



**KTH Land and Water
Resources Engineering**

POST-EIA MONITORING AND WEBTAG OBJECTIVES: A REVIEW OF SELECTED ROAD PROJECTS IN UK

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DEDICATION

I would like to dedicate this thesis to my parents who are a positive force in my life.
Thank you so much for supporting me through out my studies in Sweden.

SUMMARY (SWEDISH)

Vägar är en viktig del av infrastrukturen i något land, eftersom det underlättar transport av varor och människor. Storbritannien har fått ett bra vägnät, men har en låg motorväg densitet jämfört med andra europeiska länder. Highways Agency har ett program för att förbättra vägnätet, främst för att minska trängseln. För att säkerställa hållbarheten i vägprojekt den brittiska regeringen har satt riktlinjer och standarder som skall uppfyllas. Dessa är de kriterier som används för att bedöma vägprojekt för vilka en MKB är en viktig ingång. Denna uppsats strävar efter att hitta samband mellan de transportpolitiska bedömning och efter MKB övervakning. Studien genomfördes genom att granska miljökonsekvensbeskrivningen och CEMP dokument av tre vägprojekt i England. En kort frågeformulär med öppna frågor var också administreras. Resultaten visar att övervakning av påverkan i samband med respektive projekt som i huvudsak har föreslagits under byggtiden och för miljöpåverkan. Sociala och ekonomiska effekter är i allmänhet inte kontrolleras under och efter byggandet. Även efter mkb-uppföljning av effekter sällan sker, beror övervakning på typen av projekt inblandade, konstruktion och placering av projektet. Mer forskning behövs i olika typer av projekt, och mer behöver göras för att upprätthålla fortlöpande övervakning efter MKB för att stödja påven övningen.

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LIST OF ABBREVIATIONS

AST	Appraisal Summary Table
CA	Competent Authority
CEMP	Construction Environmental Management Plan
DMRB	Design Manual for Roads and Bridges
EA	Environmental Agency
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
EU	European Union
GDP	Gross Domestic Product
GIS	Geographic Information Systems
IMF	International Monetary Fund
LEMP	Landscape and Ecology Management Plan
MS	Member State
NATA	New Approach to Analysis
NEPA	National Environmental Policy Act
PMP	Project Management Plan
POPE	Post Opening Project Evaluation
SEA	Strategic Environmental Assessment
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TPI	Targeted Programme of Improvements
UK	United Kingdom
WebTAG	Web Transport Analysis Guidance

ABSTRACT

Roads are an important part of the infrastructure of any country, as they facilitate the transportation of goods and people. The UK has got a good road network but has a low motorway density compared to other European countries. The Highways Agency has a programme to improve the road network, mainly to ease congestion. To ensure the sustainability of road projects the UK government has set guidelines and standards that have to be met. These are the criteria used to appraise road projects for which EIA is a significant input. This paper seeks to find the connection between the transport appraisal objectives and post-EIA monitoring. The study was carried out by reviewing EIS and CEMP documents of three road projects in England. A short questionnaire with open questions was also administered. The results show that monitoring of impacts associated with the respective projects was mainly proposed during the construction phase, and for environmental impacts. Social and economic impacts are generally not monitored during and after construction. Whilst post-EIA monitoring of impacts is seldom carried out, monitoring depends on the type of project, construction involved and the location of the project. More research is required in different kinds of projects, and more needs to be done to enforce ongoing monitoring after the EIA to support the POPE exercise.

Key words: post - EIA, impact monitoring, roads, transport appraisal

INTRODUCTION

In a world of increased mobility a lot of infrastructure has been developed to facilitate transportation of goods and people. In Great Britain alone, the road network as of 2010 was a total of 245 086 miles of which 187 149 miles are in England (Office for National Statistics, 2010). The location of the United Kingdom in relation to other countries in the European Union (Fig. 1). The UK generally has an adequate strategic road network, linking all major towns and cities. Expansion and extension of roads also plays a major role in the movement of people and goods. In a report produced by the UK's House of Commons, the Association of British Drivers is quoted to have said the 'the UK's motorway network is one-third the EU average in relation to the size of its economy' (House of Commons, 2010). The country also has one of the most congested motorways with more cars per motorway mile than countries such as Germany and France. A study by Eurostat in 2004 revealed that the UK had a motorway density of less than 20km/ 1000km² compared to Netherlands and Belgium both with motorway densities above 40 km/ 1000km². This means that the country needs to expand its road network because it has one of the lowest motorway densities in Western Europe giving it an economic and competitive disadvantage.

In an effort to improve the road network further, reduce congestion on some of the major roads and ensure sustainability of transport investments the Government published a white paper entitled, A New Deal for Transport: Better for Everyone. Highways Agency initiated the Programme of Major Schemes in line with this white paper to maintain, operate and improve road transport in England. In addition to this the government also published more white papers with the aim of supporting economic growth and reducing congestion on roads and concluded that the remedy to expand the motorway network was to construct and upgrade motorways. The Department of Transport also developed a transport analysis guide known as Web Transport Analysis Guidance (WebTAG) to conduct transport studies. WebTAG includes a multi-

criteria decision making tool called New Approach to Analysis (NATA). NATA uses well established tools such as Environmental Impact Assessment (EIA), cost-benefit analysis and Geographic Information Systems (GIS) as appraisal tools and procedures. NATA requires monitoring and evaluation of a transport project as a final step.

EIA is a prerequisite for certain projects listed in the European Union (EU) EIA Directive 85/337/EEC. Potential positive and negative environmental, economic and social impacts can be predicted before a project is actually implemented. This directive requires monitoring of project impacts as good practice and most countries in the block do not have monitoring after the EIA as a requirement. However, 'the success of EIA in terms of improving project environmental soundness, and ultimately supporting sustainable development, is often questionable because the application of the process itself, evaluation of findings and post-assessment follow-up actions are inconsistent and many times insufficient' as suggested by Perine (2003). A review of post-EIA monitoring of certain projects in Western Australia by Morris-Saunders and Bailey (2000) revealed monitoring deficiencies and low accuracy in impact prediction.

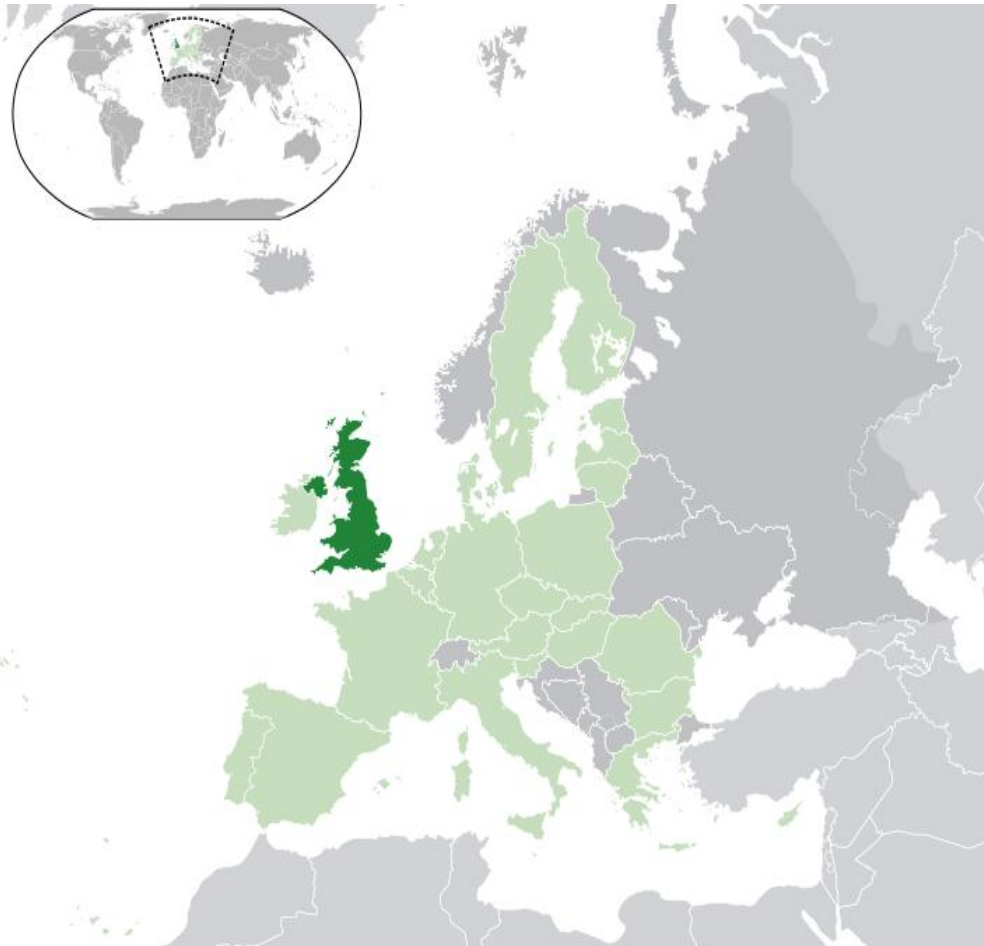


Fig. 1: The location of the United Kingdom (UK) on the world map, UK is shown in dark green and areas in light green represent the European Union (EU), adopted from Wikipedia, 2009

Environmental impact monitoring after the EIA does not always correspond to recommendations and proposals in the Environmental Impact Statement (EIS) and this is due to a number of reasons. In a review of 16 projects (Rafique Ahammed and Nixon 2005) concluded the following limitations were the causes of this lack of correlation: ‘clearly assigned monitoring responsibilities, public accountability, clearly outlined monitoring timeframes, clearly outlined aims and objectives, lack of human resources, and lack of any Environmental Impact Monitoring legislation clearly assigned monitoring responsibilities, public accountability, clearly outlined monitoring timeframes, clearly outlined aims and objectives, lack of human resources, and lack of any Environmental Impact Monitoring legislation’. This study aims to determine the level of compliance monitoring of selected projects after the EIA has been conducted (possibly during the construction phase where most mitigation measures are expected to be incorporated or when the project is under-way).

Overall aim

To evaluate the degree of compliance monitoring of impacts during implementation stage of projects that require an EIA after the EIA was carried out, the study also aims to determine the major reasons affecting compliance monitoring after the EIA.

Research Questions

Is design and implementation of monitoring programmes to address potential impacts and actual impacts from the projects coherent between EIS documents and CEMP documents?

Which impacts are mainly proposed for monitoring – what are the associated WebTAG objectives that can be satisfied through this monitoring?

What are the major reasons affecting compliance monitoring after EIA in the selected projects?

METHODS

In this study information was reviewed from road projects that were approved and were subsequently built or are in process of being built. Three projects will be selected, ideally from the Highways Agency’s Programme of Major Schemes. The following documents were reviewed:

- the EISs from the EIA that was carried out for each project
- the CEMP documents for the three projects
- a short questionnaire with questions to be answered by those who are involved in the projects, administered through a telephone interview, the questions that were administered were open questions, the questionnaire can be found in Appendix I

The following general items were evaluated:

- Design and implementation of environmental monitoring activities to address potential impacts and actual impacts for the project.
- The integration of WebTAG objectives in particular those that have to do with environmental and social impacts
- The integration of different kinds of impacts in the documents (environmental, social, economic impacts)

Criteria for evaluating the documents

General design of monitoring programmes

The following criteria have been set out for evaluating the environmental monitoring programmes of the individual projects and the programme:

Monitoring intentions in EISs

- Were environmental impact monitoring programmes proposed for each particular project?
- Were monitoring intentions discussed in a separate, clearly indicated monitoring chapter/ section?
- Were there clear, specific commitments to monitor impacts, as opposed to a vague reference that could easily be avoided?
- Were monitoring programmes outlined for scrutiny and public comment?
- Were monitoring aims and objectives outlined?
- Were responsibilities for monitoring outlined clearly?
- Were parameters and indicators to be monitored clearly stated in the monitoring programmes?
- Were monitoring timeframes and spatial distribution and limits provided – scope of the monitoring?
- Were monitoring methods outlined in the EISs?

Environmental impacts in EISs

- the number of environmental issues that could potentially be affected by a project or programme
- how are the impacts described, definite impact or likely impacts – level of significance
- the number of impacts referred to for a monitoring programme
- the number of monitoring programmes in each project as a percentage of impacts

WebTAG environmental objective

The following criteria have been set out for evaluating the incorporation of WebTAG environmental objective in the individual projects and the programme:

- Are WebTAG environmental sub-objectives incorporated in the EISs?
- Are significant impacts that may not meet WebTAG environmental sub-objectives proposed for monitoring?
- Do WebTAG environmental sub-objectives form the basis of selection of indicators or parameters for monitoring impacts?

