Sustainable Construction, Maintenance and Operations

Implementing and Environmental Assessment Approach

By

C4S at TRL Limited and Halcrow

Clients Project Reference Number
HTRL 404(387)

UNPUBLISHED PROJECT REPORT

TRL Limited

UNPUBLISHED PROJECT REPORT UPR 15/05/2008

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Draft 1

By C4S at TRL Limited and Halcrow

Prepared for: Project Record: 404(387) HTRL and Scoping Study for Implementation of Site Waste Management Plans

Client: Highway Agency Division, (Matthew Winter)

	Approvals
Project Manager	R Greenwood
Quality Reviewed	J M Reid

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Executive Summary

This report represents the outputs of a desk based review to outline an approach to assess the potential impact of Highways Agency (HA) projects in terms of waste and resource efficiency.

The HA is responsible for the construction, maintenance and operation of the strategic trunk road network. Construction and maintenance includes the building of new, improvements to existing and ongoing maintenance of all roads and structures (bridges, tunnels etc.). Construction, maintenance and operation activities on the strategic trunk road network result in the use of a large amount of raw materials and energy and additionally generate large quantities of waste.

Delivering efficiency improvements is an important part of the wider Government agenda. There are a number of current and impending national and European legislation and policy statements (including internal HA) that are acting as 'drivers' for the HA to implement an environmental assessment type approach for waste and resource efficiency. The two key drivers for the HA are Securing the Future – UK Government sustainable development strategy (2005) and Council Directive 85/337/EEC as amended by Council Directive 97/11/EC on the assessment of the effects of certain public and private projects on the environment

In 2005 the UK Government launched its strategy for sustainable development: Securing the Future – UK Government sustainable development strategy. The strategy focuses upon four agreed priorities, the first three of which have direct relevance to this review. The strategies are; 1) Sustainable Consumption and production, 2) Climate Change, 3) Natural Resource Protection 4) Sustainable Communities. This strategy is a clear signal of the Government's intention to integrate the principles of sustainable development into wider policies and legislation and the requirement for government agencies to reflect these commitments in their work and demonstrate an assessment and implementation framework within which these factors can be considered.

Council Directive 85/337/EEC as amended by Council Directive 97/11/EC on the assessment of the effects of certain public and private projects on the environment (as implemented in the UK through Section 105A of the Highways Act 1980 and by the Highways (Assessment of Environmental Effects) Regulations 1999 as amended by the Highways (Environmental Impact Assessment) Regulations 2007) provides a requirement for projects that fall within the requirements to collect baseline on the natural resources and waste that a particular project produces, and to assess the impact of these characteristics on the environment.

At a topic level legislation such as Site Waste Management Plan Regulations (2008) and proposals through the National Waste Strategy (2007) and the draft Climate Change Bill (2007) are driving a greater consideration of waste and energy as a resource and the preservation of that resource

The HA have produced a number of policy statements relating to waste and resource efficiency. The HA Business Plan (2007/08) and Sustainable Development Action Plan (2007/08) are the key internal policy drivers for the HA. Both documents recognised the impact that HA operations have on sustainability and provide actions to help deliver a more sustainable approach.

The HA and its Service Providers have an overarching responsibility to *"minimise the impact of the trunk road network on both the natural and built environment".* To assist in the identification and minimisation of impacts, at the design stage of a project, the HA has published the Design Manual for Roads and Bridges (DMRB). Volume 11 of the DMRB provides guidance to HA and it's Service Providers on the environmental assessment of trunk

road schemes, including motorways. Volume 11, first published in 1994, has evolved incrementally in response to legislation and policy drivers and as reflection of operational needs. Unlike other environmental topics such as biodiversity, landscape and ecology etc environmental guidance relating to waste and resource efficiency has not been developed by the HA. Within other parts of DMRB the majority of guidance has focussed on conservation and reclaimed materials (DMRB Volume 7).

A review of the key drivers identified that in order to be able to demonstrate performance and meet policy targets requires the HA to consider a number of approaches to minimise the impact of its operations including the development of an assessment framework whereby impacts, associated with options or a preferred route, can be identified, their significance assessed and appropriate mitigation applied. As with all policy there is a need for lower level guidance outlining how the policy is to be implemented in both construction and management of the Strategic Trunk Road Network. This review has identified a lack of current HA guidance to implement legislation and policy (including HA) commitments. In order to effectively deliver against commitments there is a need to provide clear guidance to HA representative and Service Providers to ensure an effective 'bottom up' delivery of overarching policy through schemes and network areas, to include guidance on assessment, design and management.

This review has identified a number tools, products and methodologies that currently exist and can be used to support the development of an assessment process for the environmental impact of HA projects. The review identified that of the tools, products, methodologies reviewed Life Cycle Assessment (LCA), Environmental Profiles and Environmental Product Declarations offer the greatest benefit to the HA. In addition the growth in use of CO_2 and carbon foot printing tolls, including the development of the HA CO_2 methodology, provides an increasingly robust approach, albeit limited in scope, to assessing environmental impacts. Products such as CEEQUAL also provide a high degree of rigour in assessing the use of resources and management of waste,

Of the tools, products and methodologies reviewed it is clear that there is currently no one single methodology available in the marketplace that provides the holistic assessment required for HA projects. Therefore the development of an assessment approach for the HA should be based on combining outputs of the appropriate tools, products and methodologies to assist in the delivery of a bespoke solution.

A review of existing project examples was undertaken with the purpose of determining how sustainable construction issues are currently dealt with within the EIA sector. A number of international and national assessments were reviewed to determine how widely assessments considered impacts of waste and resource efficiency and the different methodologies adopted that could benefit the development of a HA process. The assessments considered were either available internally (within Halcrow) or publicly available on line.

The review of project examples identified that whilst consideration of waste is slowly becoming part of the EIA process, there is little guidance available. As such companies, at present, are developing individual approaches, including significance criteria, to determine project impacts. Approaches developed, where in the main, not considered to be robust and often did not contain any significance criteria. The review identified that the consideration of material or energy use is not widely undertaken in the UK or overseas, although the Environment Agency is now starting to consider these issues.

A suggested approach that could be adopted by the HA for the assessment of significant impacts on the receiving environment as a result of resources used and waste arising in the construction and operation of the proposed Strategic Trunk Road Network has been developed . The approach outlined draws upon information gathered as part of the review

of national assessment guidance and methodologies and a review of approaches to assessment as carried out by other organisations This approach is not intended to be definitive but to act as a framework for discussion both internally within the HA and with Service Providers to validate its operational alignment.

It is recommended that the assessment is developed under an umbrella heading 'Material Management' with sub topic guidance on waste management, energy use and material use/management. The sub topics are identified separately because techniques for their study require different specialist approaches. The contractor would be required to carry out an impact assessment on each sub topic but report on the overall impact resulting from the project. The approach developed provides a framework of stages by which impacts are assessed. These stages, best on best practice, are as follows:

- Obtain environmental baseline information;
- Obtain information on the proposed project; and
- Assess the impact of the project on the baseline environment.
- Identify suitable mitigation measures;
- Identify suitable enhancement measures(if possible);
- Re-assess the impact in light of the mitigation and,
- Re-assign the significance of the residual (i.e. after mitigation) impact.

A summary assessment approach for material use, energy and waste is provided outlining key considerations for each of the stages, identified above and existing tools, products and methodologies that are likely to be of use in the development of the assessment. With each subtopic some suggestions on significance criteria is included, but it is noted that further work is required.

The development of this approach has identified a number of limitations and considerations that will need to be considered in the next phase of development. These issues are not definitive but are as a result of the preparation of this report. Key issues relate to the spatial extent of the assessment, likelihood of available information to ensure a robust assessment at Scoping, Simple and Detailed stages, the development of a significance criteria against which the magnitude of impact can be assessed and ensuring that the assessment process developed is 'do-able'.

A number of recommendations are made to ensure that the assessment process produced is both robust and 'fit for purpose'. The key recommendations made by this review are as follows:

- During the next stage of this project a Workshop should be undertaken with selected individuals (HA Volume 11 Managing Editor, HA Waste Focal Point, HA Regional Environmental Advisors and Service Provider 'Waste Champions'). The purpose of the workshop will be to discuss and agree an approach on geographical scope and non-geographical scope, how to deal with unknowns, and arguably most importantly, how to keep the process simple (do-able). In addition, the workshop should assist in the development of the significance criteria. It is recommended that following this workshop, attendees are retained and act as a project steering group to assist with the development of any assessment process. In this way it will increase the 'fitness for purpose' of the assessment process developed.

- This review has identified that there are a number of current methodologies available. It is believed that a number of components of these methodologies are either directly transferable or are adaptable to meet the needs of the HA. It is recommended that prior to the next stage of development discussions are held with HA procurement and Model Contract for Highways Works (MCHW) Managing Editors to determine if and how LCA, Environmental Profiles and Environmental Product Decelerations can be incorporated in the

current HA processes. In addition it is recommended a full review of the capabilities of the HA CO2 Calculator is undertaken to determine how it could be incorporated into the assessment process. This review should be undertaken as a comparative exercise including WRAP CO2 Estimator, Environment Agency CO2 Calculator for Construction Activities and DfT CO2 Calculator.

- Prior to the development of the assessment process the approach to assessment carried out by other organisations is investigated further. A review of recent HA environmental assessment (not fully available at the time that this project was undertaken) would be beneficial to determine if any best practice within HA service providers exists. In addition, discussions with the EA could be useful.

- To ensure that there is alignment with WebTAG it is recommended that early input into the NATA refresh, currently ongoing, is required to consider these issues.

1 Introduction

The Highways Agency (HA) is responsible for the construction, maintenance and operation of the strategic trunk road network. Construction and maintenance includes the building of new, improvements to existing and ongoing maintenance of all roads and structures (bridges, tunnels etc.). Construction, maintenance and operation activities on the strategic trunk road network result in the use of a large amount of raw materials and energy and additionally generate large quantities of waste.

The HA and its Service Providers have an overarching responsibility to *"minimise the impact of the trunk road network on both the natural and built environment".* To assist in the identification and minimisation of impacts, at the design stage of a project, the HA has published the Design Manual for Roads and Bridges (DMRB). Volume 11 of the DMRB provides guidance to HA and it's Service Providers on the environmental assessment of trunk road schemes, including motorways. Volume 11, first published in 1994, has evolved incrementally in response to legislation and policy drivers and as reflection of operational needs. Currently there is no specific assessment guidance provided within DMRB Volume 11 guidance relating to sections on waste or resource efficiency

Delivering efficiency improvements is an important part of the wider Government agenda. In 2005 the UK Government launched its strategy for sustainable development: Securing the Future – UK Government sustainable development strategy. The strategy focuses upon four agreed priorities, these are; 1) Sustainable Consumption and production, 2) Climate Change, 3) Natural Resource Protection 4) Sustainable Communities[1]. This document sets out how the Government aims to meet these priorities, the guiding principles and the indicators to allow an overview of sustainable development[2]. At a topic level legislation such as Site Waste Management Plan Regulations (2008) and proposals through the National Waste Strategy (2007) and the draft Climate Change Bill (2007) are driving a greater consideration of waste and energy as a resource and the preservation of that resource. In order to be able to demonstrate performance and meet policy targets requires the HA to consider a number of approaches to minimise the impact of its operations including the development of an assessment framework whereby impacts, associated with options or a preferred route, can be identified, their significance assessed and appropriate mitigation applied.

