative Statement	Qualitative Statement							
		Neutral								
	Accessibility & Social Inclusion - Overall Scale of Impact		**Accessibility & Social Inclusion - Amended Scale of Impact**							
	Neutral									

Project Appraisal Balance Sheet

Part C: Economy, Safety, Accessibility and Social Inclusion and Integration Input Sheet

An tÚdarás um Bóithre Náisiúnta
National Roads Authority

Integration

	What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Transport Integration	Connectivity of the Strategic Road Network?	○	○	○	○	◉	○	○	○
	Connectivity Between Transport Modes?	○	○	○	○	◉	○	○	○
	Sustainable Transport Networks?	○	○	○	○	◉	○	○	○
	Access to Other Transport Infrastructure Such As Ports and Airports?	○	○	○	○	◉	○	○	○
	Quantitative Statement	Qualitative Statement							
	Neutral								

	What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Land Use Integration	Objectives of Local and County Development Plans?	○	○	○	○	◉	○	○	○
	Strategic Connectivity for High Value Trips?	○	○	○	○	◉	○	○	○
	Urban Sprawl?	○	○	○	○	◉	○	○	○
	Quantitative Statement	Qualitative Statement							
	Neutral								

	What Impact Will The Project Have On…..	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Geographic Integration	Cross Border Connectivity?	○	○	○	○	◉	○	○	○
	The Trans European Transport network?	○	○	○	○	◉	○	○	○
	Quantitative Statement	Qualitative Statement							
	Neutral								

	How Will This Project Impact On The Wider Objectives For….	Don't Know / NA	Highly Negative	Moderately Negative	Slightly Negative	Neutral	Slightly Positive	Moderately Positive	Highly Positive
Other Government Policy Integration	Infrastructure and Capital Investment 2012 - 2016 (DPER)?	○	○	○	○	◉	○	○	○
	Quantitative Statement	Qualitative Statement							
	Neutral								

Integration - Overall Scale of Impact	Integration - Amended Scale of Impact
Neutral	

Project Appraisal Balance Sheet

Part D: PABS Summary Table

Project Title	PRS Reference Number	0	Project Description	Scheme Cost (€m)	Date
0	Modelling Base Year	0	0	€ 0.00	12/12/2013
	Scheme Opening Year	0			

	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_2 (Tonnes): 0 Ratio of CO_2 Do-Min/Do-Some: 0.00 Index of Overall Change in Exposure NO_2: Large Negative Index Index of Overall Change in Exposure PM_{10}: Large Negative Index Sub Ben. | Mod Ben | Sli Ben. | Negligible | Sli Adv. | Mod Adv. | Sub Adv. *Number of Sensitive Locations Experiencing Impacts That Are:* No. | No. | No. | No. | No. | No. | No.	Value of Change in Emissions (€m) €0.00
	Noise and vibration	Neutral	0	Number of Sensitive Receptors Requiring Mitigation: No. Number of Sensitive Receptors Requiring Mitigation (Not Feasible): No.	
	Waste	Neutral	0	Unacceptable Material/Contaminated Land/Hazardous Waste to be ... Disposed of Off Site: U1 [m^3] No. | U2 [m^3] No. | Left in Situ [m^3 land waste] No.	
	Landscape & Visual Amenity (incl. Light)	Neutral	0	PP | Sig P | Mod P | Sli P | I | Sli N | Mod N | Sig N | PN *Number Of Impacts That Are:* No. | No. | No. | No. | No. | No. | No. | No. | No. *Number of Profound/Significant Impacts on Sites Of:* National No. | County No. | Other No.	
	Biodiversity, Flora & Fauna	Neutral	0	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 | SN | Mod N | Maj N No. | No. | No. | No. | No. | No. | No.	
	Non-Agricultural Properties	Neutral	0	Impact on Non-Agricultural Properties Sig P | Mod P | Sli P | I | Sli N | Mod N | Sig N | PN No. | No. | No. | No. | No. | No. | No. | No.	
	Architectural Heritage	Neutral	0	Sig P | Mod P | Sli P | I | Sli N | Mod N | Sig N | PN *Number Of Impacts That Are:* No. | No. | No. | No. | No. | No. | No. | No. *Number of Impacts on Sites of National Importance That Are:* No. | No. | No. | No. | No. | No. | No. | No.	
	Archaeological and Cultural Heritage	Neutral	0	Sig P | Mod P | Sli P | I | Sli N | Mod N | Sig N | PN *Number Of Impacts That Are:* No. | No. | No. | No. | No. | No. | No. | No. *Number of Impacts on Sites of National Importance That Are:* No. | No. | No. | No. | No. | No. | No. | No.	
	Soils & Geology	Neutral	0	Number Of Impacts That Are: PP | Sig P | Mod P | Sli P | I | Sli N | Mod N | Sig N | PN No. | No. | No. | No. | No. | No. | No. | No. | No.	
	Hydrology	Neutral	0	Number Of Impacts That Are: PP | Sig P | Mod P | Sli P | I | Sli N | Mod N | Sig N | PN No. | No. | No. | No. | No. | No. | No. | No. | No.	
	Hydrogeology	Neutral	0	Number Of Impacts That Are: PP | Sig P | Mod P | Sli P | I | Sli N | Mod N | Sig N | PN No. | No. | No. | No. | No. | No. | No. | No. | No.	
Safety	Accident Reduction	Neutral	0	Accident Reduction Over 30 Years Accidents | Casualties | Fatal | Serious | Minor 0 | 0 | 0 | 0 | 0	Value of Change (€m) €0.0
	Security	Neutral	0		
Economy	Transport Efficiency and Effectiveness		0		Commuting | Business | Other | Value of Change €0.0 | €0.0 | €0.0 PSP | Indirect Tax | Res. Value €0.0 | €0.0 | €0.0 | €0.0
	Wider Economic Impact	Neutral	0	Neutral	
	Funding	Neutral	0	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	
Integration	Transport Integration	Neutral	0	Neutral	
	Land-Use Integration	Neutral	0	Neutral	
	Geographical Integration	Neutral	0	Neutral	
	Integration with Other Government Policies	Neutral	0	Neutral	

Overall Scale of Impact				
	Environmental	Neutral	Accessibility & Social Inclusion	Neutral
	Safety	Neutral	Integration	Neutral
	Economy	Neutral		

Summary of Benefits			
Present Value of Benefits (PVB)	€0.0	Net Present Value (NPV)	€0.0
Present Value of Costs (PVC)	€0.0	Benefit to Cost Ratio (BCR)	0.00