LITERATURE REVIEW

Of roads, appraisal and appraisal tools

The importance of road infrastructure

Roads have been used for many centuries to connect towns to other towns and remote areas. Road transport also dominates goods and passenger transport in many countries. A good road network is important for any country to transport goods from one place to another. If the road network is good then more goods can be transported between different places thereby improving trade and increasing economic growth. Money is lost each year due to waiting times as people and goods get

stuck in long congestion queues. A study by Sankaran et al. (2005) showed that a region in New Zealand called Auckland, home to a third of the country's population on only 2% of land, an estimated 1% of national Gross Domestic Product (GDP) was lost due to congestion. The GDP of New Zealand was estimated to be US\$ 135, 723 billion in 2010 (IMF, 2010).

Environmentalists have advocated for policies and planning that encourages public transport for the public, but this alternative remains inconvenient to most people and highways continue to be congested. It is therefore important to expand busy roads to ensure easy and faster flow of traffic to avoid wasting time and money. Road development is of economic value, a new road should be constructed where it is needed by the public and business people. Roads should also be safe because they are used by people. Development of roads should aim to reduce carnage on roads by increasing safety. Peden (2005) states that 'worldwide, nearly 1.2 million people are killed in road traffic crashes every year and 20 million to 50 million more are injured or disabled'.

A good road network should be accessible to many people, and road transport particularly of people, should be integrated with other modes of transport for example railways. Roads should also have a minimum negative impact on the environment. There is a heated debate going on in most developed countries about public spending on existing and new roads. Road projects like most other projects almost always exceed their initially estimated cost. Opposition to expenditure on roads has increased due to environmental reasons, climate change being top on the list of reasons. Anti-roads expenditure activists argue that spending money on road network expansion results in increased traffic flows and therefore climate change impact. However there are studies that say otherwise. A study of road expenditure in the UK revealed that spending money on new and existing roads does not result in increased traffic on the roads (Prakash et al., 2001).

Transport appraisal in UK

In order to increase economic efficiency many roads have been built in developed countries including UK. In 1998 the central government in England came up with a white paper 'A New Deal for Transport: Better for everyone'. The aim of the paper was to integrate transport with other aspects of government policy to achieve the goal of having transport networks that are sustainable and well integrated, improving the largely complete networks as well as maintaining new and existing transport infrastructure (Department of Transport, 1998). One of the proposed methods to achieve this was better appraisal. Better economic and environmental appraisal of transport projects was proposed. NATA was developed to for the appraisal of different solutions to transport problems by improving the planning process and development of proposal in the transport sector (Department of Transport, 1998). NATA is a consistent, multi-criteria approach for comprehensive analysis of impacts of transport projects. Alternative transport schemes are appraised by taking into account the economic, social, environmental and financial impacts of transport projects, plans and programmes. The NATA appraisal must include a statement of the problems and local objectives, together with an assessment of the extent to which they are addressed by the option being considered (Department of Transport, 1998). Typically the appraisal of transportation options should find 'combinations which perform better as a whole than the sum of the individual components' and result in 'selecting and phasing of the preferred solution, taking account

of the views of the public and transport providers' (Department of Transport, 1998).

The Department of Transport, transport analysis guidance also gives advice on objectives that should be met when developing transport infrastructure. These are '**to protect the built and natural environment, to support sustainable economic activity and get good value for money**, to reduce the loss of life, injuries and damage to property resulting from transport accidents and crime, to improve access to facilities for those without a car and to reduce severance, to ensure that all decisions are taken in the context of the Government's integrated transport policy' Department of Transport (1998). In short these are: environment, economy, safety, accessibility and integration. The objectives form the basis of appraisal of Highways Agency road schemes and local transport plans. The Highways Agency uses these as the investment criteria for the roads it controls and maintains. Alternatives of transport projects are assessed on how well they meet these 5 objectives as well as their sub-objectives.

The environmental objective is concerned with protecting the environment. There are 10 sub-objectives within the environmental objective, these are: to reduce noise; to improve **local air quality**; to reduce **greenhouse gases**; to protect and enhance the **landscape**; to protect and enhance the **townscape**; to protect the **heritage of historic resources**; to support **biodiversity**; to protect the **water environment**; to encourage **physical fitness**; to improve **journey ambience** (Department of Transport, 1998). The environmental impacts that are of concern include noise, pollution, atmospheric pollution of different kinds, vibration, formal intrusion, severance, impacts on countryside and wildlife, ancient buildings and monuments (Department of Transport, 1998). WebTAG environmental objective now incorporates reduction of impacts of transport on the wider global environment, especially as a result of the emission of carbon dioxide into the atmosphere.

Appraisal tools and procedures

NATA is a multi-criteria decision making tool that uses well rooted tools and procedures such as EIA to aid in the appraisal of transportation schemes. In order to have a good road system that works well, is safe for people, is economically viable and environmentally safe there is a need to have good tools to plan and follow up on those targets and measures. EIA is an appraisal tool that is used by NATA. The findings from the EIA process can be used as input for transport appraisal (Department of Transport, 1993). The relationship between the environmental assessment process and the transport appraisal process is shown in Fig. 2 below. Guidance of environmental assessment of road projects has been well developed and readily available, but not so for other modes of transport such as railways and seaports (Department of Transport, 1998). Guidance for environmental impact assessment of projects is provided in the EU EIA Directive. In addition to this directive, the DMRB offers extensive guidelines assessing the environmental impacts of road projects among other things. The standard is furnished with details on how to cluster environmental impacts, how to assess the impacts and how to report the results of the assessment in a statement. SEA is required for transport plans and programmes under the EU EIA directive. NATA and SEA are similar because they are both used to compare different alternatives to meet a specific objective, but SEA gives an emphasis on environmental impacts. GIS is another tool that is used in transport appraisal. GIS is used to assess the accessibility

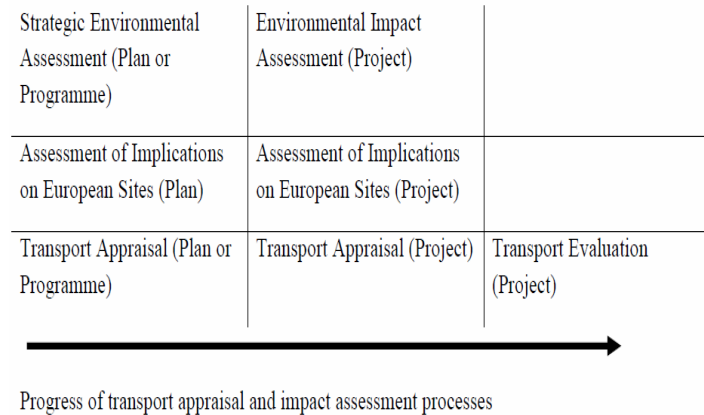


Fig. 2: Environmental Assessment process and Transport Appraisal process. Adopted from *Design Manual for Roads and Bridges* (Department of Transport, 1993)

of transport networks and integration of different transport modes with one another. GIS in transportation is also increasingly being used to determine system flow for example travel time in a highway (Miller and Wu, 2000), which can help on deciding which section of a highway to expand. Cost-benefit analysis is used as a tool in the appraisal of transport projects to provide an objective framework for the assessment of benefits against costs. A lot of information required to produce the Appraisal Summary Table (AST) comes from EIA and cost-benefit analysis. A transport or land-use/transport interaction model can also be employed by the NATA process to determine future transportation trends and needs to better inform on where and how to invest in transportation. Land-use/transport interaction models can also be used to assess the sustainability impacts of land use and transport policies, scenarios and investments (Geurs and van Wee, 2004).

Environmental Impact Assessment (EIA)

The United Kingdom Department of Environment (1989) has defined the term environmental assessment as ‘a technique and a process by which information about the environmental effects of a project is collected, both by the developer and from other sources, and taken into account by the planning authority in forming their judgements on whether the development should go ahead’. EIA is a planning tool or process with many important purposes which include: an aid to decision making, an aid to development action formulation and as an instrument for sustainable development as stated by Glasson et al. (2005). EIA also provides information about environmental consequences of projects, whilst ensuring the identification of and enhancement of good mitigation measures. EIAs have been used for many years in different countries as a way of ensuring sustainable development by minimizing environmental, social and economic impacts of projects. EIAs were first used in the 1960s and the United States of America (USA) was the first country to make EIA part of its legislation through the National Environmental Policy Act (NEPA) (Glasson et al. 2005).

The EIA process

EIA is a process that involves a number of steps. These can be subdivided into two main categories:

Before the decision

The first steps are project screening to determine if an EIA is required for a particular project, this is called screening. The next is scoping to determine which impacts need to be considered for the project. The following steps follow – the consideration of alternatives, establishing the environmental baseline and impact identification. Impact prediction, impact evaluation and impact mitigation then follows. Consultation of stakeholders including the public are then made, followed by the EIA presentation, the review of the Environmental Impact Statement (EIS). The European Union (2011) summarises the pre-decision steps as follows ‘the developer may request the competent authority to say what should be covered by the EIA information to be provided by the developer (scoping stage); the developer must provide information on the environmental impact (EIA report – Annex IV); the environmental authorities and the public (and affected Member States) must be informed and consulted’. Finally a decision is made by the competent authority on whether the project should be implemented or not, taking in account the consultations of stakeholders.

After the decision

After a decision has been made to proceed with the implementation of the project, an announcement of the decision must be made and this can be challenged in a court of law. The remaining steps are monitoring and auditing, particularly of the impacts of the project (Table 1)

What is EIA follow-up and Compliance Monitoring

It would be difficult to know the effects of EIA without EIA follow-up. One important part of the EIA follow-up and implementation process is monitoring and in particular monitoring of impacts. There are different follow-up activities after the decision to proceed with a project: surveillance, monitoring, evaluation and auditing (McCallum, 2004). The International Network for Environmental Compliance and Enforcement (INECE) n. d. define monitoring compliance as ‘collecting and analyzing information on the compliance status of the regulated community, one of the most important elements of an enforcement program’. Post-EIA compliance monitoring is often guided by monitoring programmes which should be in the Environmental Impact Statement (EIS). Ideally this impact monitoring programme should be distinguished from the monitoring of the operations of the project (Dipper et al. 1998). The design of a monitoring programme depends on the type of project and its expected impacts. Compliance of monitoring activities to recommendations in the EIS and environmental guidelines in general is important.

Why monitor impacts after the decision

Monitoring of impacts after the EIA is required to measure the actual impacts and trends, verify if they comply with agreed conditions and set standards, facilitate impact management, determine the accuracy of impact prediction and review the effectiveness of mitigation measures (United Nations Environment Programme, n.d). The INECE (n.d) states that monitoring compliance is essential to ‘detect and correct violations, provide evidence to support enforcement actions and evaluate programme progress by establishing compliance statuses.

Post-EIA compliance monitoring is required to check if regulations have been followed and to audit the impact prediction- to compare actual impacts on the ground and those that were predicted. This is done to check if impacts were correctly predicted and if regulations are being followed so that EIAs do not just act as a means to get a project started.

Morrison-Saunders and Arts (2004) state the following as the objectives of EIA follow-up, 'control of projects and their environmental impacts, maintain decision-making flexibility and promote an adaptive management approach, improve scientific and technical knowledge, improve public awareness and acceptance and integration with other information'.