1.1 Scope of this report

This report is the output of a desk based review to outline an approach to assess the potential impact of HA projects (new build and maintenance) in terms of resource use, waste production and energy use. This research was undertaken in 4 discrete stages as follows:

Stage 1: A review of the current drivers behind the need for HA to produce bespoke assessment guidance
Stage 2: A review of current HA guidance on the assessment of waste and resource efficiency
Stage 3: Identification and review of assessment methodologies used in other types of developments
Stage 4: Develop an outline approach that can be used by the HA to assess impacts of projects in terms of waste and resource efficiency

This report provides the baseline on which further work will be undertaken in developing an approach to assess the impact of waste and resource efficiency.

[1] Ibid
[2] Ibid p21

1.2 Structure of this report

This report is divided into 6 sections. Section 1 of the report outlines the introduction and scope of the report. Section 2 of this report identifies legislation and policy (including EU, National and HA) that are acting as drivers for the HA to develop an assessment approach for waste and resource efficiency. Section 3 provides a review of the current and impending advice connected to the assessment of waste and resource efficiency that is provided to HA representatives and Service Providers. Section 4 provides information on the extent that assessment guidance is currently provided at the international level and at national level and provides a summary of a review of Methodologies, in the form of Products, Schemes and Applications, that have been developed and could assist the HA in the development of an assessment. Section 5 considers existing project examples that demonstrate how sustainable construction issues are currently dealt with within the EIA sector. Finally, Section 6 outlines a suggested approach that could be adopted by the HA for the assessment of significant impacts on the receiving environment as a result of resources used and waste arising in the construction and operation of the proposed Strategic Trunk Road Network.

2 Environmental Assessment – Key Drivers

There are a number of 'drivers' that are either currently implemented, through legislation and/or policy, or are on the horizon, that are acting as either direct or indirect drivers for the HA to implement an environment assessment type approach for material and energy use and waste management. This section considers these key drivers in terms their relevance to the HA. This section starts with a review of key legislation at both European and National level. It also considers relevant European and National policy drivers that exist through strategies and plans. Finally, this section considers the HAs own policies, plans and existing guidelines, relevant to waste and resource efficiency, and the commitments that have been made through them.

2.1 Legislation and Policy Drivers

2.1.1 Legislation

2.1.1.1 Environmental Assessment

Council Directive 85/337/EEC as amended by Council Directive 97/11/EC on the assessment of the effects of certain public and private projects on the environment.

This directive is implemented in Highways Agency Projects through Section 105A of the Highways Act 1980 and by the Highways (Assessment of Environmental Effects) Regulations 1999 as amended by the Highways (Environmental Impact Assessment) Regulations 2007.

This legislation is the main legislation under which Environmental Impact Assessments (EIAs) are carried out in the UK. Under this legislation the characteristics of a project must be considered having regarded to (*inter alia*):

- The use of natural materials;
- The production of waste; and
- Pollution and nuisances.

This could be interpreted in two ways; one is that the characteristics of the project must be assessed when considering each topic area (e.g. impact on using natural resources on ecology, soils, landscape etc.) or that an assessment of the above must be carried out as part of the EIA assessment. Up to now it has been assumed that the former is the appropriate interpretation. However 'waste' is now often considered as a separate section in the EIA process, but this is believed to be driven more by the requirements of Local Planning Authorities than due to EIA legislation. It is widely considered that the increased prominence of issues such as climate change and sustainability will mean that it will become a standard requirement for all EIA projects (where it is considered there will be a significant effect on the environment) to consider material and energy use associated with construction and operation and any waste arising.

Under the legislation a description of the likely significant effects of a proposed project on the environment is required. This should cover the direct and indirect effects, secondary, cumulative, short, medium and long-term, permanent and temporary, positive and negative effects of the development, resulting from:

- The existence of the project;
- The use of natural resources;
- The emission of pollutants; and
- The elimination of waste.

It is therefore clear that information on these needs to be obtained and applied to a robust transparent methodology to enable an environmental assessment to be carried out, not only at the project level (within the application boundary and surrounding area) but also potentially where any impacts may occur.

Driver: There is a clear driver through this legislation to collect baseline information on the natural resources and waste that a particular project produces, and to assess the impact of these characteristics on the environment.

2.1.1.2 Climate Change

Kyoto Protocol

The Kyoto Protocol is a protocol to the international Framework Convention on Climate Change with the objective of reducing greenhouse gases that cause climate change. It was agreed on 11 December 1997 and has been ratified by the UK government. The UK is currently committed to cutting its carbon emissions by 12.5% from 1990 levels by 2012 under this protocol.

Climate Change Bill (draft)

The Climate Change Bill, published in March 2007 in response to the Kyoto Protocol, is a draft law aimed at moving the UK to a low carbon economy and society. It is a statement of intent from the Government that it will create a new legal framework to underpin the UK's contribution to tackling climate change. Under this bill the net UK carbon account for the year 2050 will be cut to at least 60% lower than the 1990 baseline. This bill also has an intermediate target of between 26% and 32% by 2020.

Driver: Energy is consumed in all HA activities including the extraction, processing, manufacturing and transportation of construction materials and products, vehicles that travel on the network once it is operational, and the ongoing maintenance and operation requirements including such things as messaging signs and lighting. There is a pressing need to show energy minimisation by all industries and individuals. The Climate Change Bill signals the UK Governments intent to address climate change which may in the future set specific targets applicable to the HA which would need to be taken into consideration in the assessment of the characteristics of a project and the resulting effect on the environment.

2.1.1.3 Waste Management

Council Directive 1999/31/EC on the Landfill of Waste (known as the Landfill Directive)

This directive is implemented in the UK through "The Landfill (England and Wales) Regulations 2002"

The Landfill Directive aims to improve standards of land filling across Europe, by setting specific requirements for the design, operation and aftercare of landfills, and for the types of waste that can be accepted at landfill sites. The Landfill Directive also implements the European Waste Catalogue (EWC), which categorises waste into 20 main groups and approximately 900 codes. Sites have been classified into one of three categories: hazardous, non-hazardous or inert, according to the type of waste they receive. Pre-treatment of wastes prior to landfilling is a requirement. The Directive requires a reduction of biodegradable waste sent to landfill.

Clean Neighbourhood and Environment Act, 2005

This Act provides local authorities, parish and community councils and the Environment Agency with more effective powers and tools to tackle poor environmental quality and anti-social behaviour. Section 54 of the Act gives the Secretary of State the power to make regulations that require contractors to prepare a written Site Waste Management Plan (SWMP) for the management and disposal of waste created during construction and demolition work. The plans will identify waste minimising opportunities during the design phase, the types and volumes of waste expected to arise on site and the options for reusing or recycling such waste. SWMP came into force on 6th April 2008.

Driver: The purpose of a SWMP is to provide a framework to assist in reducing material use or waste on site. The information contained in SWMP is initially provided at the design stage of a project and then updated frequently as part of the construction of a project. The SWMP itself only contains and reports on information, the SWMP is not directly a process whereby alternatives are considered and decisions made. It is the environmental assessment approach that provides this framework. As such there is a close association between an assessment process and a SWMP. Work undertaken as part of a waste assessment will directly influence the information provided in a SWMP providing the baseline at the design stage against which the project will be measured.

Soil Framework Directive (unadopted)

The Soil Framework Directive was proposed on 22 September 2006 when the European Commission adopted the Thematic Strategy for Soil Protection. The overall objective of the Soil Thematic Strategy is to ensure the protection and sustainable use of soil, based on the following guiding principles:

- preventing further soil degradation and preserving its functions; and
- restoring degraded soils to a level of functionality consistent at least with current and intended use, thus also considering the cost implications of the restoration of soil.

A Framework Directive was proposed by the Commission as the best means of ensuring a comprehensive approach to soil protection. However, at the EU Environment Council meeting on 20 December 2007, Environment Ministers were unable to reach political agreement on European Commission proposals for an EU Soil Framework Directive.

A Soil Strategy for England (2008)

A Soil Strategy for England is currently being developed to take forward the 'First Soil Action Plan for England' (2004-06). It does not appear to be directly linked to the proposed Soil Framework Directive, though both are concerned with the protection of soil as a resource. The Soil Strategy for England will take stock of progress under the Action Plan, as well as taking forward emerging priorities for soil protection on maintaining soil carbon and the recycling of organic wastes to land. Defra plans to go out for consultation on the Strategy in early-2008.

Driver: There are clear drivers on the horizon relating to the protection of soil as a resource. The environmental assessment of resources and waste will assist in implementing Government policy in terms of identifying the impact and defining strategies to protect soils and increase the recycling of materials.

2.1.2 Conclusions to legislative position / national strategies

The existing EIA legislation is a driver for carrying out environmental assessments of the use of materials, energy use and the production of waste. Carrying out assessments of these subjects will also help meet national strategies with respect to soils and sustainability. There are a number of other legislative drivers that are both imminent and on the horizon with a clear objective of protecting and minimising natural resources and improving waste management. Development of an environmental assessment framework whereby impact can be assessed and mitigated will support delivery of these legislative drivers.

2.1.3 National Policy

2.1.3.1 The UK Government Sustainable Development Strategy (2005)

The UK Sustainable Development Strategy sets the high level framework for delivering the Government's aims and objectives for sustainable development both nationally and internationally. The Strategy identifies four agreed priorities – sustainable consumption and production, climate change, natural resource protection and sustainable communities. The first three of these priorities, as identified in Table 1, are of most relevance to the development of approaches to assess the potential impacts of HA projects, with those in italics directly applicable to the need to demonstrate an integrated approach and improving efficiency and minimising impact.

Table 1: Summary of key commitments in the UK Sustainable Development Strategy

Priority Area	Commitments
Sustainable Consumption and Production	• Strengthening UK and international measures to improve the environmental performance of products and services, including improved product design • A continued drive to improve resource efficiency and reduce waste and harmful emissions across business sectors, aided by the new Business Resource Efficiency and Waste (BREW) programme • New commitments on sustainable procurement in the public sector to make the UK a leader within the EU by 2009 • Support for innovation to bring through new products, materials and services • Stronger partnerships with key business sectors such as the food, tourism and construction industries, and • A review of the waste strategy, with increased emphasis on reducing waste at source and making use of it as a resource*.
Climate change	• Long term goal of reducing carbon dioxide emissions by some 60 per cent by about 2050, with real progress to be shown by 2020. • Target under the Kyoto Protocol to reduce greenhouse gas emissions by 12.5 per cent below base year levels by 2008-12, and a more ambitious national goal of reducing carbon dioxide emissions by 20 per cent below 1990 levels by 2010. • Discussion at an international level on further engagement of all parties to the United Nations Framework Convention on Climate Change on future action to reduce greenhouse gas emissions, and adaptation strategies • A consultation on the draft code for sustainable buildings during 2005, with national rollout planned to begin in 2006 • Publication of a climate change adaptation policy framework during 2005.
Natural resource protection	• Producing an integrated policy approach for protecting and enhancing natural resources with stakeholders in 2005 • Researching environmental limits and environmental inequalities • Bringing together all the UK Government's policy frameworks, targets and strategies for natural resources • Modernising the delivery framework through the creation of new agencies to manage the marine and terrestrial environments • Addressing problems of degraded resources and environmental inequalities by enhancing the role of the Environment Agency, the creation of the Integrated Agency, and by strategic partnership work nationally and locally between DEFRA and the Department of Health and their agencies

Driver: The Sustainable Development Strategy is a clear signal of the Government's intention to integrate the principles of sustainable development into wider policies and legislation. It is clear that there will be a need for the HA to reflect these commitments in its work and to demonstrate an assessment and implementation framework within which these factors can be considered.

2.1.3.2 Draft Strategy for Sustainable Construction (2007)

The Draft Strategy for Sustainable Construction reflects the guiding principles and key commitments of the Government's Sustainable Development Strategy. It sets out the Government's policy relating to the construction industry with the aim of providing the industry and its clients with an integrated approach towards achieving more sustainable outcomes. Effectively, the strategy will be one of the mechanisms for implementing the aims and objectives of the Sustainable Development Strategy.

The overall aims of the draft Strategy for Sustainable Construction are to:

- Make a step change in the sustainability of the construction industry and then to drive continuous improvement;
- Support the development of a committed, skilled and adaptable workforce and take forward change in the construction industry in order to enhance efficiency; and

- Create long term certainty so that industry can innovate and lead internationally in products and services for sustainable construction.

The Strategy does not propose new legislation. Rather, the emphasis will be making existing regulation work better. The following key areas outlined in the draft strategy are of most relevance to HA:

- Reduced carbon footprint of activities within the construction sector, and better use of resources;
- Zero net waste, at construction site level;
- Effective use of Government procurement power as an enabler to transform the market for innovative and sustainable solutions;
- Development of voluntary agreements and initiatives by the construction industry and its clients with the aim of reducing the carbon footprint and use of resources within the built environment; and
- Greater uptake of training programmes, improving skills and increasing retention rates of skilled workers within a safer industry.

The draft Strategy identifies a number of priority areas along with specific targets. The priority areas and targets of relevance to the HA are summarised in Table 2.

Table 2: Summary of priority areas and targets

Priority Area	Targets
Climate change	• Reduce carbon emissions on the central Government office estate by 12.5% by 2010/11 and 30% by 2020 relative to 1999/2000 levels. • Central Government's office estate to be carbon neutral by 2012. • Departments to increase their energy efficiency per square metre by 15% by 2010 and 30% by 2020.
Natural resource protection	Water • A reduction in water consumption to an average of 3 cubic metres per person per year for all new office builds or major office refurbishments on the Government Estate. • Reduce water consumption by 25% on the office and non-office estate by 2020 relative to 2004/5 levels. • Public consultation on options for ownership and adoption of Sustainable Drainage Systems will take place towards the end of 2007.
Sustainable Consumption and Production	Waste • By 2012 a 50% reduction of construction, demolition and excavation waste to landfill compared to 2005. • By 2015, zero net waste, at construction site level. • By 2020, zero waste to landfill. Materials • 50% of products with type III Environmental Product Declarations by 2010. (proposed new target for industry) • 50% of buildings and construction schemes over £1m in value using stewardship and responsible sourcing principles21 by 2010. (proposed new target for industry)

Driver: The strategy will be a direct driver for the HA to address the issues identified and summarised above. HA will have a role to play in meeting the overall targets relating to climate change, resource efficiency and waste management. This will therefore require an assessment approach within which projects can be considered against baseline targets and will enable the HA to monitor and report its own performance against these targets. This will be made all the more relevant by the strong emphasis on improving public sector performance.

2.1.3.3 Waste Strategy for England (2007)

The Waste Strategy for England maps out the Government's high level policies over the medium and longer term for the management of all waste in England. It aims for greater ambition than its predecessor through a greater emphasis on waste reduction by decoupling waste production from economic growth and setting more challenging targets for recycling, recovery and landfill reduction. It places the management of waste firmly in the context of the Government's overall strategy for tackling climate change.

Waste Strategy 2007 identifies the construction and demolition sector as one of its priority sectors for future action. The Government's objectives in relation to construction waste are:

- To provide the drivers for the construction sector to improve its economic efficiency by creating less waste at every stage of the supply chain, from design to demolition;
- To get the sector to treat waste as a resource, closing the loop by re-using and recycling more and asking contractors for greater use of recovered material; and
- To improve the economics of the re-use and recycling sector by increasing sector demand and securing investment in the treatment of waste.

The Strategy also proposes a number of targets relating to construction waste:

- 50% reduction of construction, demolition and excavation wastes going to landfill by 2012;
- Construction clients to include contractual requirements for measurement and improvement of materials resource efficiency in one-half of construction projects in England over £1 million in value by 2009;
- Government to achieve waste-neutral construction in its major construction projects by 2012.

Therefore, the Waste Strategy will complement the Strategy for Sustainable Construction. It reflects the same targets and reinforces the government's intention to improve the sustainability of construction. Furthermore, it reiterates the commitment to the public sector leading by example.

Driver: In a similar way to the draft Strategy for Sustainable Construction, Waste Strategy 2007 provides a strong driver for HA to develop ways to assess its own performance in meeting the specific targets for reducing waste production and diverting waste from landfill. It provides additional weight to the need to develop an assessment approach that enables HA to monitor and report its own performance against these targets. This is further reinforced by the strong emphasis on improving public sector performance.

2.1.3.4 Sustainable Consumption and Production

Sustainable Consumption and Production (SCP) is one of the four priority areas for UK action set out in the government's Sustainable Development Strategy. The SCP agenda, co-ordinated jointly by DEFRA and DBERR, is based around a range of activity, including measures to promote such issues as better products and services (reducing environmental impact), cleaner, more efficient production processes and shifts in consumption towards goods and services with lower impacts.

It is directly influenced by major EU policies which are reviewed later in this section.

2.1.3.5 Landfill Tax / Aggregates Levy

There are a number of fiscal instruments that are designed to ensure that the environmental impact of an activity is more fully reflected in the price, thereby encouraging the adoption of alternative, more sustainable, practices. The main fiscal instruments of relevance to HA operations are the Landfill Tax and Aggregates Levy.

The Landfill Tax is the Government's primary fiscal instrument to encourage waste reduction, recycling and to promote alternatives to landfill. The current rate of landfill tax for active wastes is £24 per tonne (financial year 2007-08). From April 2008 Landfill Tax will rise by £8 per tonne per year to reach £48 per tonne by 2010/11.

The Aggregates Levy was introduced in 2002 to encourage the use of recycled and secondary aggregates. It encourages economy in the use of construction aggregates and more recycling of construction and demolition waste in place of new quarrying. The current rate of £1.60 per tonne will rise to £1.95 per tonne from 1 April 2008.

Driver: Whilst not a direct driver for implementing an assessment framework, fiscal drivers should be viewed as a tool to support the protection of the environment based on the fact that impact has a direct correlation with cost. These two fiscal instruments are direct financial drivers for HA. The Aggregates Levy provides pressure to reduce the use of virgin aggregate and to find alternative secondary and recycled materials where appropriate. The Landfill Tax increases the pressure to reduce waste arisings, reduce the reliance on landfill disposal and to recycle and recover more waste. An assessment methodology would assist the HA by providing information to monitor material use and waste arisings and disposal and may also benefit the HA by helping to control costs.

2.1.4 International Policy

Many environmental policies and legislation in the UK are directly influenced by the work of the European Union. In particular, the European Commission is developing three policies which are beginning to influence directly the work of the UK government on sustainable resource use and waste management:

- EU Thematic Strategy on the Prevention and Recycling of Waste (COM(2005) 666 final);
- EU Thematic Strategy on the Sustainable Use of Natural Resources (COM(2005) 670 final); and
- Integrated Product Policy (COM (2003) 302 final).

The EU's Thematic Strategies represent a modern holistic way of decision making on environmental issues.

The Thematic Strategy on the Prevention and Recycling of Waste is a long-term strategy which sets objectives and outlines the means by which the EU can move towards improved waste management, through waste avoidance and increased use of waste as a resource.

In particular, the strategy identifies the use of *life-cycle thinking* to assess the full environmental impact of products and not just the resulting waste. Therefore, the strategy complements and supports the Thematic Strategy on the Sustainable Use of Natural Resources which will be the primary mechanism, for the development of the life cycle approach. The life-cycle approach will be incorporated in EU legislation and will have significant consequences for framing new policy and for waste management principles and practices in the future.

The Thematic Strategy on the Sustainable Use of Natural Resources has been prepared as a long-term strategy that integrates the environmental impacts of using natural resources into wider policymaking. It has been prepared to move environment policy beyond solely addressing issues such as emissions and waste control by developing the means to identify the environmental impacts of the use of materials and energy throughout *life cycles* and to determine their respective significance. The Strategy also identifies the use of environmental impact assessments and strategic environmental assessments to reduce the negative environmental impacts of resource use of individual projects or plans, programmes and policies.

The strategy includes actions to:

- Improve the understanding and knowledge of European resource use, its negative environmental impact and significance in the EU and globally;
- Develop tools to monitor and report progress in the EU, Member States and economic sectors;
- Foster the application of strategic approaches and processes both in economic sectors and in the Member States and encourage them to develop related plans and programmes; and
- Raise awareness among stakeholders and citizens of the significant negative environmental impact of resource use.

The Commission proposes that each EU Member State develop national measures and programmes on the sustainable use of natural resources to achieve the strategy's objectives. These initiatives should focus on resource use which has the most significant environmental impacts.

Integrated Product Policy (IPP) is an integral part of the EU's Sustainable Development Strategy. Its primary aim is to reduce the environmental impacts from products throughout their life-cycle, harnessing, where possible, a market driven approach. IPP will also be a key part of the implementing measures for the Thematic Strategies on Resource Use and the Prevention and Recycling of Waste.

In common with the Thematic Strategies, IPP will promote the application of life cycle thinking and the Commission has identified Life Cycle Assessments as providing the best framework for assessing the potential environmental impacts of products currently available. The Commission intends to provide a platform to facilitate the communication and exchange of information on life cycle data and a directory of LCA databases.