Table 1: Key steps in the EU EIA process (European Commission Guidance on EIA: EIS Review)

KEY STAGES	NOTES
Project Preparation	The developer prepares the proposals for the project
Notification to Competent Authority	In the MS there is a requirement for the developer to notify the CA in advance of the application for the development consent. The developer may also do this voluntarily and informally
Screening	The CA makes a decision on whether EIA is required. This may happen when the CA receives notification of the intention to make a development consent application or the developer may make an application for a Screening Opinion. The screening decision must be recorded and made public.
Scoping	The Directive provides that developers may request a Scoping Opinion from the CA. The Scoping Opinion will identify the matters to be covered by the environmental information. It may also cover other aspects in the EIA process. In preparing the opinion the CA must consult the environmental authorities. In some MS scoping is mandatory.
Environmental Studies	The developer carries out studies to collect and prepare the environmental information required by Article 5 of the Directive.
Submission of Environmental Information to Competent Authority	The developer submits the environmental information to the CA together with the application for the development consent. If an application for an Annex I or II project is made without environmental information the CA must screen the project to determine whether EIA is required. In most MS the environmental information is presented in the form of an Environmental Impact Statement (EIS).
Review of Adequacy of the Environmental Information	In some MS there is a formal requirement for independent review of the adequacy of the environmental information before it is considered by the CA. In other MS the CA is responsible for determining whether the information is adequate. The guidance on EIS review is designed to assist at this stage. The developer may be required to provide further information if the submitted information is deemed to be inadequate.
Consultation with Statutory Environmental Authorities, Other Interested Parties and the Public	The environmental information must be made available to the authorities with environmental responsibilities and to other interested organisations and the general public for review. They must be given an opportunity to comment on the project and its environmental effects before a decision is made on development consent. If transboundary effects are likely to be significant other MS must be consulted.
Consideration of the Environmental Information by the Competent Authority before making Development Consent Decision	The environmental information and the results of the consultations must be considered by the CA in reaching its decision of the application for development consent.
Announcement of Decision	The decision must be made available to the public including the reasons for it and a description of the measures that will be required to mitigate adverse environmental effects.
Post-Decision Monitoring if Project is Granted Consent	There may be a requirement to monitor the effects of the project once it is implemented.
The highlighted steps must be followed in all Member States under Directives 85/337/EC and 97/11/EC. Scoping is not mandatory under the directive but Member States must establish a voluntary procedure by which developers can request a Scoping Opinion from the CA if they wish. The steps which are not highlighted form part of good practice in EIA and have been formalised in some Member States but not all. Consultation with environmental authorities and other parties may be required during some of the additional steps in some Member States.	

Monitoring and auditing are important because they test the effectiveness of the EIA process and prediction of impacts, as well as identification of unanticipated impacts. The prediction of possible impacts and identification of measure to mitigate them form the basis upon which decision on whether to execute a project or not are made as mentioned by Bisset (1980). Monitoring of impacts also evaluates the mitigation measures to see if they are effective or not.

Monitoring and auditing: the weakest steps in the EIA process

After the Environmental Impact Statement has been written and a project approved for implementation, execution of the project should involve follow-up of the EIA. Monitoring and auditing are key parts of EIA follow-up but unfortunately are the weakest steps in the EIA process and they are weakly enforced in most countries. The EIA process has been developed over many years and many EIAs have been done all over the globe. However EIA would be a linear and static process without feedback mechanism provided by the monitoring and auditing steps. Bisset (1980) advocates for EIA to be a continuous process where 'there is a link between monitoring, analysis of impacts arising from a project, and the implementation of appropriate mitigating measures'. In a study of 16 projects in South Australia, (Rafique Ahammed and Nixon 2005) found that environmental impact monitoring in South Australia in practice was found not to correspond with either environmental impact monitoring proposals in the corresponding environmental impact statement or environmental impact monitoring recommendations in the government assessment reports. They also found that monitoring programmes appear to be carried out at the discretion of the project proponents and no project was found to have environmental impact monitoring that directly corresponded to either proposals in the environmental impact statements or recommendations in the assessment report.

In another study (Dipper et al. 1998) found that is likely so where there is inadequate quality control, leading to monitoring data biased towards the developer's interests. Wood et al. (2000) revealed that 56% of impacts predicted were auditable and 21% were inaccurate in another study of 28 UK projects. By and large studies show that there is little emphasis on post-EIA follow-up, by comparing the predicted impacts with the impacts that actually occur as a result of the project, even where monitoring is done it is not always adequate. Dipper et al. (1998) state that 'where monitoring data are available for the purposes of post-auditing, they are frequently found to be inadequate, inappropriate, unsuitable, unreliable and measured over an insufficiently long period of time'.

Major problems encountered when monitoring project impacts

Limited information and resources

There are many reasons monitoring of impacts can be difficult in practice. 'Uncertainty and limited information, deficiencies in EISs, lack of guidance, legislative deficiencies, and demands on financial and staff resources' as noted by Morrison-Saunders and Arts (2004), all this makes it difficult for the designing and implementing monitoring programmes and to do so efficiently. Sometimes EISs predict impacts that are difficult to ascertain. Harrington and Canter (1998) list the 'use of testable hypotheses for impact prediction' as a component of a good environmental monitoring programme. Another problem that is encountered when monitoring project impacts is inadequate baseline data with which to compare monitoring data. Petts and Eduljee (1994) suggest that monitoring would have to begin early during project design and during prep-

aration of the EIA documentation giving details in the EIS. Data recorded from monitoring impacts may also be of poor quality. In addition monitoring techniques may be inappropriate or inadequate and implementation tools may be weak, a study of Canadian government projects by McCallum (2004) showed that project data that is necessary for follow-up to be done is not always readily available to those attempting the follow-up. Resource limitations particularly money and time for monitoring impacts is not always made available by the developers, and manpower commitments for this are limited. A review of nine projects in the USA by Harrington and Canter (1998) indicates that 'monitoring was often planned for assessing short-term rather than long-term impacts' because of the constraints faced when implementing monitoring programmes.

Self-assessment by developers

There also are few incentives for developers to implement monitoring programmes after the decision. Dipper et al. (1998) states that there are no consequences to be suffered by the developer if impact predictions are not right, even if an EIS can accurately predict the impacts there are no rewards for doing so, and the cost-benefit equation is thought to be tipped against them. Self assessment by developers and no informal means to ensure that recommendations from the EIA are followed through are problems mentioned by McCallum (2004) in monitoring project impacts. All these reasons make it difficult to persuade developer's of projects to implement monitoring programmes after the EIA. EIA is a planning tool and 'once a decision has been made on a project stakeholders such as project planners, decision makers and interested members of the public tend to focus their attention to new projects' states Bisset (1980).

Improving the effectiveness of EIA monitoring programmes

Good post-EIA monitoring programmes must follow guidelines stated in the EIS, with appropriate techniques used in the monitoring process. Şahin and Kurum (2009) state that 'the monitoring method should be developed for each project phase and allow for periodic reporting and assessment of compliance with environmental conditions and requirements of the EIA'. A good monitoring programme should not only be about monitoring the impacts of the project itself, but should also act as feedback into the EIA process. This feedback can then be used in EIAs of other projects, for example a mitigation measure that was evaluated in an EIA monitoring programme can be recommended for a project with similar impacts. This can save EIA practitioners money and time. However feedback from EIA monitoring programmes can only be used if monitoring is actually done, and by creating a platform to share experiences from these. In general monitoring programmes should make it clear who is responsible for the monitoring.

Legislative requirement

Some countries have come up with laws to ensure that monitoring and evaluation of impacts takes place after the decision to execute a project, during implementation of the project or during operation of the project. For example Netherlands has a law that makes it the responsibility of the competent authority to investigate impacts during implementation or after implementation of a project (Arts et al. 2001). The project proponent has to cooperate with post-decision monitoring and evaluation because in practice they do most of the work. Portugal has also enacted legislation that provides for post-decision impact monitoring and evalua-

tion. The EIA regulation focuses on ‘compliance of the detailed project design with the EIA decision and monitoring and auditing in all cases’ as stated in Arts et al. (2001). Under this regulation the project proponent should submit regular monitoring reports that comply with the recommendations and requirements of monitoring programmes in the EIS to the competent authority. The competent authority in turn can carry out audits to verify compliance to monitoring programmes at any stage in the project.

Consistency

Monitoring is generally a long-term commitment. Şahin and Kurum (2009) noted that EIA-oriented environmental monitoring must be designed to provide regular updates on actual impacts, compliance with environmental operating conditions and the effectiveness of environmental mitigation measures. The monitoring data collected must also be standardized to make comparison easy, periodically documented and/or updated, and ideally the staff that started the monitoring programme should remain to carry it out. New staff may not have the same knowledge as experienced staff. In addition to this the documentation of monitoring information should be consistent (Harrington and Canter, 1998).

Benchmarks

Details about predicted impacts that should be included in the EIS are: the specific impacts, the geographic extent of these impacts and the likely changes to the environment, or environmental processes and parameters. The establishment of these benchmarks makes it easier to monitor project impacts because the degree or size of an impact is predetermined. This view is supported in the work of Bisset (1980). The temporal and spatial scale of the monitoring programme should be linked to the monitoring objectives to facilitate the design and magnitude of the monitoring programme (Harrington and Canter, 1998).

Changes in the project

More often than not there are changes in the project, which need to be taken into account in the monitoring programmes. Changes in the project can result in unexpected impacts and changes in the geographic extent of impacts, and changes in the time that impacts occur. This is often the case in multi-phase projects where the different phases of the project may actually be implemented at different stages. More often than not the personnel who implement the project are different from those that propose the project and write the EIS; making changes during project implementation are inevitable if there is no reference to the EIS.

Public participation in EIA monitoring programmes

In most cases the monitoring of impacts during project execution is the responsibility of the developer. Research has shown that involving the public, particularly those that are affected by these impacts can improve monitoring programmes by providing an independent point of view. Public participation can also improve knowledge about the environment and encourage environmental protection in general (Şahin and Kurum 2009). In Hong Kong the monitoring information is made available to the public via the internet on a website, which can also be used by members of the public to comment or complain about the project (Arts et al. 2001). By providing opportunities for public participation a developer can show the public that he is concerned about protecting human health and the environment, this opinion is supported by Harrington and Canter (1998).

The EU EIA Directive and monitoring

The EU EIA directive (1985) amended in 1997, 2003 and 2009 lists post-decision monitoring if a project is granted consent as the last step in the EIA process (International Plant Protection Convention, n.d.) but does not legally bind member states to do so. Table 1 above also shows that monitoring is listed as a stage for good EIA practice, but not all member states are obliged to monitor after a decision to proceed with a project has been made. The European Commission (2001) review lists have: 'are arrangements proposed to monitor and manage residual impacts' as a review question. Article 11 of the EIA directive states that member states and the Commission should exchange information on the experience gained in applying the directive (EU EIA directive, 1985), as a means of getting feedback. Generally provisions for monitoring impacts after a decision has been made are rare throughout the EU and where they do exist they are not part of the legislation that has been adopted from the EIA directive, for example in Spain (Bond and Wathern, 1999).

EIA compliance monitoring in UK

EIA in this country is mainly used for planning purposes. In UK the EU EIA directive (1985) was adopted in the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations of 1999, which were amended in 2000. The law requires that an environmental statement (ES) be written by the developer together with a planning application to get consent for the project from the local planning authority. The EIA regulation does not explicitly state that impacts of projects should be monitored. An environmental management plan in the ES forms the basis for the effective implementation of recommendations and findings of the ES (The Royal Town Planning Institute, 2001). This environmental management plan should have clear performance indicators and benchmarks for the monitoring of mitigation measures. The local planning authority also lays down as a condition that 'the requirements of the EMP are translated into bidding and tender documents for physical works to ensure that contractors assign costs to the necessary protective measures' as stated by The Royal Town Planning Institute (2001). The public may also be involved in the monitoring of impacts.

WebTAG and monitoring impacts of transportation projects

WebTAG guidance documents provide guidance on monitoring at the strategic level, for plans and programmes. The guidance on strategic environmental assessment outlined in WebTAG documents is based on the EU SEA directive (Department of Transport, 1998). The directive states that member countries should monitor significant environmental impacts of plans during the implementation stage of the plan. Proposals for monitoring, including aims, objectives and methods to be employed should be included in the environmental report, but these should be considered when objectives to be achieved by the plan are formulated when preparing the plan. The performance of the plan against the SEA objectives is measured using indicators; the same indicators can also be used in monitoring the implementation of the plan (Department of Transport, 1998). The NATA process does not currently require monitoring of significant environmental impacts; however a monitoring and evaluation stage is included as a last stage of the process.