Driver: These three major EU policy instruments are not in themselves direct drivers for the HA in developing an approach to assess the impacts of its operations. However, they will be a significant influence on UK policies and programmes on sustainable resource use, which ultimately will have an impact on the HA's operations through the implementation of national policies.

Importantly, they will deliver an information source on life cycle approaches to assessing the environmental impact of products and services which will provide useful knowledge base for the development of an approach to assess the HA's own operations.

2.2 Conclusions to National and International Policy

There are a number of high level strategies and policies at both national and international level driving improvements to the use of natural resources and the management of waste. Although many of the instruments, such as the EU initiatives and the Government's Sustainable Development Strategy, are operating at a high level they are directly influencing policies and targets which in turn will have direct implications for the HA's operations. Meeting specific targets set for waste reduction in the draft Strategy for Sustainable Construction and Waste Strategy 2007, for example, will necessitate systems for monitoring and reporting waste production and disposal at the individual project level. Furthermore, all of the high level strategies place a strong emphasis on the public sector leading by example.

2.3 Highways Agency Policy and Plans

2.3.1 Helping you with your journey - Highways Agency Business Plan 2007/08

This plan sets out how the Highways Agency intends to help its customers with their journeys on the Strategic Network in 2007-08 and gives an indication of the Highways Agency's longer term intentions. Within the plan the Highways Agency states that its main impact on sustainability includes such issues (*inter alia*) as use of materials, energy and waste production. This document refers the reader to the Sustainable Development Action Plan, which complements the Business Plan.

2.3.2 Achieving Sustainability – Highways Agency's Sustainable Development Action Plan 2007/08

This document gives key actions to help deliver a more sustainable approach, including the following policies:

- Policy No 5 - to develop waste, resource use and recycling strategy for maintenance and construction operations seeking to establish a benchmark for future target setting. Continue research and development in sustainable construction;
- Policy No 7 - investigate Highways Agency Procurement Strategy for validity and alignment alongside DfT sustainable procurement objectives;
- Policy No 20 - Investigate the Highways Agency's greenhouse gas/carbon footprint from construction, maintenance and network operations and identify potential future actions for reduction; and
- Policy No 25 - Develop an energy efficiency strategy for road lighting that will identify ways to reduce carbon emissions and pollution of the night sky.

Driver: The Business Plan and Sustainable Development Action Plan are the key internal policy drivers for the Highways Agency. To support the policy statements set down in these policies and plans requires a holistic approach to be adopted by the HA including developing contractual targets, guidance including robust assessment frameworks, and tools to measure performance. As part of this holistic approach the development of an environmental assessment process could be a tool to demonstrate that the materials use, energy and waste impacts associated with construction of a project are being considered and appropriate reduction methods are developed, as well as providing a framework to deliver savings during the operational phase.

2.3.3 Building Better Roads: Sustainable Construction, 2003

This document brings together the Highways Agency position with respect to sustainability in 2003. It sets out expectations for suppliers and information for stakeholders. It includes sections on:

- Management of natural resources - designing for minimum waste, lean construction, and recycling and reuse;
- Reducing energy consumption and emissions – minimising energy consumption during construction and use; and
- Reducing emissions – minimising noise and emissions to air, water and ground.

Driver: Although possibly now out of date this document represents the Highways Agency position statement with respect to sustainability in 2003. If the environmental assessment process considered materials, waste and energy it would ensure that the Agency's position is implemented on projects.

2.3.4 Towards a balance with nature: Highways Agency Environment Strategic Plan, 1998

This document is now ten years old and may be replaced next year (2009). However, it remains a key policy document for the Highways Agency. It provides overall environmental objectives to minimise the impact of roads on the natural and built environment.

Driver: Not considered a direct driver of the assessment process, but again guides the requirement for some form of assessment to take place.

2.4 Conclusions to Highways Agency Policy and Plans

The HA internal documents provide key and clear statements of intent that resource and energy use and waste need to be assessed, although these documents do not specifically indicate that the assessment should fall under the existing EIA-type assessment found in DMRB Volume 11. It is clear that in order to deliver key policy statements a robust framework is required to be developed, within which will consist, amongst others, a robust environmental process.

3 Environmental Assessment – HA Guidance

As identified in the previous section there are a number of HA policy documents in existence that recognise the impact that HA operations can have on the natural and built environment. Some of these key policy documents, Achieving Sustainability – Highways Agency's Sustainable Development Action Plan, 2007/08 and Building Better Roads: Sustainable Construction, 2003, makes clear commitments relating to waste and resource efficiency. As with all policy there is a need for lower level guidance to be produced outlining how the policy is to be implemented in both the construction and management of the Strategic Trunk Road Network This section considers the current and impending advice connected to the assessment of waste and resource efficiency that is provided to HA representatives and Service Providers.

3.1 Current Highways Agency Guidance for Service Providers

3.1.1 Design Manual for Roads and Bridges (DMRB)

3.1.1.1 DMRB Volume 11

DMRB Volume 11 (Environmental Assessment) is an industry recognised methodology for the assessment of significant environment impacts arising from a project on the receiving environment. DMRB Volume 11 is used by all overseeing organisations in the assessment of statutory and non statutory environmental assessments. In addition, DMRB Volume 11 is used by local authorities, in the assessment of transport schemes, and it is also common place for methodologies to be adapted to suit other projects including mixed use developments.

Volume 11 of the DMRB provides guidance to Service Provider on the environmental assessment of trunk road schemes, including motorways. It also provides advice on the level of environmental assessment required at the key stages in the development of a scheme and the requirements for reporting the effects on the environment. Volume 11 is split into technical sections, such as air quality, ecology and landscape effects, etc. Currently there is not specific assessment guidance provided within the current DMRB Volume 11 guidance relating to sections on waste or resource efficiency, with the exception some waste related guidance on Borrow pits as detailed below.

Chapter 3 (Disruption Due to Construction) currently deals with EIA of borrow or disposal sites and transport impacts of moving these materials. There is a section in Chapter 3, which includes advice on borrow material, indicating that waste material should be considered where appropriate. If existing Borrow pits or disposal sites are used, it is assumed that the environmental impact of the sites will already have been undertaken. The approach is then to note this in the Environmental Statement (rather than re-assess the impact). However, the amount of material, the number of lorry movements and any disruption due to traffic should be noted. The worst case should be considered and an assessment of impact on property users and any other adverse impacts (e.g. on ecology or on agriculture) should be made. It is stated that the Environmental Statement should also make the following statement 'That the decision on the location of borrow pits and disposal sites is ultimately one for the contractor to take, bearing in mind relevant legal requirements. While certain sources of secondary material may be acceptable, the contractor is entitled to use alternative sources'.

The deficiencies in Volume 11 were recognised by the Government with an instruction that the guidance be brought up to date as part of the New Deal for Trunk Roads in England. DETR (the government department responsible for transport at the time) stated: *"The sections of the Design Manual for Roads and Bridges dealing with environmental assessment and good design practice will be reviewed in consultation with the statutory advisory bodies and other interested parties to ensure that it remains up to date"* (DETR, 1998a, p.28).

In recognition of the changing HA business needs and the realisation of the varying impacts on the environment as a result of the construction of new and redevelopment of the existing Strategic Trunk Road Network DMRB has recently undergone some extensive modernisation. Interim Advice Note 76/06 (Aims and Objectives of Environmental Assessment), as part of this modernisation, shows the structure of the new DMRB Volume 11 to include a section on 'Materials' (which is assumed to include waste as part of it). However, further detailed guidance on how materials should be considered is not included in the IANs.

3.1.1.2 DMRB Volume 10

DMRB Volume 10, like DMRB Volume 11 applies to all overseeing organisations. DMRB Volume 11 provides guidance to Service Providers on the environmental design, implementation and management of the strategic trunk road. The advice is intended to be used by Service Providers to help in the identification of areas and issues where careful consideration of environmental factors is required.

Volume 10 (Section 0, Chapter 1) has an environmental objective with respect to waste management as follows:

'To develop techniques to ensure that the trunk road network is managed in the most sustainable manner, conserving the existing resource, generating less waste and removing barriers that prevent or inhibit the use of secondary or waste materials.'

However, there is no further reinforcement of this objective within other parts of Volume 10.

No guidance is currently provided on how to design out waste, or on the use of sustainable materials within Volume 10. However, these issues are covered in other parts of the HA's procedures (see below).

The HA Environmental Information System (EnvIS) was published as an Interim Advice Note (84/07) in July 2007. EnvIS consists of environmental asset and management data that is supplied by Service Providers, the Highways Agency and other bodies, which is collated and displayed in the Highways Agency Geographical Information System (HAGIS). Waste and Material Resources is one of seven subsets within EnvIS which the Service Provider is required to record and submit data relating to it. As part of this requirement Service Providers will record and submit data relating to waste and material resources that is used by projects and area schemes at specified milestones as follows:

Waste

- EWC code;
- Description;
- SHW Series;
- Waste class;
- Quantity (tonnes) and,
- Destination.

Material resources

- Description;
- SHW Series;

- Material Class;
- Quantity (tonnes) and,
- Origin (but does not include transportation distance).

At present EnvIS does not include any information on energy use.

EnvIS provides a useful source of baseline information for assessments in the future and will encourage Service Providers to consider these issues (except energy use).

3.1.1.3 DMRB Volume 7 – Pavement Design and Maintenance

There is a section in Volume 7 of the DMRB titled 'Conservation and the use of secondary and recycled materials' (Section 1, Part 2 HD 35/04). This gives advice on the conservation and use of reclaimed materials in road construction and maintenance. It is driven by Government policy to encourage conservation and facilitate the use of reclaimed and marginal materials wherever possible, in order to obtain environmental benefits and reduce the pressure on natural reserves of primary aggregate. It lists and describes suitable secondary and recycled materials that can be used in pavement construction (such as burnt colliery spoil or recycled concrete). Consideration is also given to conserving the existing pavement as an option.

3.1.2 Other HA Guidance

3.1.2.1 Network Management Manual (Issue 1, amendment 6, June 2007) and Routine and Winter Service Code (NMM and RWSC)

These two documents describe the requirements and advice for the management of maintenance on the trunk road network. Some guidance is provided on waste legislation, but in general there is minimal guidance relating to sustainable construction.

3.1.2.2 Managing Down Cost (MDC) Pressures Toolkit

The MDC Toolkit is an initiative designed to help project teams identify options for reducing costs. The Standard Safety and Research (SSR) Toolkit No 46 (which is a series of sheets from 46a through to 46i) cover the use of recycled materials for a range of different structures (earthworks, pavements, drainage, concrete, glass and filter drains). Each sheet gives a description of the idea, recommendations for action, what infrastructure elements they can be used for, the financial, legislative and environmental benefits and a summary of reference documents associated with the idea.