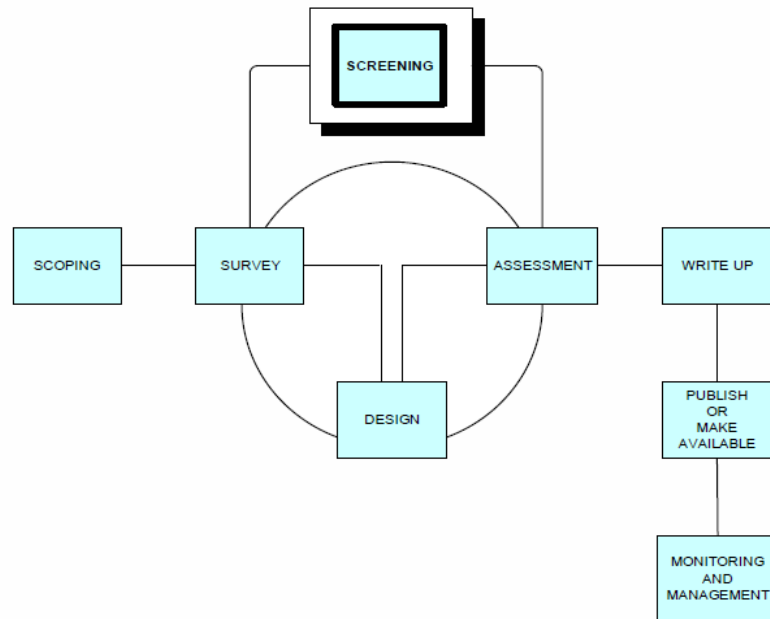


Fig. 3: Activities undertaken within the Environmental Impact Assessment process. Adopted from *Design Manual for Roads and Bridges* (Department of Transport, 1993)

Monitoring is considered as good practice but not necessarily required. The Department of Transport has its own check list for quality control of environmental statements prepared for road and bridge projects. The check list has listed the inclusion of monitoring commitments in the environmental statement as one of its quality control criteria (Department of Transport, 1993). The activities that are undertaken in the EIA process (Fig.3). The DMRB 11:3:7 which outline guidance on assessing environmental impacts of road projects state that there is no requirement to monitor impacts such as noise and vibration after the completion of the project. However monitoring may be required during construction.

Other post-EIA follow up mechanisms

In addition to the monitoring of impacts in the post-EIA era there are other mechanisms in place in order to follow up on the findings of the EIA as well as the appraisal of road projects in the UK. These include the Post Opening Project Evaluation (POPE) which is done by the Highways Agency and started in 2001. This involves the Highways Agency carrying out an evaluation following the opening of a road project, one year after and five years after the opening of the project. The benefits of the scheme are compared with the impacts that were predicted by the EIS and appraised, with the actual impacts that occurred and the objectives of the projects. The POPE process uses the EIS and the Appraisal Summary Table as the baseline information. In addition to this, information on maintenance and on-going monitoring if available can improve the quality of the evaluation (Atkins, 2008). Consultations with external parties can also be a valuable source of information (Atkins, 2008). The interaction of EIA, transport appraisal and POPE processes (Fig. 4) shows that the process allows for lessons to be learnt about the effectiveness of the existing appraisal processes, so that better decision making can be done in the future. This is done for all projects in the Programme of Major Improvements.

Motivation for selecting the case studies

The importance of road infrastructure cannot be over-stressed. Development of road infrastructure is important to facilitate movement of people and goods. The projects that were selected for review in this study are part of the Highways Agency's Programme of Major Schemes which seeks to improve existing motorways and trunk roads. The programme was initially named Targeted Programme of Improvements, it was initiated after the release of the white paper 'A New Deal for Transport: Better for Everyone' by the British government. A road project must cost more than £5 million to enter the programme. WebTAG on which NATA is based was first issued in 2003, which makes the chosen projects subject to NATA appraisal. The investment criteria used for investing in the major roads under this programme are the same as the objectives that must be met by transport projects when they are appraised according to WebTAG. These are environment, economy, safety, accessibility and integration. The projects should also address WebTAG environmental objectives. Due to the climate change debate there has been growing objection to the construction of roads as this increases emissions. Road projects like most other projects often cost more than initially estimated. It is important to evaluate if project proponents are prepared to address public dissatisfaction with building more roads whilst ensuring economic viability by monitoring impacts after the projects have been approved.

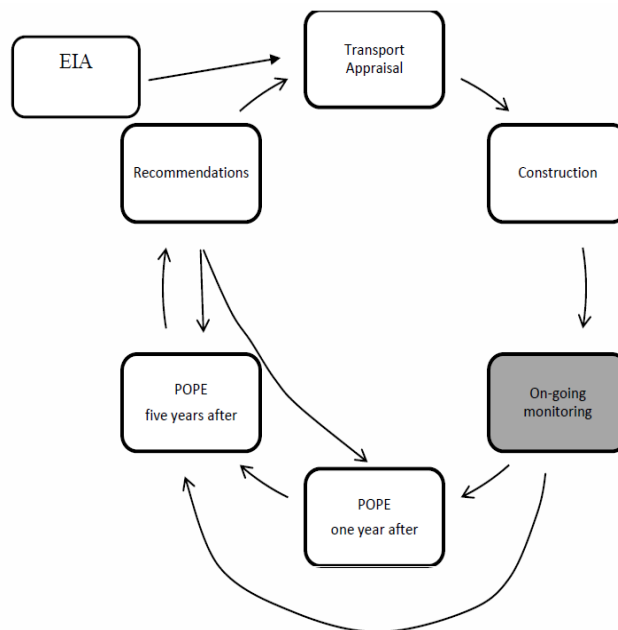


Fig. 4: Interaction of the EIA, appraisal, and POPE processes

RESULTS

The case studies

All three case studies are under the Highways Agency's Programme of Major Schemes, formally known as the Targeted Programme of Improvements. The aim objective of the programme is 'to contribute to sustainable development by maintaining, operating and improving the trunk road network in support of the Government's integrated transport and land use policies' as stated by the Highway Agency (2008). The programme was initiated to improve and maintain trunk roads in the country to motorway status but it has also shifted its focus to include improvements of existing motorways (Fig. 5). All three projects required an EIA according to the EU EIA Directive (1985) which require an EIA to be done for transport infrastructure projects involving '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 realigned and/or widened section of road would be 10 km or more in a continuous length'.

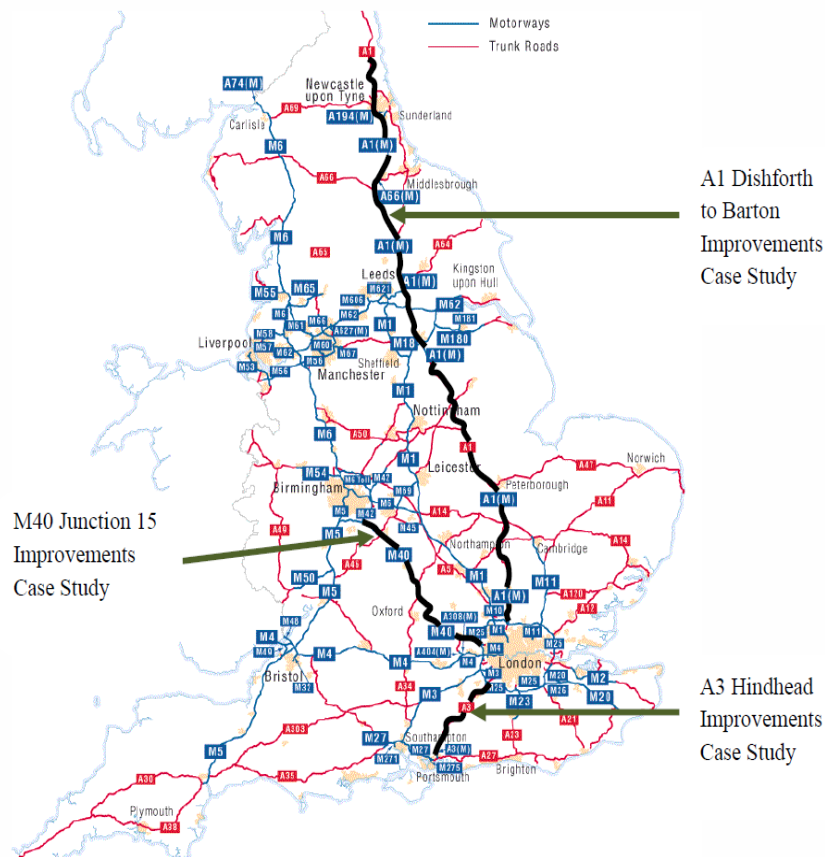


Fig. 5: UK road network, motorways are shown in blue, strategic trunk roads are shown in red, adopted from the Highways Agency, 2011. The selected case studies are shown here in bold, black lines, the location of the improvement works is shown in bold, green arrows.

1. A1 Dishforth to Barton improvement

The A1 road is a major trunk road in UK; it is the longest numbered road in UK at 610km. It runs from London, England to Edinburg, Scotland. It is also known as the Great North Road. Many parts of the road can be classified as motorway. A proposal was put forward to upgrade the whole road to a motorway in 1989, but this was withdrawn in 1995 in response to road protests. The proposed improvement to the A1 entered the Government's Targeted Programme of Improvements (TPI) for highways in 2002. The initial justification of the improvement project came from the A1 Bramham to Barton Road based Safety Study carried out on behalf of the Department of Transport in 2002. The study revealed the following:

This section of the A1 carries a high proportion of long distance traffic and also provides an important route for local businesses and commuter traffic. The area around this section is mainly rural and as a result slow moving agricultural vehicles use the road as a connection between local roads as well as for gaining access to adjacent fields. This creates conflict between local and slow moving traffic and long distance through traffic on the A1 (Highways Agency, 2006a).

The A1 between Dishforth and Barton has a higher accident rate than the national average rate for dual two-lane all-purpose trunk roads, but because of the mix of traffic and the high proportion of heavy goods vehicles, the percentage of fatal and severe personal injury accidents is high. Accidents on this section of the A1 cause major problems with a minor accident affecting traffic flows for a period of hours. Serious accidents can shut one or both carriageways resulting in the diversion of traffic onto the local road network (Highways Agency, 2006a).

The proposed project involves the expansion of the existing dual two-lane carriageway to a dual three-lane motorway (Fig. 6). This will improve journey reliability and reduce journey times. The motorway when complete will also have the advantage of reducing the risk of accidents occurring on this section of the road. It also offers a better opportunity to manage such incidents.

The project is largely an online widening project, it has the following components:

- The expansion of the dual two-lane carriageway to a dual three-lane carriageway between Dishforth and Barton
- Construction or modification of 32 bridges
- Upgrading of three existing junctions and the construction of two new junctions (junctions will be grade separated)
- A side road for local traffic

The upgrading of the section of the road between Dishforth and Barton to a motorway has been divided into two phases: Dishforth to Leeming Bar and Leeming Bar to Barton. The first phase which started in March 2009 is currently underway and is expected to be complete in the summer of 2012. The second phase of the project has been withdrawn as a measure to cut government spending. The improvement involves upgrading 38,6km of dual carriageway to full three lane motorway standard. The contract to build the road was awarded to the Carillion and Morgan Est. construction companies as a joint venture.

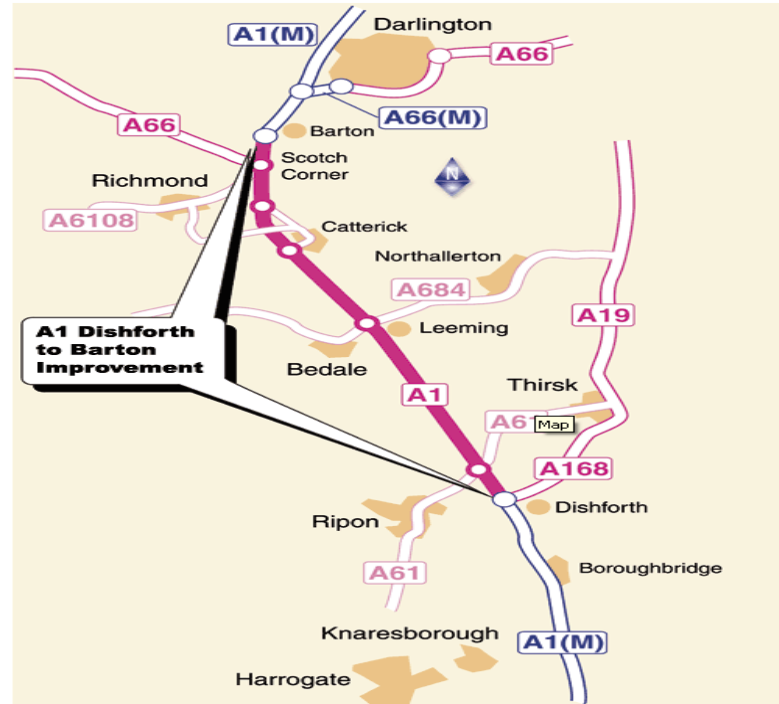


Fig. 6: A1 Dishforth to Barton improvement works location (Highways Agency, 2011).

2. A3 Hindhead improvement

The A3 Trunk road is strategic link road, 108km in length that runs from London to Portsmouth. It is also known as the Portsmouth Road, it is the main regional connecting road between London and Portsmouth, figure 4 below shows the location of the A3 road. The road is a dual carriageway except in the area of Hindhead. The area around Hindhead has got poor horizontal and vertical alignment with restricted visibility as it climbs around the Devil's Punch Bowl (Highways Agency, 2004). This section of the road also has a high accident rate and serious accidents can close the entire road for several hours. There are several priority junctions and many private accesses which introduce conflicts between local and through traffic where the alignment is better. The section of the road which has a single carriageway causes severe congestion which in turn causes significant amounts of traffic to divert onto other local roads to avoid the congestion queues (Highways Agency, 2004). Improvements on this road were proposed to ease congestion on this road (Fig. 7). The area of this section of A3 is an environmentally sensitive area in terms of landscape, biodiversity and heritage; this has resulted in delay to reach consensus on improving this section of the road. The Devil's Punch Bowl has got the status of a Site of Special Scientific Interest (SSSI). The project will deliver quicker and more reliable journey times on a safe road. The improvement involves construction of the following components:

- Upgrading the final single carriageway section of the A3 road into a dual carriageway
- A 1,8km tunnel, which will be constructed under the Devil's Punch Bowl.
- A new local road on the southeast side of the new A3 connecting High Pitfold to Hammer Lane

- An underpass at High Pitfold for walkers, cyclists and horseriders
- A grade-separated junction will be located at Hazel Grove and will cater for all movements, with the new A3 cutting under the junction

The aim of the project is to alleviate severe traffic congestion at the A3/A287 signal controlled crossroads by providing a new route for the A3, bypassing Hindhead and including 1.8km long twin bored tunnels to take the A3 under the Devil's Punch Bowl Site of Special Scientific Interest (SSSI) and Special Protection Area (SPA). The new road will be 6.5km long including the tunnel. The project is valued at £370 million (UD\$ 597 million/ €420 million). Work on the project started in January 2007 and is expected to be complete in the summer of 2011. The contract to build this road was awarded to Balfour Beatty Construction Company.

3. M40 junction 15 (Longbridge) Bypass improvement

M40 is a principal motorway that connects London and the West Midlands conurbation. It is part of the road network that offers alternative routes from Southern England to West Midlands. Most of the motorway is 3 lane dual carriageways. Junction 15 on the motorway was very busy because a lot of traffic from the motorway and trunk roads meet at there. Junction 15 is a strategic grade-separated junction on the trunk road and motorway network and facilitates the movement of vehicles between London and Coventry or Stratford-upon-Avon via M40 and A46. The junction also provides a strategic link between the M40 and M1 via the A45 and A46. There are a number of key problems that were identified which have led to lengthening of traffic queues and delays highlighting the need for the improvements at Junction 15 (Highways Agency, 2006b). These were:

- M40 Junction 15 is an important interchange for both 'local' and 'strategic' traffic, this conflict of interest causes significant delays and leads to queues, thereby increasing the potential for high-speed collisions on the motorway
- Increasing traffic worsens the queuing of traffic
- Between 2002 and 2006, 68 accidents involving 105 casualties have occurred at M40 Junction 15 roundabout, 2 involved non-motorised users
- The interim solution built in 2003/ 2004 is already starting to show sign of stress as traffic levels have increased.

The project aims were to ease the congestion at the junction by constructing a bypass. The components of the project were:

- A46 dual carriageway bypass
- A new 4 span bridge which will be built to take the new A46 dual carriageway bypass over the M 40 motorway
- A two-level free flow link at the northern connection between the new bypass and the A46 Warwick bypass
- A new, large roundabout at the southern connection between the new bypass and the A46, which will provide access to the B4463 and the M40 Junction 15. (Fig. 8).

The project was valued at £60 million (UD\$ 97 million/ €68 million). Construction of the bypass started in March 2008 and was completed in July 2010. The contract to construct this road was awarded to Galliford Try Construction Company.

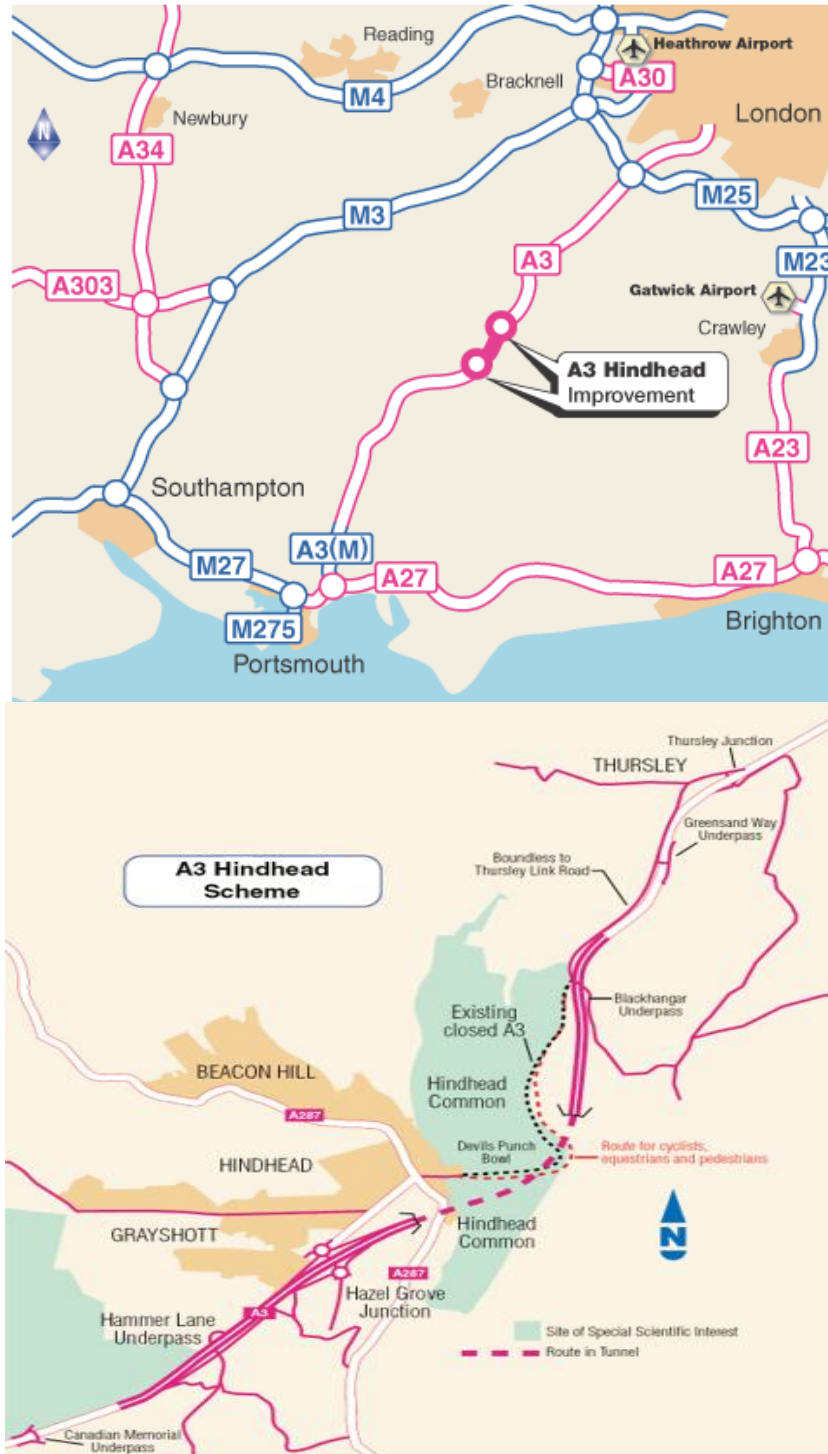


Fig. 7: The A3 Hindhead improvement. The figure above shows location of the A3 trunk road from London to Portsmouth, the figure above shows the location of A3 improvement works in the Hindhead area, adopted from the Highways Agency, 2011.

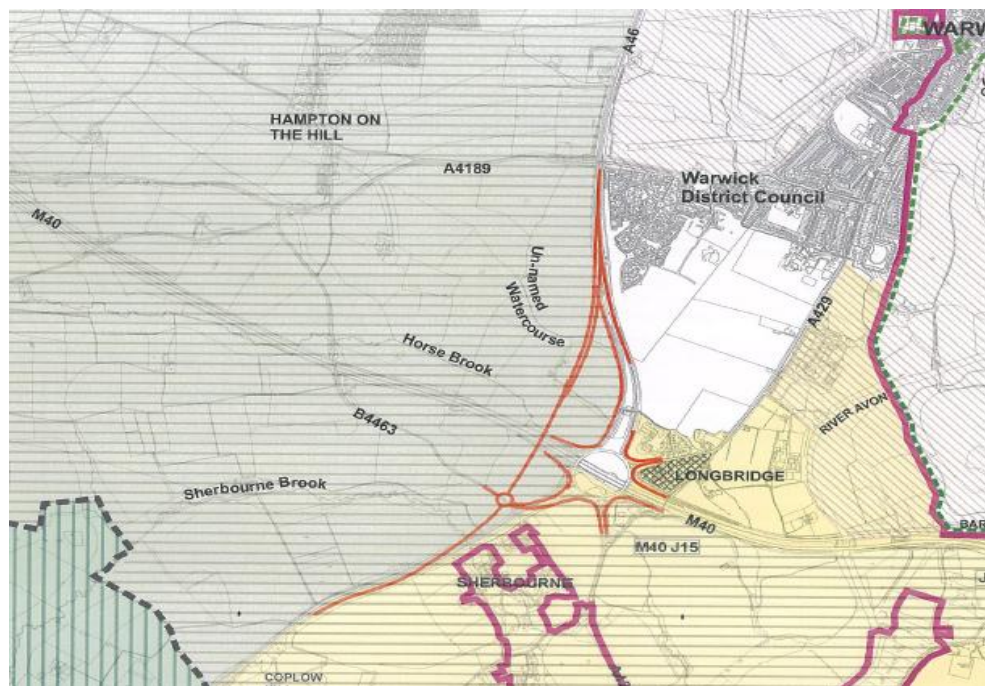
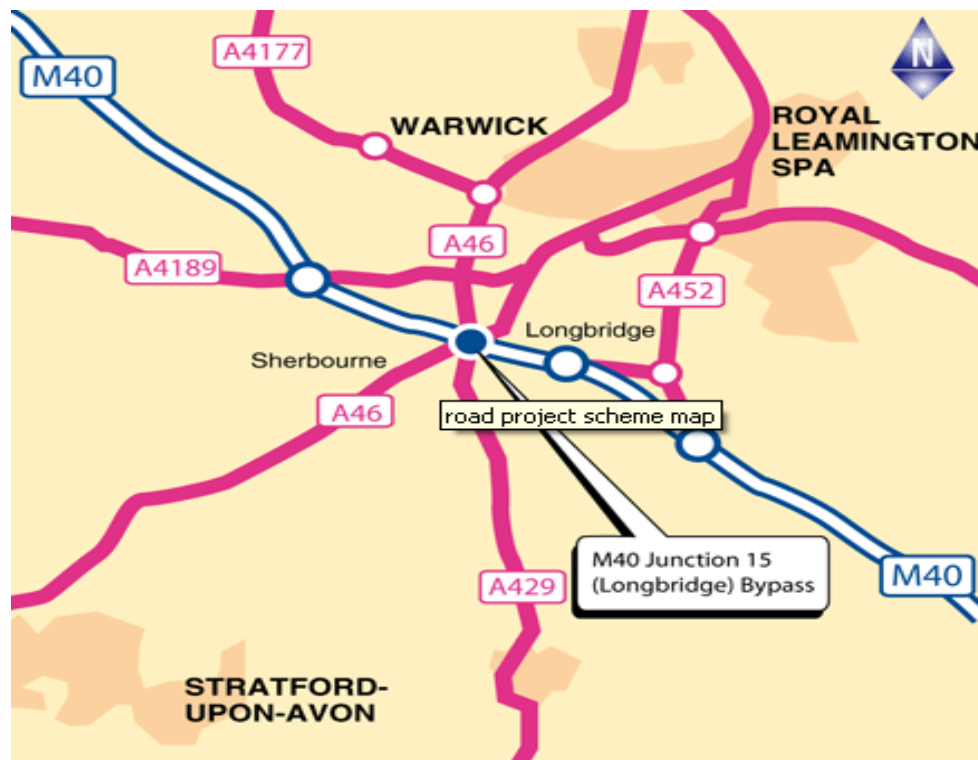


Fig. 8: The M40 Junction 15 improvements, the figure above shows the location of the M40 motorway in England, the figure below shows the location of the M40 Junction 15 improvement works (Highways Agency, 2011), the proposed project is shown in orange (M40 J 15 environmental statement, 2006)

The general design of monitoring programmes in EISs

Proposition post-EIA environmental impact monitoring programmes for each particular project

The case studies were reviewed to assess if any impact monitoring programmes were proposed for each project. Baseline monitoring which forms the basis of impacts assessment was also considered (Table 2). For most impacts baseline surveys which involved monitoring were carried out, with post-EIA monitoring proposed for some impacts such as noise and nature conservation for all three projects (Table 2). No monitoring programme was proposed for impacts on vehicle travellers for all three projects.