3.1.2.3 Area Performance Indicator Handbook (API Handbook), Issue 5, Revision 1, March 2007

The API Handbook details the measurement system developed by the Area Maintenance Community for the delivery of the Agency's Managing Agent and associated contract management. It aims to quantify performance and drive improvement by identifying best practice. API 15 – Recycling and Reuse is relevant to sustainable construction; its stated purpose is to promote the recycling and re-use of materials used in or arising from all network activities. Performance is measured by the percentage of materials recycled and reused.

3.1.2.4 Highways Agency CO_2 Methodology

In order for the HA to meet its obligations to contribute to the UK Government greenhouse gas (GHG) emission reduction targets and the Government estate carbon neutrality targets the HA is looking at ways to reduce its carbon footprint. In order to set meaningful targets for carbon reductions across the HA business it is necessary to understand the current

carbon footprint and to have a consistent method and reporting mechanism for the ongoing calculation, monitoring and management of future GHG emissions. To achieve this HA are currently developing a carbon accounting methodology to be adopted by the HA and some of its key suppliers. The carbon accounting tool will be used to provide indicative measures for the likely carbon emissions from each construction and maintenance operation. This will enable a comparison of each process, which can then be factored into the HA decision making process.

3.2 Conclusion on Highways Agency Position

The Highways Agency have a number of strong internal drivers that promotes the minimisation of waste and the efficient use of materials and energy across all of its activities which support the delivery of overarching objectives contained in a number of policy documents including the Sustainable Development Action Plan. To date there is little by way of on the ground advice or guidance that can be used by Service Providers to support the delivery of key objectives. The majority of HA guidance in this area has focussed on conservation and use of reclaimed materials (DMRB Volume 7). No guidance is provided on waste management or energy efficiency. Unlike other environmental topic areas such as biodiversity, landscape, waste, etc environmental assessment guidance has not yet been developed by the HA, except for minimal waste guidance relating to borrow pits, and then this is caveated to allow contractors to change the source from that that has been assessed.

It is clear that in order to effectively deliver against a number of commitments made in overarching HA policy documents as well as other government and legislative drivers (Waste Strategy 2007 and Climate Change Bill etc.) there is a need to provide clear guidance to HA representatives and Service Providers to ensure an effective 'bottom up' delivery of overarching policy through schemes and network areas, to include guidance on assessment, design and management.

Effective guidance on assessment ensures that all impacts (negative and positive), relating to waste and resource efficiency, are considered and implemented at the pre design stage of a project. Recent development of tools such as the HA CO2 Methodology and EnvIS provides a framework by which impacts (energy) can be assessed and considered and baseline data recorded which will beneficial to the development of an assessment process.

4 Environmental Assessment – Non HA Guidance and Methodologies

The first part of this section provides information on the extent that assessment guidance is currently provided at the international level and at national level within a sample of other UK government agencies The second part of this section reviews a number of Methodologies, in the form of Products, Schemes and Applications, that have been developed and may assist the HA in developing a waste and resource efficiency assessment methodology.

4.1 Guidance

4.1.1 International

4.1.1.1 Equator Principles

The Equator Principles is a financial industry benchmark for determining, assessing and managing social and environmental risk in project financing. The Equator Principles Financial Institutions (EPFIs) have adopted these Principles in order to ensure that the projects they finance are developed in a manner that is socially responsible and reflect sound environmental management practices. For all major projects, sponsors must produce an Environmental Assessment, such as that implemented by the World Bank (see below for details).

4.1.1.2 IFC/World Bank Requirements

The World Bank has an Operational Policy on Environmental Assessment (OP 4.01, January 1999). The Bank requires Environmental Assessment of projects proposed for Bank financing to help ensure that they are environmentally sound and sustainable and thus to improve decision making. Environmental Assessment should take into account the natural environment, human health and safety, social aspects and transboundary and global environmental aspects.

The IFC/World Bank have a series of performance standards that sponsors have to meet. They include:

- Managing renewable natural resources in a sustainable manner;
- The client should examine and incorporate in its operations resource conservation and energy efficiency measure;
- The client will avoid or minimize the generation of waste as far as practicable; and
- The client will promote the reduction of project-related greenhouse gas emissions.

International guidance supports the concept of carrying out environmental assessment, though does not go into the detail of what that assessment should include (except in very broad terms).

4.1.2 National

4.1.2.1 Environment Agency

The Environment Agency (EA), like the HA, are considered as a significant construction client. In 2007 the EA total construction spend (£200 million) accounted for approximately 3% of the construction civil engineering sector. As a construction client, the EA's role is to lead by example and demonstrate what sustainable construction means in practice. Key to this concept is 'improving resource efficiency', 'minimising waste to landfill' and 'reducing carbon emissions' from all construction projects. To achieve this, EA have produced internal and external guidance and tools to support the environmental assessment process.

EA internal guidance *'Work Instruction – Environmental Impact Assessment (2006)'* identifies a series of environmental resources/receptors that are required to be considered by the contractor in assessing whether or not the proposed project is likely to have a potential impact on the existing and future baseline environment. This requirement is for both statutory and non statutory environmental assessments. The guidance document identifies the 'use of natural resources' as one of the resources that the contractor is required to consider, in particular the following issues:

- Use of energy, including electricity and fuels;
- Effects from extraction and consumption of materials, water, energy or other resources;
- Use of sustainable materials or recycled materials;
- Capacity of sewerage or water system; and
- Land use effects - in terms of:
    - Quantity and quality of agricultural land;
    - Sterilisation of mineral resources;
    - Effect on surrounding land uses;
    - Waste handling on site and disposal;
    - Use of minerals, aggregates, forestry products;
    - Loss of Greenfield land; and
    - Loss of soils off site as waste.

To support this assessment process and to provide a standardised approach to the collection and reporting of data the EA have developed a number of tools. One such tool, relevant to this report is the carbon calculator introduced by the EA in 2007 The EA carbon calculator is a compulsory requirement on all projects going through an approval "gateway", which includes option appraisal and detailed design. The EA carbon calculator is discussed in more detail later in this section. In brief, the carbon calculator is an Excel spreadsheet that calculates the embodied carbon dioxide (CO2) of materials plus CO2 associated with their transportation. It also considers personal travel, site energy use and waste management. The tool provides a mechanism to assess and compare the sustainability of different designs (in CO2 terms) and to influence option choice at the options appraisal stage and can be used to calculate the EA's total carbon footprint from construction.

4.1.2.2 Transport for London

Transport for London's (TfL's) environmental action plan, published in 2002, was the first step in co-ordinating and managing all TfL's actions that impact on London's environment. The Plan concentrates mainly on the contribution that its transport network can make to wider environmental and sustainability issues, such as the use of low emission fuels to improve air quality and reducing road and rail noise.

More recently objectives for waste minimisation and designing for efficient use of materials have been included in the 2006 Environment Report, containing objectives and KPIs relating to construction and demolition waste produced and the proportion recycled, and the Mayor's Municipal Waste Management Strategy 2003 and London Plan 2004 which include the Mayor's aims to reduce waste, to dramatically increase reuse, recycling and composting, to promote new technologies for waste management and reduce waste to landfill.

Surplus materials and waste issues are included in a number of Tfl's major projects in a direct response to both EC Directive 97/11 which requires 'material assets' to be assessed where it is likely that they have an impact on the environment and echoing some of the key policies and proposals in relation to waste management set out in the Mayor's Municipal

Waste Management Strategy and London Plan. Known projects that have included an assessment of surplus materials and waste include Thames Gateway Bridge and the redevelopment of Tottenham Court Road Station. No formal guidance is provided by Tfl by which materials and waste assessments are undertaken with the approach being informed by publications such as *'Preparation of Environmental Statements for Planning Projects that Require Environmental Assessment: A Good Practice Guide' (1995)* and *'DETR Circular 02/99: A Guide to the Transport and Works Act Procedures.(2004)'*

4.2 Methodologies

4.2.1 Products

4.2.1.1 Green Labels

"Green labels" provides information about the environmental aspects of products or services are becoming increasingly popular. Green labels are most commonly associated with consumer products, such as white goods, for which energy labelling is mandatory.

However, there are a number of approaches to green labelling that may be applicable to assessing the impact of materials used in Highways Agency projects.

Green labels are not always easy to define, and there is no simple way of categorising all green labels according to what they cover. But the International Organisation for Standardisation (ISO) has developed a classification system for environmental product claims and labels, based on the nature of the claim:

- ISO 14024 is for what are known as Type I claims - declarations which meet criteria set by third parties (not by the manufacturer or retailer themselves), and are based on life cycle impacts, like the EU Ecolabel and national ecolabelling schemes. These are award-type labels. As they require the product to meet independently set criteria, they should in theory be fairly demanding, but this depends on how strict the criteria are, and on the body which controls the criteria.
- ISO 14021 covers Type II claims, which are manufacturers' or retailers' own declarations, sometimes called "green claims". These can be useful, but much depends on the type of claim that the manufacturer or retailer makes.
- ISO 14025 is for Type III claims, which consist of quantified information about products based on life cycle impacts (or Environmental Product Declarations – EPDs). Type III claims should enable products to be compared easily, for example for public procurement purposes, because they consist of quantified information about aspects such as energy output.

A number of possible product claims and labels are reviewed in this section to provide the Highways Agency with information on how they might be used in the development of an assessment process.

4.2.1.2 Environmental Product Declarations (EPDs)[3]

EPDs are Type III claims containing quantified product information, with an obligated 3rd party validation. EPDs provide quantified environmental data for a product from cradle to grave with pre-set categories of parameters based on ISO 14025, but not excluding additional environmental information. The overall goal of EPDs is to encourage the demand and supply of products that cause less stress on the environment through communication of

[3] http://www.environdec.com/pageId.asp?id=105&menu=4,14,0

verifiable and accurate information, thereby stimulating the potential for market-driven continuous environmental improvement.

EPDs are standardised under the ISO14040 series of standards, which is also the framework for Life Cycle Assessment and EPDs are frequently derived from an LCA of products. Therefore, EPDs would be consistent with a Life Cycle approach to assessing the environmental impacts of the Highways Agency's operations.

The most basic application of EPDs could be to compare and select products on the basis of their life cycle environmental impacts using basic pre-requirements set by the Highways Agency. As EPDs are derived using internationally recognised standards they are regarded as being:

- Comparable – because the information in EPDs are being collected and calculated based on international accepted and harmonised calculation rules.
- Credible – through the requirements for routine inspections, review, approval and follow-up by an independent verifier.
- Accurate - because the information has to be continuously-updated based on in-company routines for documentation and follow-up procedures.

In a broader context an EPD could function for the Highways Agency as a:

- Management tool for the HA as a specifier and purchaser by monitoring the product data and applying the outcomes to improve environmental performance.
- Communication tool by offering environmental information and functioning as a source of information, while enhancing environmental awareness.
- Evaluation/assessment tool by using the EPD for making decisions and for bench-marking environmental information.
- Political tool providing an opportunity to disseminate information about environmental performance.
- Action tool by participating in the determination of environmental information items and product criteria.