Monitoring intentions discussed in a separate, clearly indicated monitoring chapter/ section

The results show that for most impacts the monitoring intentions were not presented in separate sections in the EIS documents (Table 3). For all three projects the EIS documents state that the details of monitoring programmes would be contained in the CEMP. Separate sections the monitoring intentions of impacts were available for one, two and three impacts for A1 Dishforth to Barton, M40 Junction 15, and A3 Hindhead respectively. This represents less than half of the impacts discussed in all three projects.

Table 2: Proposed monitoring programmes, stage of monitoring in the project and the impacts to be monitored, based on the EIS documents of the three case studies

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1										
Baseline/survey	No	Yes	No	Yes	Yes	Yes	Yes	No	Yes	No
Construction	No	Yes	No	No	No	Yes	No	Yes	No	No
Operational	No	No	No	No	Yes	No	No	No	No	No
A3										
Baseline/survey	Yes	Yes	Yes	Yes	Yes	No	No	No	No	No
Construction	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No
Operational	No	No	No	No	Yes	No	No	No	No	No
M40										
Baseline/survey	No	Yes	Yes	No	Yes	Yes	No	Yes	Yes	No
Construction	No	Yes	Yes	Yes	Yes	No	No	No	No	No
Operational	No	No	No		Yes	No	No	No	No	No

Clear and specific commitments to monitor impacts in EIS documents

The results show that no specific commitments were made for the A1 Dishforth to Barton project, and the M40 Junction 15 had the most specific monitoring commitments in the EIS due to the inclusion of the outline CEMP in the EIS. The partial commitments refer to monitoring commitments being made but without all the details being provided (Table 4)

Scrutiny and public comment for monitoring programmes

There were no monitoring programmes that were put for scrutiny of public comment for the A1 Dishforth to Barton case study (Table 5). Only two of the discussed impacts in the EIS documents for the other projects had monitoring programmes that were actually in the EIS and therefore put forward for scrutiny and public comment. In general information about the monitoring of impacts was not detailed in the EIS documents. Instead the documents stated that the information would be provided in the CEMP. M40 Junction 15 project provided an outline CEMP in the EIS which included a commitments register.

Monitoring aims and objectives in the post-EIA era

No post-EIA monitoring aims and objectives were included in the EIS documents for the A3 Hindhead project. The M40 Junction 15 case study provided the most aims and objectives for post-EIA monitoring in the EIS documents (Table 6). The A1 Dishforth to Barton case study had only two impacts types for which clear aims and objectives for post-EIA monitoring were provided in the EIS documents. For nature conservation impacts of the latter case study, monitoring aims were given for badgers only and not for other species.

Table 3: Monitoring intentions in separate sections in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	No	No	No	No	Yes	No	No	No	No
A3	No	Yes	No	Yes	No	Yes	No	No	No	No
M40	No	No	Yes	No	Yes	No	No	No	No	No

Table 4: Clear and specific monitoring commitments in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	No	No	No	No	No	No	No	No	No
A3	No	Partial	Yes	Yes	Partial	No	No	No	No	No
M40	No	Yes	Yes	Yes	Partial	Yes	No	No	No	No

Responsibilities for monitoring

The table shows that the A1 Dishforth to Barton case study had one impact type where monitoring was proposed and the responsibility of monitoring given in the EIS documents (Table 7). The M40 Junction 15 case study had half of its impacts have the responsibilities for monitoring outlined in the outline CEMP. The monitoring of impacts in the post-EIA era, most of which has been proposed during the construction of the projects has been left to the contractors.

Parameters and indicators to be monitored

The results show that most parameters that would be monitored are not stated in the EIS documents. Only one impact type, noise for which monitoring was proposed had the parameters/ indicators to be monitored clearly stated in the EIS documents, for the A3 Hindhead case study (Table 8). Parameters/ indicators to be monitored are only given for the badgers for the nature conservation impacts of the A1 Dishforth to Barton.

Monitoring timeframes and spatial distribution and limits, scope of the monitoring

For most impacts the monitoring timeframes and spatial distributions were not included in the EIS documents (Table 9). In most case timeframes for monitoring of impacts were given as during construction and rarely during the operational phase of the different projects. The specific spatial limits of monitoring of impacts was not given for water and nature conservation impacts of the A3 Hindhead case study, this is illustrated as partial (Table 9). Where baseline monitoring was carried out as the basis of assessment of potential impacts, the timeframe and spatial limits of this type of monitoring was given in detail in the EIS documents.

Monitoring methods

Monitoring methods were not included in the EIS documents and where included they were partially described; (Table 10). For example cultural heritage would be monitored during the construction of the M40 Junction 15 using geotechnical methods, but the specific geotechnical methods that would be employed are not stated. The EIS documents for all three case study stated that the method statements or details of the methods to be employed in the monitoring of impacts would be included in the CEMP.

Table 5: Scrutiny and public comment for monitoring programmes in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	No	No	No	No	No	No	No	No	No
A3	No	No	Yes	No	Yes	No	No	No	No	No
M40	No	Yes	Yes	No	No	No	No	No	No	No

Table 6: Monitoring aims and objectives in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	Yes	No	No	Partial	Yes	No	Yes	No	No
A3	No	No	No	No	No	No	No	No	No	No
M40	No	Yes	Yes	No	Yes	Yes	No	No	No	No

Table 7: Monitoring responsibilities in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	No	No	No	No	No	No	No	No	No
A3	No	Yes	Yes	No	Yes	Yes	No	No	No	No
M40	No	Yes	Yes	Yes	Yes	Yes	No	No	No	No

Table 8: Parameters and indicators to be monitored in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	No	No	No	Partial	Yes	No	No	No	No
A3	No	Yes	No	No	No	No	No	No	No	No
M40	No	Yes	Yes	No	No	Yes	No	No	No	No

Table 9: Monitoring timeframes and spatial distribution and limits in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	Yes	No	No	Yes	Yes	No	No	No	No
A3	No	Yes	No	Partial	Partial	No	No	No	No	No
M40	No	Yes	Yes	No	Partial	Yes	No	No	No	No

Table 10: Monitoring methods in EIS documents

Project name	Impacts									
	Land use	Noise	Air	Water	Nature conservation	Cultural heritage	Landscape	Geology	Community effects	Vehicle travellers
A1	No	No	No	No	Partial	Yes	No	No	No	No
A3	No	No	No	No	No	No	No	No	No	No
M40	No	No	No	Partial	No	Partial	No	No	No	No

Construction Environmental Management plans (CEMP)

CEMP documents were provided for A1 Dishforth to Barton and A3 Hindhead improvement projects and a project environmental plan for the M40 Junction 15 project. A method statement for the environment in or near watercourses, gives details on the monitoring of water throughout the project. The A1 Dishforth to Barton CEMP gives more information on the monitoring of impacts than in the EIS. It also summarises the baseline conditions topics considered in the EIS. It gives information on the aims and objectives of monitoring impacts, those responsible for monitoring different impacts and their contact details, methods to be employed during monitoring (Table 11). For instance it refers to guidance that will be used in the monitoring of dust during construction and mitigating the effect of this. It also gives details for the methodology for archaeological monitoring of topsoil removal during construction. However some specifics are still omitted, such as the parameters that will be monitored (for water) and the frequency with which the monitoring will be done. The project environmental plan for the M40 Junction 15 gives less information than the outline CEMP in the EIS. The section on monitoring gives vague statements. It states that the environmental performance for the project will be continuously monitored by regular site Health Safety and Environmental inspections. However it goes on to say that these site inspections will be carried out by the Health Safety and Environmental Advisor, who will in conjunction with the Operations Management Team compile a monthly Health Safety and Environmental performance report. The methods statements that will be used to check environmental performance will be prepared by the Operations Management Team.

Environmental impacts in documents

The discussion of impacts was done following the EIA topics that are in the DMRB; however the A1 Dishforth to Barton case study also included a section in the EIS on cumulative impacts as a result of interaction of the project with other projects or roads in the area. Other EIA topics also included in all three projects but not considered in this study are: disruption due to construction and impact of the road project on policies and plans. The percentage of impacts to be monitored, is the percentage of impacts that were proposed or monitoring during the post-EIA era, during construction (Table 12).

Results from the questionnaire

Results were obtained from a short questionnaire, containing questions about post-EIA monitoring that had been done by the project members, answers were provided by the construction environmental managers of the projects. The short questionnaire which can be found in Appendix I, contains some questions that were addressed in the review of the documents that were provided and some questions that were not addressed in the review of the documents or for which information was not provided initially. Staff of the A3 and M40 case studies stated that financial resources had been set aside for the entire monitoring programme. The results from the impacts that were monitored during construction had an impact on mitigation measures applied in the projects, were used to measure the effectiveness of mitigation measures, and aid in environmental design where necessary. Periodic environmental reports, which at times incorporate the monitoring results, were not provided to the public for scrutiny or comment, though the public was informed of monitoring of vibration during the construction of the A3 Hindhead tunnel.

Table 11: Details of monitoring of impacts and mitigation measures in the CEMP documents

Project name	A1	A3	M40
Clear and specific commitments	Cultural heritage, ecology, landscape, watercourses, groundwater	In the PMP	Vague commitments
Monitoring aims and objectives	Cultural heritage, ecology, landscape, watercourses	Water	Not mentioned
Responsibilities for monitoring	Cultural heritage, ecology, landscape, watercourses	In the PMP	Inspections will be conducted by the Health, Safety and Environmental Advisor
Parameters to monitor	Cultural heritage, ecology (badgers), landscape, watercourses	Noise and vibration, water depth	Not mentioned
Timeframes and spatial distributions	Cultural heritage, landscape, groundwater	During construction for water – quarterly and monthly monitoring	During construction
Methods for monitoring	Cultural heritage, ecology, watercourses, groundwater - partial	Air – carbon emissions accounting, landscape, water	No information provided
Review of monitoring results	Cultural heritage, landscape, watercourses	Weekly meetings, monthly reports	Information provided
Responsibilities for reviewing	Cultural heritage, watercourses	In the PMP	By senior site manager
Comparison with standards	Groundwater, ecology watercourses	Water results compared with and discharge consent conditions	Yes
Response due to failure to comply	Groundwater, watercourses	Landscape, water, noise and vibration	Dust, noise and vibration
Procedures for response to failure	Groundwater, watercourses	In the PMP	Dust, noise and vibration

Table 12: Discussion of environmental impacts in documents

Project name	EIA topics	Description of impacts	Impacts monitored	% impacts monitored
A1	13	Significance and magnitude level	3	30
A3	12	Significance and magnitude level	5	50
M40	12	Significance and magnitude level	4	40

DISCUSSION

General/ main findings

The main findings from the study are that the EIS documents for the case study did not give adequate information on the monitoring of impacts after the EIA, notably during construction or in the operational phase of the projects. This is in line with results from previous studies, which have shown that EIA documents do not give adequate information on the monitoring of impacts during execution and operation of projects, and that little follow up by means of monitoring is actually carried out. The EIS documents referred to the CEMP for more detailed information on post-EIA monitoring. The CEMP documents showed that information that was provided to a satisfactory level was mainly on the responsibilities of monitoring. However the specific and detailed information on the methods to be employed during the monitoring and the detailed programmes for monitoring were not given. The information on the actual monitoring of impacts was hard to come by.

General review of the EIS documents

The EIAs carried out for all three case studies resulted in the production of comprehensive and detailed EISs. A lot of information was provided on the background of the projects, the criteria (level of significance and impact level) that were used to evaluate the potential impacts on the environment, and baseline conditions of the environment. The UK has got a lot of comprehensive guidelines and standards. The EISs comply with the specific guidelines that have been set out, for example the DMRB which gives specific guidelines on the assessment of impacts on the environment from road projects. Information on the monitoring of road impacts was mainly contained in the mitigation sections of the discussions of the different impact types. Generally there is a lot of information provided in these sections where applicable, however details are at times lacking both in the EIS and the CEMP. A personal viewpoint from this author is that the EIS documents are just too elaborate and provide too much information. Also judging from the lack of coherence between the EISs and the CEMPs for example in the A3 Hindhead case, some of these things are never carried out at the end of the day.

Explaining the results

Details of the monitoring of impacts in EIS and CEMP documents

Monitoring of impacts during the period after the EIA has been done and a project has received consent or approval, is recommended by the EU EIA Directive as good practice. The UK EIA regulation and other guidelines on the assessment of impacts of road projects such as the DMRB do not require the monitoring of impacts. The regulation however stipulates that there should be an environmental management plan,

with clear benchmarks and indicators for the implementation of the recommendations from the EIA process. However not much information is available in the EIS documents about the monitoring of impacts in the cases where monitoring has been suggested. The EIS documents give reference to the CEMP for more detailed information. The CEMP is compiled by the contractor; this is made easier by the Early Contractor Involvement in all three projects. Contractors are involved in the early stages of the project to aide in the design of the projects, and suggest mitigation measures that work from their previous experiences. This also ensures that changes in the projects later on are well catered for. The CEMP provided for the A1 Dishforth to Barton Improvements gave reasonably adequate or satisfactory information on the monitoring of some impacts. The CEMP provided for the A3 Hindhead Improvements provided less information with details of some information being referred to the Project Management Plan (PMP).

Monitoring plans, commitments and propositions

The information that was given in the EIS documents and CEMP about the monitoring of impacts was not adequate and did not account for a complete plan. For instance the EIS for the M40 Junction 15 (Longbridge) improvements contains an outline CEMP but the PMP that was provided gives even less information than the outline CEMP. Monitoring of impacts was mentioned and in some cases commitments were made. Monitoring intentions in the EISs documents were not discussed in separate sections, thereby demonstrating a low level of commitment to the actual monitoring that would be done later on. All three projects had less impact monitoring intentions discussed in separate sections in the EISs than the impact monitoring propositions that were made. A1 Dishforth to Barton Improvements case study had three impact types that were proposed for monitoring, that is, noise, cultural heritage and geology as shown in table 1. However of these only cultural heritage impacts were discussed in a separate section in the EIS (Table 2). Consequently cultural heritage impacts satisfied most of the criteria in the evaluation the CEMPs concerning monitoring of impacts (Table 11). This would suggest that the more information on monitoring that is given in the EIS documents, the more information will be provided in the CEMPs. It should be noted that the same impact type for the same case study failed in the other criteria that were used to evaluate the monitoring intentions in the EIS, notably aims and objectives and spatial distribution of the monitoring were not included.

The CEMP is based on/ or is an expansion of the recommendations of the EIS. If the EIS does not have a lot of information on monitoring, then the CEMP will even have less information, thereby compromising the implementation of the project environmental plan. But then there is the case of the M40 Junction 15 case study where the EIS gives more information on environmental and monitoring commitments and the project environmental plan that was provided barely touches on it. Another scenario could be no information in the EIS or the CEMP but with monitoring of an impact actually taking place. For example, in their response to the questionnaire that was administered, the A3 Hindhead project team conceded that landscape impacts (historic hedge bank within Boundless Copse and qualitative inspection of planting plots) were being monitored by quarterly inspections but this information was neither in the EIS or the CEMP of the project. This point is reiterated by Morris-Saunders and Arts (2004) who listed limited information and deficiencies in EIS as some of the major problems affecting the imple-

mentation of the recommendations of the EIA process. The latest POPE revealed that there are 'inconsistencies in the availability of monitoring information' with overall availability being poor for biodiversity impacts (Atkins, 2009). Only one provided copies of on-going monitoring information to be considered as part of the evaluation process. The reasons given included 'information archived and difficult to retrieve, staff changes since construction, post-construction monitoring reports unavailable at time of request' as stated by Atkins (2009).

The POPE of 2009 also showed that stakeholders were not well informed about issues such as post implementation biodiversity surveys from the Highways Agency. Lack of resources and data including information on monitoring was one of the reasons given by statutory consultees who had been involved in the initial design and appraisal process, when asked to comment on their opinion on predicted impacts and those that were observed (Atkins, 2009). It would also suggest that despite the advances that have been made in EIAs, they are still largely used as planning and regulatory tools in order to get consent for projects rather than as management tools. The results from the questionnaire also showed that there was little or no involvement of the public in the monitoring of impacts, with periodic/ regular environmental reports produced during construction not subject to public comment or scrutiny. Public participation can also improve knowledge about the environment and encourage in environmental protection in general (Şahin and Kurum 2009). However the A3 Hindhead team did well to provide annual water monitoring results to private water abstraction stakeholders and the local authority in the area.

Specific monitoring commitments were given in a separate section of the EIS, with monitoring aims and objectives clearly outlined. However monitoring responsibilities were not given. Other characteristics of a good environmental impact monitoring programme are: 'a cost estimate of the entire monitoring programme and the establishment of an information management system to define data analysis prior to data collection' (Asian Development Bank, 1997). These were however not included in this study, but because limited information on the monitoring of impacts was provided on the monitoring of impacts none of the documents reviewed contained this information. However the results from the questionnaire conceded that money had been set aside for the monitoring programmes.

The CEMPs that were provided included an outline of those responsible for implementing the recommendations of the EIS, as well as those who would review the reports generated from the implementation of the mitigation measures. Information such as the specific methods that will be used are not included in the CEMP, an outline of the monitoring programme, the frequency and consistency of monitoring that will be used was not given in the CEMPs. In general the information on the monitoring in the post-EIA era does not provide technical details of the monitoring that should be carried out. In their study of 16 projects in South Australia, Rafique Ahammed and Nixon (2005) concluded that the projects did not meet the recommendations of including technical details of monitoring programmes that would be carried out in the post-EIA era. Even the parameters/ indicators that would be monitored were not stated in the CEMP in some cases, the CEMP for A1 states that water testing will be carried out during construction, however the exact parameters that will be tested are not included, though a baseline monitor-

ing/ survey was carried out to determine existing conditions which should have provided a basis for the parameters to watch out for.

Baseline monitoring or surveys were carried out for most impacts that were suggested for monitoring in the EISs, as well as some impacts which were not suggested in the post-EIA era. This inventory of existing conditions formed the basis of the assessment of the effects that the projects would have on the environment, and are also a good starting point for monitoring of impacts in the post-EIA era, which can be used as quality assurance. Some of the baseline monitoring or surveys were carried out over a year in order to gather a lot of information on seasonal variation, for example the baseline surveys for ecology and nature conservation impacts of the M40 Junction 15 case study were done between July 2004 and August 2005 (Highways Agency, 2006b). An air quality survey was done for the same project for over more than a year between 12 September 2003 and 7 January 2005 (Highways Agency, 2006b). The EISs also came up with some clear bench marks, for example the spatial and temporal distribution of impact occurrence which would aide the actual monitoring of impacts.

The assessment of the impacts followed the DMRB guidelines, to assess the effect of the project one and fifteen years after the opening of the project. Most impacts were suggested for monitoring during the construction phase when the effects would be significant. Most impacts would then reduce in severity with time and in some cases the effect would be neutral or even positive if the mitigation measures are put in place and they are effective. Computer software programmes were employed at times, to project the effect that the project would have on the environment for example with noise impacts by considering the amount of traffic that would be flowing on the roads as time goes by. Of the 14 road projects that were evaluated in the Highways Agency POPE Meta-analysis report of 2009, impacts of projects had been predicted with an accuracy of 86% (Atkins, 2009).

Twelve of these projects are in their 'one year after' evaluation stage, despite the fact that 5 of the projects were opened between 2003 and 2004 and would have qualified for 'five years after' evaluation in the 2009 Meta report. The reason given was that the 'five years after' evaluations had not been completed. The EIA guidelines in the DMRB require that impacts such as landscape and townscape be predicted one year and fifteen years after the roads has opened, but the POPE process follows up on them one year and five years after. The latest POPE Meta report of 2009 included one 'five years after' project and one 'ten years after' project, the latter which was undertaken as a pilot for the POPE process. The POPE meta report uses a sample of projects. Seven of the projects used in the latest report were used in the original POPE report and 6 of them in the 2006 Meta report. However the Highways Agency lists 55 projects for which a POPE was done, at least at the 'one year after' stage, which could have been used to contribute improvements in transport appraisal and post-EIA follow up.

Monitoring was not considered to be important during the operational phase of the projects, and conclusions on the effects of the projects were made based on the results of conceptual models produced using computer software programmes. This could be because a POPE is carried out for all projects in the Programme of Major Roads. Nevertheless a reliable evaluation through the POPE exercise requires on-going monitoring especially after opening of a road. Monitoring during the operational phase was not suggested to confirm the results from the computer

modelling. The construction of a conceptual model such as that generated from the software that was employed in the EIA to project impacts such as noise, is good because it can form the basis of a good design of a monitoring programme (Asian Development Bank, 1997). At the same time it is on these impact predictions that impact compensation is based, which is used in project appraisal. Armour (1988) suggests that 'monitoring data can be used to refute or support claims for impact compensation'.

Another thing that was missing from the details that were provided on the monitoring of impacts from the project was a sampling design. Most of the impacts were considered for monitoring during the construction phase, the CEMP for the A1 Dishforth to Barton case study cultural heritage impacts would be monitored on regular site visits. The regularity of the site visits is not mentioned. The sampling designs of other impacts of the same project that were proposed for monitoring were not given in the documents that were reviewed. The A3 Hindhead case study gave information on the sampling design of groundwater, that is, 10 abstraction wells would be sampled quarterly and one would be sampled monthly, during construction, but monthly environmental reports that were provided did not give any information on this. However in answers given to the questionnaire, the A3 Hindhead team stated that results from the monitoring of impacts were indeed incorporated into regular reports. The development of a rigorous sampling design which reflects a consistent, systematic and statistically valid approach is important in designing a good environmental monitoring programme for impact monitoring (Asian Development Bank, 1997).

A system for quality control was also missing in the information that was provided on monitoring. Of the impacts that were proposed for monitoring in the post-EIA era for the A3 Hindhead case study only one had a quality assurance/ control system that was mentioned in the documents that were reviewed. This was surface water for which sampled effluent would be checked against discharge consent conditions for compliance. The discharge consent conditions are given in the CEMP for three parameters. General quality control plans were produced for the A1 Dishforth to Barton case study but details of these were not given in the CEMP. The establishment of a rigorous quality assurance and control mechanism is an important part of a well designed monitoring programme (Asian Development Bank, 1997; Van Niekerk, 2004). The A3 Hindhead and M40 projects, in the answers provided from the questionnaire, said that results from monitoring were used compared against standards and guidelines. This shows that inconsistency of the information given in the reviewed documents and that given when asked. Results from the monitoring can also be compared with those from the baseline survey or monitoring, to determine if the project has any effect on the components of the environment. Consequently results from the monitoring should also be compared with regulatory standards where applicable to ascertain if mitigation measures are effective enough.

Other things that can be done in order to have good impact monitoring programmes are: 'formulation of specific questions - defining assessment endpoints, establishment of an information management system, periodic review,' (Asian Development Bank, 1997). Where information was provided on the review of the results from the monitoring, the responsibilities were given to someone already working for the project, for example the M40 Junction 15 case study monitoring results would be reviewed by the senior site manager. This was also conceded in the an-

swers provided to the questionnaire; A3 Hindhead also did the same. This problem of self assessment is one of the problems faced in the monitoring of impacts from projects for which an EIA has been carried out; this was also concluded by McCallum (2004).

The criteria that were used to evaluate the EIS and CEMP documents tried to cover the characteristics of a good monitoring programme or plan. This included clear monitoring intentions with aims and objectives, monitoring methods and parameters or indicators to be monitored, just to mention a few. Some of the impacts types fared quite well in some of the criteria but failed dismally in other criteria, an example is the one given above of cultural heritage impacts associated with the A1 Dishforth to Barton improvements case study.