It should be noted that EPDs are often complex which has led to a relatively low market penetration of EPD information. In response, the concept of "single-issue EPDs" has been introduced, as a digest of an entire EPD to provide the information in a simpler format. The first example of the single issue EPD is "climate declarations" which describe the emissions of green-house gases, expressed as CO_2-equivalents for a product's life cycle. With regards to full EPDs, climate declarations are based on verified results from LCA based information.

It is not entirely clear how multiple EPDs for the range of different products that would be used in HA projects could be applied considering the complexity of the information. Therefore, climate declarations may provide a simplified way of applying EPDs for complex projects.

4.2.1.3 Environmental Profiles[4]

Certificated Environmental Profiles provide information about the environmental performance of construction products to help designers, specifiers and purchasers to identify, compare and select products that will best fulfil sustainability brief.

Environmental Profiles have been developed by BRE in partnership with Government and 24 Trade Associations from the construction products sector.

In many respects Environmental Profiles are similar to EPDs and in common with EPDs are based on LCA information. However, Environmental Profiles have been developed specifically for the construction industry. They provide a set of common rules and guidelines for applying LCA to UK construction products, to produce Environmental Profiles for products and a UK database[5] to create a one-stop-shop for environmental information provided by industry.

At its most basic level the profiling method is able to consider the impacts of a single construction product allowing simple comparisons between different products at an early stage in any assessment process. However, Environmental Profiles for different construction materials used in a more complex project can be aggregated to show the combined impact of all the products used. In turn this allows comparison between different projects and therefore can facilitate benchmarking.

Environmental Profiles are based on a standardised methodology to identify and assess the environmental effects of construction materials over their life cycle. This covers:

- Extraction and processing (including impacts from virgin and recycled inputs);
- Use and maintenance (taken over a typical life cycle and including maintenance and replacement); and
- Demolition and disposal (the waste produced, allowing for recycling and reuse).

Environmental Profiles provide key indicators of environmental sustainability:

- Climate change – from CO_2 and other greenhouse gases especially associated with energy use;
- Ozone depletion – from gases affecting the ozone layer;
- Acidification – contribution to the formation of acid rain;
- Consumption of minerals and water;
- Emission of pollutants to air and water – including toxicity to humans and ecosystems;
- Quantity of waste sent to disposal; and
- Ecopoint rating – a single measure of overall impact.

The LCA methodology[6] used for Environmental Profiles complies with ISO14041, an internationally established approach for analysing the environmental impacts of products and processes. Environmental Profiles are reviewed and verified on an annual basis to ensure that information is both valid and up-to-date, and are recalculated every three years.

[4] http://www.bre.co.uk/page.jsp?id=53
[5] www.bre.co.uk/envprofiles
[6] BRE Report BR370, available from www.brebookshop.com

Environmental Profiles information is used in ENVEST2, an environmental impact estimation tool developed by BRE (discussed below) which allows designers to consider the life cycle environmental impact of materials at the inception stage. Environmental Profiles are also used in the BRE Green Guide to Specification[7].

4.2.2 Schemes

4.2.2.1 CEEQUAL

CEEQUAL is an awards scheme to assess the environmental quality of civil engineering projects. Its objective is to encourage the attainment of environmental excellence in civil engineering projects, and thus to deliver improved environmental performance in project specification, design and construction.
It is appropriate to any civil engineering project, including roads. CEEQUAL is intended to complement the statutory requirements of EIA and in turn can address the issues raised in the EIA by operating during and after design. As such it addresses issues wider than just the resource use, waste production and energy use associated with a particular project.

The CEEQUAL assessment framework is based on a points scoring system measuring performance in design and during construction across 12 sections, which are summarised in Table 3 below along with the weighting given to each. Just over a quarter (26.7%) of the weighting relates to energy use, material use and waste management.

[7] The Green Guide to Specification (Reprinted 3rd Edition). Jane Anderson, Building Research Establishment, David E Shiers, Oxford Brookes University, Mike Sinclair. ISBN0-632-05961-3

Table 3: CEEQUAL Assessment Framework

Section	Description	Weighting
1. Project environmental management	Covers the need for environmental risk assessments and active environmental management, training, the influence of contractual and procurement processes, delivering environmental performance, minimising emissions, and human environment considerations	12.0%
2. Land use	Covers design for minimum land-take, legal requirements, flood risk, previous use of the site, contaminated land and remediation measures	8.2%
3. Landscape	Covers covering consideration of landscape issues in design, amenity features, local character, loss and compensation or mitigation of landscape features, implementation and aftercare	6.9%
4. Ecology & biodiversity	Covers impacts on sites of high ecological value, protected species, conservation & enhancement, habitat creation measures, monitoring and maintenance	8.5%
5. Archaeological & cultural heritage	Covers surveys, measures to be taken if features are found, and information to the public and public access	6.2%
6. Water issues	Covers control of a project's impacts on, and protection of, the water environment, legal requirements, minimising water usage, and enhancement of the water environment	8.9%
7. Energy	Covers life-cycle energy analysis, energy in use, and energy performance on site, but not embodied energy.	8.5%
8. Use of materials	Covers minimising environmental impact of materials used, minimising material use and waste, selection of timber, using re-used and/or recycled material, minimising use and impacts of hazardous materials, durability and maintenance, and future demolition	9.5%
9. Waste	Covers design for waste minimisation, legal requirements, waste from site preparation, and on-site waste management	8.7%
10. Transport	Covers location of a project in relation to transport infrastructure, minimising traffic impacts of a project, construction transport, and minimising workforce travel	7.6%
11. Nuisance to neighbours	Covers minimising operation and construction-related nuisances, legal requirements, nuisance from construction noise and vibration, and from air and light pollution, and visual impact, including site tidiness	7.3%
12. Community relations	Covers community consultation, community relations programmes and their effectiveness, engagement with relevant local groups, and 'joy in use'	7.7%

There is a very wide range of criteria used in CEEQUAL to assess energy use, material use and waste management. Table 4 provides a number of examples of the assessment criteria and the evidence required to demonstrate good practice.

The breadth of the CEEQUAL assessment criteria, and the relatively small proportion of the overall weighting assigned to energy, materials and waste means that it might be too broad to provide the Highways Agency with a focused approach to assessing the impacts of energy and resource use.
Furthermore, it does not specifically address the environmental impacts of individual materials such as embodied energy.

CEEQUAL does however provide an industry standard approach that compliments and assessment process. It is widely considered that although CEEQUAL is a best practice approach to assessing environmental impacts it is likely to have the same impact as BREEAM whereby it becomes standard on all projects. Within the HA there is a clear driver to adopt CEEQUAL on all major projects as indicated in the commitment made in the Highways Agency Sustainable Development Action Plan 2007/08. Policy No 25 states that "Investigate, in liaison with Customer Business Areas, how recognition of CEEQUAL could be included in contracts".

Table 4: CEEQUAL Assessment Criteria (Energy, Materials and Waste)

	Assessment criteria	Evidence required
Energy	Has a life-cycle energy analysis been undertaken for the key materials and components to be used in the project?	Life-cycle assessment report or equivalent.
	Is there evidence that the design has considered the energy consumption of the project *during operation*, including energy requirements in maintenance?	Project records, minutes of project team meetings, etc.
	Is there evidence that the design has explored opportunities for the incorporation of energy from renewable sources?	Project records – minutes of project team meetings, technical reports, drawings etc
	Has energy from renewable sources been incorporated in the scheme where appropriate?	Drawings, specifications or photographs.
	Has an energy management plan or energy management section of a SEMP or integrated project plan been drawn up and implemented?	Evidence of some considerations of energy issues in site planning is needed as a minimum, along with evidence of measures being implemented.
Materials	Was a plan that makes recommendations for material use to minimise environmental impact drawn up? Has this plan been implemented?	Evidence could be a specific materials plan or a specific consideration recorded within design meeting records. Implementation of the recommendations could be demonstrated by incorporation into specifications and drawings, or through physical evidence such as photographs.
	Is there evidence that materials have been stored appropriately so as to avoid waste through breakage?	This could be photographic evidence or site records etc. The Verifier should ascertain that photographs demonstrate a sustained achievement of this question for the duration of the project.
	Is there evidence that durability and low maintenance of structures and components have been actively considered in design and specifications?	Evidence should be found in the specifications or a life-cycle costing analysis.
	Is there evidence that long-term planned maintenance has been considered properly in the design process?	Evidence should be found in the specifications, a HAZOP assessment (or similar), in a contract maintenance schedule or in the form of a maintenance plan to be handed to the client or managing agent.
	Is a material register provided to the client or future managing agent at hand-over that identifies main material types to facilitate recycling on demolition?	Evidence can include a Health & Safety file, provided this has been extended to include information about material types that will enable recycling on demolition.
Waste	Is there evidence that the client has actively included design for waste minimisation in the brief?	Evidence would be a reference to waste minimisation as an objective in the project brief
	Is there evidence that the designer has incorporated the principles of waste minimisation in the design of the completed works, and/or for the construction process?	Evidence will need to include more detailed records than just cut & fill optimisation. Some other examples are included in the guidance above.
	Does the principal contractor have specific documented mechanisms for adopting a 'Reduce, Re-use, Recycle' approach to waste minimisation and for identifying and dealing with all wastes arising from the civil engineering work?	Evidence for adherence would include quality or environmental management system records.
	What percentage by volume of waste from demolition has been taken to	Evidence should be found in quantity surveyors' documentation or project accounts.

Assessment criteria	Evidence required
landfill?	The evidence provided should substantiate the percentage being claimed.
Has a Waste Management Plan or waste management section of a SEMP or integrated Project Plan been drawn up on the basis of such an analysis, and implemented?	Evidence of waste planning needs to be shown within the overall construction planning, or a separate Project or Site Waste Management Plan (

4.2.3 Applications

4.2.3.1 Life Cycle Assessment (LCA)

LCA is an internationally standardised methodology that applies life cycle thinking in a quantitative way to the environmental analysis of activities related to processes or products (goods and services).

An LCA of a product includes all the production processes and services associated with the product through its life cycle, from the extraction of raw materials, the production of the materials which are used in the manufacture of the product, the use of the product, to its recycling and/or ultimate disposal of some of its constituents. This approach is often termed "*cradle to grave*". Transportation, storage, and other activities between the life cycle stages are included where relevant. This life cycle of a product covers the complete supply-chain of the product plus its use and end-of-life treatment.

Therefore, LCA includes information on:

- Use of resources and raw materials;
- Energy use;
- Emissions to air, water and land; and
- Waste and by-products.

LCA probably provides the most comprehensive and holistic approach to assessing the environmental impacts of individual products and materials. Both EPDs and Environmental Profiles (discussed earlier in this section) are derived from information generated through LCA. One of the strengths of the LCA approach is that the methodology is standardised through the international standard framework in the ISO 14040 series. Furthermore, LCA has been identified as a cornerstone of the EU' Integrated Product Policy and the Thematic Strategies on Waste Prevention and Recycling and the Sustainable Use of Natural Resources.

There are a number of proprietary LCA tools available in the market place, but due the breadth and range of such tools, individual LCA tools have not been reviewed in this document. A list of LCA tools can be found on the European Commission's LCA portal: http://lca.jrc.ec.europa.eu/lcainfohub/toolList.vm

4.2.3.2 CO_2 calculators

CO_2 calculators are an example of single issue EPDs and are similar to the climate declarations discussed earlier in this section. Therefore, they address the inherent complexities involved with the interpretation of EPDs by focusing on the CO_2 emissions.

However, as a result they do not account for the wider environmental impacts associated with material use, such as raw material extraction, emissions to water and land or other emissions to air. Therefore, they form only one part of wider sustainability assessments.

The two CO_2 calculators reviewed in this section deal with construction activities and do not take account of maintenance or more general operations. Therefore, their application is somewhat constrained. However, it should be noted that the WRAP

CO2 calculator discussed below does take account of the embodied energy within materials.

4.2.3.3 WRAP CO_2 Estimator

The WRAP CO_2 Estimator has been designed specifically to allow the assessment of CO_2 emissions associated with construction projects. The estimator is based on a spreadsheet which uses a range of UK and European standard data sources for CO_2 emissions associated with material extraction and production, transport, fuels and construction methods. Outputs are expressed in tonnes of CO_2 equivalent (tCO_2e).

The estimator takes into account inputs of different materials, the *embodied energy* within each material, the energy used in product manufacture, different transport types for delivering the materials (e.g. road, rail, water) along with different types of transport fuels and construction methods. As such, the tool allows comparisons to be made between different options, e.g.:

- Different materials – e.g. concrete, bitumen, aggregates;
- Different levels of recycled content;
- Embodied energy from production and consumption of materials;
- Applications – surface course, binder course, base course;
- Construction methods, plant, vehicles and energy sources; and
- Transport – road, rail, water, fuel types, vehicle types.

4.2.3.4 Environment Agency CO_2 Calculator for Construction Activities

The EA in conjunction with Jacobs has developed a carbon calculator aimed at assessing the carbon impacts of its own construction activities. It will be used all of the EA's major construction projects from November 2007 onwards.

The calculator is an Excel spreadsheet that calculates the embodied CO_2 of materials plus CO_2 associated with their transportation. It also considers personal travel, site energy use and waste management. The tool has been designed to assess and compare the sustainability of different designs (in CO_2 terms) and to influence option choice at the options appraisal stage.

The tool was developed with the EA's construction activities in mind (predominantly fluvial and coastal construction projects). However, the tool directly applies to the activities of the HA.

It is essentially a carbon footprinting tool and therefore forms only one part of wider assessment of the sustainability of the EA's projects.

4.3 Conclusion on Non HA Guidance / Methodologies

This section has reviewed a range of tools, products and methodologies that can be used to support the development of an assessment process for the environmental impact of Highways Agency projects. One of the main conclusions to be drawn from this work is that there is no single methodology available in the marketplace that provides the holistic assessment required for the HA's projects. Therefore, the development of an assessment approach for the Highways Agency should be based on combining the outputs of the appropriate methodologies, tools and products in the marketplace to deliver a bespoke solution.

Life Cycle Assessment, for example, is a powerful tool for assessing the environmental impacts of individual products and services. Whilst LCA is not appropriate to provide the assessment methodology in itself, it does provide robust quantitative information about the whole life cycle of individual products or services. It also has the advantage of being an internationally recognised standard and being recognised as an integral component of EU level policies on sustainable resource use and waste management.

LCA forms the basis for the information generated and provided by green label type products such as Environmental Product Declarations, Climate Declarations and Environmental Profiles. As discussed previously, the information generated for these products can be complex and whilst this in turn might make assessment a more complex process there is the advantage that the methodology is rigorous and the information produced is robust. LCA is also sufficiently flexible to provide information on a more basic level, for example, through the single issue EPDs such as Climate Declarations. Whilst not as holistic as EPDs or Environmental Profiles, for example, single issue EPDs may provide a more workable approach in the case of complex projects. Therefore, LCA is likely to play an important role in the development of an assessment approach for the Highways Agency through the provision of standardised, robust and comprehensive information about the environmental impact of individual products and services.

Similarly, the growth in the use CO2 calculators and carbon footprinting tools by the public sector and industry provide an increasingly robust approach, albeit limited in scope, to assessing environmental impacts. The current focus on climate change from a public policy perspective and from a corporate social responsibility point of view means that making assessments on the basis of climate impacts is increasingly well recognised. In addition, the development of a nationally recognised standard (PAS 2050) will ensure the standardisation, and therefore the comparability between methodologies. However, focusing on the CO2 impacts excludes wider environmental impacts associated with resource use and waste management.

Products such as CEEQUAL also provide a high degree of rigour in assessing the use of resources and management of waste. CEEQUAL has the distinct advantage that it is that it is focused on assessing projects as a whole. The drawbacks are that the overall assessment is much broader than just resource use and waste management and that as a commercial product there would be an associated cost for each individual project. Therefore, the Highways Agency might wish to consider CEEQUAL from a wider perspective of achieving excellence on construction. In doing so, it would provide a rigorous assessment of procedures but might not deliver quantitative information in a way that an approach drawing on LCA based methodologies might.

The key challenge in developing an assessment approach for the Highways Agency will be combining the various approaches available into a workable methodology that can address the combined impacts of the various products, services and operations used and undertaken by the Highways Agency at the project level. In doing so, the methodology needs to draw on the outputs that combine the rigour of and robustness of information generated through LCA for individual products or services and produce, for example, in order to produce comprehensive and comprehensible outputs.

5 Assessment Approach Carried Out by Other Organisations

5.1 Introduction

This section considers existing project examples that demonstrate how sustainable construction issues are currently dealt with within the EIA sector. The following section reviews a series of international and national assessments relating to a number of different projects and client types. As part of this research a number of assessments were reviewed to determine how widely assessments considered impacts of waste and resource efficiency and the different assessment methodologies adopted. These reports were either available internally (within Halcrow) or publicly available on-line. Of the assessments reviewed very few contained any reference to waste and resource efficiency.

5.2 International Project

5.2.1 Investigation Assignment for Widening of Tolo Highway/Fanling Highway between Island House Interchage and Fanling – Final EIA Report by Mott Connell Ltd (2000)

This project was for the widening of a highway in Hong Kong. This report included a chapter (Chapter 7) on Solid Waste Management Assessment, which considered waste produced during both construction and operation. The assessment followed the Technical Memorandum – Environmental Impact Assessment Ordinance, which is part of Hong Kong's legislative framework. The Technical Memorandum includes guidance on how to assess waste, but does not include sections on material use (except as an implicit part of the waste assessment – see below) or energy use.

The guidance for the assessment of waste (Annex 15 of the Technical Memorandum) includes for consideration of opportunities for reducing waste generation by:

- Changes to design;
- Good waste management practices on site;
- Reusing or recycling waste;
- Diverting waste to other construction sites;
- Using recycled materials for construction;
- Segregating waste during the operational phase; and
- Arranging segregated waste to be collected during the operational phase.

Having taken these factors into account, the type and quantity of waste should then be estimated, and consideration given as to the disposal options for each type of waste.

The impact caused by handling waste should be addressed, including potential hazard, air and odour emissions, noise, wastewater discharges and public transport. When large quantities of waste are identified, the impact on the capacity of waste management facilities, especially the strategic solid waste disposal facilities have to be addressed.

For the Tolo Highway project, it was concluded that potential impacts from waste (assuming that the mitigation was carried out) would lead to no significant adverse environmental impacts. However, there is no clear definition of 'significance' against

which the assessment was carried out. There is also no clear guidance on this issue in Annex 15 of the Technical Memorandum.

5.2.2 Khalifa Port and Industrial Zone – Area B – Environmental Statement (EIA), for Abu Dhabi Ports Company (2007)

This project was for the development of a large container and industrial port and the development of over 100km^2 of industrial, logistical, commercial and residential areas. The EIA for Khalifa Port included a chapter on waste management. There is no specific in-country guidance for the waste assessment, so the methodology was devised by Halcrow for use on the project. This included consideration of the legal framework, description of the existing conditions, impact assessment, mitigation measures, consideration of alternatives and a monitoring programme.

The waste section considered the impact of waste on the use of natural resources and on air and climate. Use of natural resources included consideration of landfill capacity and the need for raw materials (including energy use in transporting the materials). With respect to landfill capacity it quantified the extra percentage of waste likely to be going to landfill as a result of the proposed project. However with respect to raw materials, it only mentioned that they would be affected, but did not attempt to quantity the impacts. Consideration was given as to whether the project was likely to be in-keeping, or otherwise, with local and regional environmental objectives with respect to landfill capacity and treatment of waste.

There was an extensive section listing the possible mitigation measures that could be undertaken to deal with waste, though no certainty was given on what would be carried out.

5.3 National Projects

5.3.1 London Underground Ltd – Station Upgrade (name is client confidential) – Environmental Management Plan (2007)

London Underground Ltd set out environmental objectives in their annual Environmental Report, to ensure the translation of their policies into action. To ensure that individual projects integrate these objectives, appropriate project-based objectives have been developed. For this particular project, there are thirteen sustainability objectives, such as:

- Adopt waste hierarchy in construction and demolition of waste handling;
- Maximise opportunity for using recycled materials in construction and operational activities; and
- Minimisation of embodied energy in materials.

The Environmental Management Plan is more of a sustainability plan than a detailed action plan (as is traditionally produced for projects, usually as a result of the findings of the Environmental Statement), and considers the application of certain principles with respect to the station upgrade project. These include waste management, sustainable design (including energy management strategy, resource usage and waste management), and water usage and procurement strategy. This is an important example as it covers the implementation of sustainable construction issues on a project.

5.3.2 VSM Estates - RAF Bentley Priory Environmental Statement (2008)

This project was the development of a 100 unit, mainly residential development, in London. The assessment of the environmental impact of wastes generated during the demolition, construction and operational phases comprised the following:

- Review of the existing policy situation;
- Review of the existing baseline with respect to waste management on site;
- description of proposed project with respect to type and quantity of waste likely to be produced;
- Description of likely waste management treatment;
- assessment of significance of waste (described further below); and
- Description of waste mitigation.

Sensitivity of impact was measured against the current capacity of landfill in the region to accept the waste. The magnitude was assessed by whether the impact (by extent, duration or magnitude) was of more than local significance or in breach of, legislation, policy or standards. The combination of the sensitivity and the magnitude gave the overall significance of the impact. The project considered waste with respect to the region, i.e. what the regional capacity was for dealing with waste at landfill sites.