Monitoring of different kinds of impacts

On reviewing the case studies in this study it was noted that there were certain impacts that had monitoring suggested and monitoring commitments attached. These are shown in the results above. They are noise, water, air, nature conservation and cultural heritage to some extent. A review of EIA documents that was done for 16 projects by Rafique Ahammed and Nixon (2005) showed that most of the issues that were actually monitored after the EIA were air quality, noise and water quality including groundwater. Another review of developmental projects, including transport infrastructure by Braniš and Christopoulos (2005) looked at monitoring of impacts that was mandated by competent authorities after the EIS review and public meeting in the Czech republic, revealed that most of the impacts that were recommended for post-project monitoring were: noise, water, air, soil and biota. The POPE reports also focus on water and biodiversity in addition to landscape and cultural heritage.

The number of impacts and impact types that can actually be monitored or proposed for monitoring depends on the types of projects and their locations. The projects reviewed by Rafique Ahammed and Nixon in their study are only mentioned as development projects for which an EIA was required. Project type and specific location may have a bearing on the impacts or effects of the project that will need to be monitored. An example can be taken from the projects that were reviewed in this study. The A3 Hindhead improvements case study is located in an area with an SSSI, the Devil's Punch Bowl – a historic nature conservation site, for this reason nature conservation impacts were proposed for monitoring both during the construction and operational phases of the project. The M40 Junction 15 project also proposed monitoring of the same impacts during construction and operation of the project because protected species were found in the area during ecological surveys that were done to gather baseline information.

In general social impacts such as community effects and vehicle travellers were not proposed for monitoring in all three projects. Other impacts not considered for monitoring were land use and landscape. This is not to say that monitoring could not have been suggested for these impact types. One of the rationales of impact monitoring as stated by Armour (1988) is that 'monitoring can detect unanticipated problems and signal the need for corrective action' and can be used 'as a means of assessing the effectiveness of mitigation measures'. She goes on to say that regardless of how impact prediction is carried out, few impacts can be predicted with certainty. Effects of the projects on vehicle travellers can be confirmed by continuous monitoring when the projects are operational rather than just relying on computer software programmes that

project a reduction in congestion, for instance. Conclusions that have been drawn from previous studies on the reason of lack of social impact monitoring include: knowledge constraints and reluctance on the part of affected/ interested communities to cooperate in further data collection (Armour, 1988). Generally social impacts are difficult to assess owing to the fact that there is risk associated with the need to rely on the subjective inputs of those being monitored, therefore social impact assessment requires risk assessment (Armour, 1988; Becker, 2001). Social impacts such as community effects and vehicle travellers are revisited in the POPE exercise which determines if the objectives of the project such as the decrease in congestion have actually been met.

Monitoring impacts such as changes in landscape or community effects can be done but it may require a long time to assess the effects of the project. In the same article Armour (1988) also concluded that the community resistance to projects in their backyards is often rooted in the concern that the serious problems that are associated with these projects are the ones that creep up gradually and can go unnoticed for a long time. However a 'one year after' opening POPE exercise revealed that most mitigation measures were implemented as expected for landscape effects, but in some case it was too early to say if they had been successful (Atkins, 2009). The monitoring that was suggested in all three projects seemed to focus on the more immediate and direct effects of the project. This is illustrated in Table 1 which shows that two of the projects, A1 Dishforth to Barton and A3 Hindhead improvement case study had only one type of impact that they had proposed for monitoring during the operational phase of the project, notably nature conservation. The provision for monitoring of impacts was mainly incorporated for direct, short-term environmental impacts rather than long-term social impact monitoring. Monitoring of direct short-term impacts would satisfy the WebTAG environmental sub-objectives. There seems to be a difficulty in incorporating long-term monitoring plans/ programmes in the project development timetable. Harrington and Canter (1998) also conceded that where monitoring was done, it was of short-term impacts and not of long-term impacts. Social impacts such as community effects and vehicle travellers were not proposed for monitoring in the post-EIA era, however baseline surveys were carried out for impacts on community effects in the case of the A1 and M40 case studies. As a result they did not satisfy all the criteria that were used to evaluate the proposition of post-EIA monitoring.

Another short-coming to take note of was the fact that the monitoring was proposed for impacts that would result from the projects only, limited consideration was made for cumulative impacts. Where it was done, it was an assessment of how the project would affect policies and plans, such as those of local authorities in the study areas. Traditionally cumulative impacts are not addressed well in EISs. This is in line with a study of 30 EIS reviews by Burriss and Canter (1997) who concluded that cumulative impacts did not receive detailed attention, and where they were mentioned they were addressed in a qualitative manner without clear delineations of spatial and temporal study boundaries. They concluded that this was due to either the absence of specific requirements or uncertainty as to what to address. The A1 EIS states that there would be cumulative land use and agricultural impacts from the proposed A1 project in conjunction with another project (A684 Bedale / Aiskew / Leeming Bar Bypass) that was proposed in the vicinity of the A1 Dishforth to Barton proposed route, but that these were not known and therefore could not

be assessed at the stage when the EIA was done. Other reasons resulting in the deficiency in documentation of cumulative impacts are lack of knowledge and limitations in methodologies and procedures (Cooper and Canter, 1997; Wärnäck and Hilding-Rydevik, 2009). It is important to address cumulative impacts in EISs because they can be a determining factor of the overall significance of the impacts that will result directly from the project and ultimately whether a project gets consent or not.

Incorporation of WebTAG environmental sub-objectives in the EIS documents

WebTAG environmental sub-objectives were incorporated well in the EIS documents. This was mainly done in the mitigation section of each EIA topic. For example A3 Hindhead the project would take land that will affect habitats of animals. The mitigation measures that have been proposed are alternative habitats will created at other locations favourable to the affected animals. This reflects the projects desire to support biodiversity is incorporated in the EIS. In some cases or for some impacts the incorporation of the WebTAG environmental sub-objectives was done in the design of the project. All the projects aim to reduce congestion of traffic on the roads. The WebTAG environmental sub-objective; to improve journey ambience has been incorporated in the design of the project. Journey ambience would be improved by widening the roads to reduce driver stress caused by congestion. Some of the environmental issues that were discussed in the EIS documents do not have supporting WebTAG environmental sub-objectives, such as geology and landuse. WebTAG environmental sub-objectives were followed up in the latest POPE, with particular attention being paid to heritage, biodiversity, water quality and landscape.

Monitoring of significant impacts to meet WebTAG environmental sub-objectives

Some of the impacts that were assessed to have an adverse impact were proposed for monitoring in the post-EIA era. For example nature conservation impacts have been proposed for monitoring for the A1 Dishforth to Barton case study, for some species because the project will have a minor negative impact on the biodiversity of the area, this is shown in Table 2. However some impacts that would have a negative effect, and which the mitigation measures would not be able to alleviate were not proposed for monitoring. For instance the A1 Dishforth to Barton case study will result in increased severance by non-motorised road users but no monitoring of this severance has been proposed. Most of the post-EIA monitoring of impacts that has been proposed in the EIS documents will be during the construction phase, and very few impacts have been proposed for monitoring in the operational period when the project is in use. The DMRB gives guidelines on predicting impact significance/ magnitude for the different impacts that need to be assessed. However monitoring of impacts should verify the significance and magnitude of impacts rather than monitoring those impacts that have been predicted to be significant by the EIA, because some impacts such as noise are predicted using conceptual models. Even where mitigation measures have been proposed sometimes there is no follow-up that will be done to make sure if they are working. All the projects will affect the landscape in some way for which planting of vegetation is a common mitigation measure but there is no follow-up to see if this will be enough. The selections of parameters or indicators to be monitored are motivated by the need to meet the WebTAG environmental sub-objectives.

Integration/ System/ Holistic perspective of environmental impacts of projects

Environmental impacts of the projects are treated as individual issues. The EIS documents do not integrate the environmental impacts that will arise from the construction of the projects. The environmental impacts are integrated to some extent with social and economic impacts of the project. The projects are also assessed in terms of their impacts on the comprehensive national, regional and local policies and plan on transport, land use and environment, just to mention a few. The projects were considered to be beneficial or neutral in most cases, though the overall assessment on policies and plans does not mean that a project does not have adverse effects. For example a project can be said to have an overall positive effect on the environment even if it results in the loss of woodland.

In volume 11 of the DMRB, assessment of impacts is divided into EIA topics. These are: air quality, cultural heritage, landscape, nature conservation, geology and soils, materials, noise, effects on all travelers, community and private assets, road drainage and the water environment. The impacts of a road project in the EIS are clustered in these groups. Each EIA topic incorporates a number of specific impacts. For instance the noise EIA topic encompasses traffic noise levels, ground-borne vibration and airborne-induced vibration. There is no separate section in the respective EISs that specifically discusses social and economic impacts. The EIS documents are mainly concerned with the direct impacts of the projects that they have been compiled for. Most of the EIA topics which are prescribed by volume 11 of the DMRB, assessment of impacts are environmental issues; social issues are integrated through discussions on the effects on all travellers or community effects, including pedestrians and cyclists; air quality and noise. Economic impacts are also mentioned in sections on vehicle travellers because the projects will result in improved journey ambience even for economic purposes such as the transportation of goods across the country. Economic and social issues are also mentioned in the discussion for the basis of the projects which have been proposed to ease congestion on the roads thereby reducing journey times to improve economic efficiency.

Limitations of the study

The major limitation of this study is that the method of assessment used in reviewing the EIA documents was largely personal discretion. Some criteria were easy to evaluate whilst others were not. For example, on determining clear and specific commitments to monitor impacts in the documents, a simple statement can be considered as a commitment by one reviewer, and yet another may not consider this as a commitment. Another limitation which made it difficult to validate the proposition of monitoring of impacts in the EISs and in the CEMPs was the lack of available data on the actual monitoring that may have taken place in the study areas of the case studies.

Opportunities for future research

Many studies have been done concerning the monitoring of impacts after the EIA. More often than not conclusions are drawn that there is little or no monitoring that is being done of impacts that are associated with the project during construction or during the operational phase of the project. Details of specific location of these projects or even project types are not given. There is need to carry out more project specific studies, that is, monitoring of impacts of similar projects with reasons given of why the monitoring specific impacts was not done for the pro-

jects. The proposition of monitoring of impacts in the EIS depends on the project type and its associated impacts as well as the location of the project. Other factors may also have an effect on this. Further research is also required on why monitoring of impacts is still not included in most EIA regulations of most countries, including developed countries such as UK, even though research has demonstrated the need and importance of monitoring. The EU EIA regulation states that monitoring is not mandatory but is recommended as best practice. Most countries in the EU are still to adopt best practice. Different monitoring strategies can be adopted for the different impact types arising from the projects. Environmental impacts tend to require a more scientific or technical approach where as social impacts require a different approach. An attempt can also be made to come up with a template or a standardised criterion to be satisfied where monitoring of impacts is required. Standardisation or the use of manuals in environmental impact assessments has worked well in the UK; the compliance of the projects with the DMRB guidelines and recommendations is evident through out the EISs. This can also make the availability of monitoring information more readily available to support other post-EIA evaluations such as POPE.

CONCLUSIONS

By reviewing EIA documents from a specific infrastructure development sector, that is roads; this study gives an insight into the monitoring propositions that are made for road projects. The UK having an extensive set of guidelines and standards, with specific EIA guidelines for road projects and transport appraisal was an interesting location, to see how transport appraisal objectives are met through monitoring intentions of project impacts. Clearly monitoring of impacts in the post-EIA era is crucial to follow-up on the recommendations that have been made in the EIA. Direct, environmental impacts are mainly targeted for monitoring after the EIA as opposed to indirect, social, and cumulative impacts. It can therefore be concluded that WebTAG environmental sub-objectives are followed up in the post-EIA era by monitoring, whereas social sub-objectives are not, at least where road projects are concerned. Whilst impacts that arise from a project depend on the type of project, location of the project and, the construction involved. More research is required in other types of infrastructure development projects to determine patterns of impact monitoring to further substantiate the argument for post-EIA monitoring. More needs to be done to address the inaccuracies between monitoring intentions in EIS and CEMP, and to make monitoring of impacts part of the EIA legislature.

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APPENDIX

Appendix I: Short Questionnaire for project team members

Did you set aside any money for the impacts that you intended to monitor **or** was there a cost estimate for the entire monitoring programme?

Did you involve the public in any of the monitoring that you did/ have been doing?

Was the data from the monitoring of impacts reviewed by an independent agency/ consultancy?

Do you have any information management system to help you carry out data analyses?

How often are monitoring results reported and reviewed?

Do these results have an impact on mitigation measures?

How are the monitoring results/ data used?

Are they compared with a standard or guideline?

Are monitoring results incorporated into periodic/ regular environmental reports about the project execution?

Are periodic/ regular environmental reports about the project execution provided to the public for public comment and scrutiny?