5.3.3 Persimmon – Land at North Penkridge Environmental Statement (2008)

This Environmental Statement, for a residential housing development at Penkridge in Staffordshire, included a section on waste management. This considered waste with respect to the local waste strategy for the area, the existing waste from the site and future waste. The significance of the impact was considered with respect to the amount of waste produced and the capacity of the relevant landfill sites that would accept the waste. Consideration was given to waste production during construction and operation. Significance was assessed through a similar process as that described above for RAF Bentley Priory, and as with that project, consideration was made of the regional capacity of the area to manage any changes to waste produced as a result of the project.

5.3.4 Environment Agency – Ripon Flood Alleviation Environmental Statement (2006)

This ES, for a flood defence project in North Yorkshire, included a section entitled the 'Use of Natural Resources'. This chapter considered the amount of materials that would be used for the construction of a flood defence scheme and the likely source of materials. The information was obtained from the design engineers and stated only the quantity, type and whether the material was to be sourced locally from borrow pits (soil and clay only) or was to be imported, exported or recycled on site. It did not include further information on impacts at the source or disposal site of materials.

It included a number of objectives such as 'the management of the supply chain will be implemented by the contractor to ensure effective ordering'. However, this ES did not include consideration of waste or energy management. The insertion of the section on use of natural resources was carried out at the request of the Environment Agency and was not standard practice under their internal guidance

procedures (known as Agency Management System (AMS). There were no criteria given for how significance was ascertained.

5.4 Conclusions from review of other projects

Consideration of waste is slowly becoming a standard part of the environmental impact assessment process. However, it is rare (with the exception of Hong Kong (and possibly other countries not identified)) that there is Government guidance on what should be included in a waste assessment. There is currently little guidance in the UK at a national level, and companies (such as Halcrow) are developing their own approach. There are therefore likely to be a number of different approaches developing, along with different significance criteria, as the subject area develops.

For the projects reviewed the approaches taken were not always very robust, and frequently did not include significance criteria. The assessments appear to be carried out on professional opinion. However, some companies (such as Halcrow) are developing their own significance criteria, and are using the capacity of regional landfill sites to manage any increase in waste as the criteria. The legislative and policy drivers do not appear to be driving the assessment of sustainable construction issues and they are therefore still not always being done at project level. When they are carried out, the driver is often at the request of the client or on the advice on the consultant.

Impacts of resources, where considered, do not consider a more than local spatial context. Consideration of all three issues (waste, energy and resources) has been used only in one project, and the assessment was considered against sustainability objectives, rather than significance criteria.

The consideration of material or energy use is not widely undertaken in the UK or overseas, although some organisations (particularly Government bodies) have started. For example the Environment Agency has started considering these issues in some of their projects and is now leading the way on energy use with the obligatory use of a carbon calculator on new projects at options appraisal stage as well as detailed design. The Environment Agency also has guidance on sustainable construction. London Underground Ltd/Transport for London is now also encouraging the study of sustainability issues on their projects through the setting of environmental objectives (although it is not known if this takes place on all their projects).

It should be recognised that the assessments reviewed only represent both those available, as part of this research, and a snap shot of the moment in time. It is widely believed that increasing drivers such as the Waste Strategy for England (2007), and The UK Government Sustainable Development Strategy (2005) and The Draft Strategy for Sustainable Construction (2007) will begin to force waste and resource efficiency onto developer's agenda which will then need to be considered through the assessment and planning frameworks. Recent guidance published by the Environment Agency highlights the strength of legislative and policy drivers which in the near future is likely to be emphasised through best practice initiatives such as CEEQUAL.

6 Environmental Assessment – A Suggested Approach

6.1 Approach

This section outlines a suggested approach that could be adopted by the HA for the assessment of significant impacts on the receiving environment as a result of resources used and waste arising in the construction and operation of the proposed Strategic Trunk Road Network . The approach outlined below draws upon information gathered as part of the review of national assessment guidance and methodologies, as detailed in Section 4, and a review of approaches to assessment as carried out by other organisations, as detailed in Section 5. This approach is not intended to be definitive but to act as a framework for discussion both internally within the HA and with Service Providers to validate its operational alignment. The development of this approach has identified a number of limitations and considerations that will need to be considered in the next phase of development.

6.1.1 Options

There are a number of different options that can be taken in the development of an assessment approach. These options relate to how the assessment of each aspect (waste, materials and energy) could be undertaken and reported on in order to provide robust and transparent information to assist decision makers. For the purpose of this approach it is proposed that all three aspects are considered together under an umbrella heading of say 'Material Management' with sub topic guidance on waste management, energy use and material use/management. The sub topics are identified separately because techniques for their study and the mitigation of impacts on them require different specialist approaches. The contractor would be required to carry out an impact assessment on each sub topic but report on the overall impact of 'material management' resulting from the project on the environment.

This approach ensures a thorough assessment of sub topic is undertaken and the significance of each aspect clearly reported and mitigated. The approach also enables the contractor to consider and report on the links between the various sub topics, especially waste and materials, as one tend to lead to the other and also, for example, the potential impact of waste destination and materials origin on an energy assessment in terms of CO_2 emitted. If all aspects are considered together then the impact of one on another becomes more obvious. It is worth noting that this approach one that is currently adopted within the modernised HA Cultural Heritage assessment (DMRB Volume 11 Section 3 Part 2) and is currently taken in the CEEQUAL assessment process.

6.2 Environmental Assessment Process

All environmental assessment procedures tend to be based on the same process, as follows:

- Obtain environmental baseline information;
- Obtain information on the proposed project; and
- Assess the impact of the project on the baseline environment.

The following impacts will be considered:

- International, national, regional, district and local;
- Direct and indirect;
- Secondary, cumulative;
- Reversible/irreversible;
- Short, medium and long term;
- Permanent and temporary and,
- Positive and adverse.

Impacts must be quantified where possible estimating the change from the baseline conditions and the range of uncertainty. The significance levels of the impacts must be identified and their significance evaluated as:

- Major;
- Moderate;
- Minor and,
- Neutral.

N.B. For each sub topic significance levels will need to be defined and applied consistently.

- Identify suitable mitigation measures;
- Identify suitable enhancement measures(if possible);
- Re-assess the impact in light of the mitigation and,
- Re-assign the significance of the residual (i.e. after mitigation) impact.

So, taking each sub topic, Tables 1-3 show what could be considered under each heading. This will need further consideration, particularly the significance criteria.

6.2.1 Material use

Table 5: Key considerations in the various stages of environmental assessment of material use

	Assessment stage	Key considerations	Existing tools
1	Obtain environmental baseline information	Set significance criteria for the assessment. Consider the regional and national planning and policy framework for materials.	CEEQUAL
2	Obtain information on the proposed project	Obtain quantities, type of materials (timber, aggregates, plastics etc.) and material class (primary, recycled and reused etc.) to be used in constructing and operating the project. Evaluate environmental performance of construction products that are to be used in the project and consider availability within the UK/locally. Consider materials to be used in terms of lifecycle (what waste will be generated once the materials have reached the end of their product life). Consider alternative materials (in line with current HA specifications) Consider whether sustainable procurement issues have already been taken into account. (e.g. wood from FSC source).	See Envis (IAN 84/07 Part 4) for list of materials. EPD, Environmental Profiles, LCA
3	Give the impact a significance value	With regard to information collected as part of assessment stage 1 and 2 and using the defined significance criteria assess the impact of the materials to be used on the project on the environment. Consider whether any impacts are beneficial (e.g. use of sustainable materials or reuse of material on site to avoid disposal).	CEEQUAL,LCA, Environment Agency
4	Identify suitable mitigation measures	Consider whether materials could be reduced, or recycled materials used.	
5	(if possible identify suitable enhancement measures)	To be considered further.	
6	Re-assess the impact in light of the mitigation	Reconsider point 3.	
7	Re-assign the significance of the residual (i.e. after mitigation) impact.	Reconsider point 4.	

Significance criteria

Significance criteria would have to be given further consideration. However, CEEQUAL provide some useful examples on quantifiable indicators. For example:

- The percentage of non-contaminated excavated material that will be beneficially re-used on or near the site;
- The percentage of topsoil that can beneficially be used as topsoil on or near the site; and
- The percentage of timber that is from a sustainably managed resource or from reuse.

In addition the following could be used to provide a framework against which the project could be assessed:

- The percentage of aggregates to be sourced from recycled / secondary sources (including those reused from within the site); and

- Assessment against sustainability objectives.

6.2.2 Energy Use

Table 6: Key considerations in the various stages of environmental assessment of Energy Use

	Assessment stage	Key considerations	Existing tools
1	Obtain environmental baseline information	Set significance criteria for the assessment. Consider the regional and national policy framework for energy/carbon/greenhouse gases (GHG). Consider existing use of energy on the site (e.g. lighting for existing road if an improvement).	
2	Obtain information on the proposed project	Identify embodied energy contained within materials to be used in constructing and operating the project. Identify distance of origin of materials and destination of waste in relationship to the project. Identify energy use during construction (e.g. Site machinery and traffic); Identify energy use during maintenance energy (e.g. vehicles used for upkeep of roads and plant machinery); Identify energy use during operational (e.g. vehicles using the road after construction, energy of signage and lighting).	EPD, Environmental Profiles, LCA, HA Carbon Calculator
3	Give the impact a significance value	With regard to information collected as part of assessment stage 1 and 2 and using the defined significance criteria assess the impact of the materials to be used on the project on the environment. Consider whether any impacts are beneficial (e.g. incorporation of energy from renewable resources).	CEEQUAL, LCA
4	Identify suitable mitigation measures	Consider energy reduction measures, or use of energy from sustainable sources. On site good practice during construction and maintenance.	
5	(if possible identify suitable enhancement measures)	To be considered further.	
6	Re-assess the impact in light of the mitigation	Reconsider point 3.	
7	Re-assign the significance of the residual (i.e. after mitigation) impact.	Reconsider point 4.	

Significance

As with material use, significance would require further consideration, but could include:

- Assessment against net-zero energy use;
- The percentage of energy saved through the design process;
- The percentage of energy from sustainable sources;
- The use of materials with low embodied energy;
- The use of renewable energy as part of the construction, maintenance and operation of the project;
- The amount of carbon emitted as a result of the construction, maintenance and operation of the project; and
- Assessment against sustainability objectives.

6.2.3 Waste Management

Table 7: Key considerations in the various stages of environmental assessment of Waste Management

	Assessment stage	Key considerations	Existing tools
1	Obtain environmental baseline information	Set significance criteria for the assessment. Consider the regional and national policy framework with respect to waste. Obtain information on the current waste management of the project site (e.g. litter and gully clearance on existing road). Obtain information on existing landfill site capacity and other facilities for the treatment of waste.	
2	Obtain information on the proposed project	Identify waste arising from process of generating raw materials to be used in constructing and operating the project. Identify waste likely to be produced as a result of the project, including quantity, waste class, destination, treatment and method of disposal.	
3	Give the impact a significance value	With regard to information collected as part of assessment stage 1 and 2 and using the defined significance criteria assess the impact of the materials to be used on the project on the environment. Consider whether any impacts are beneficial (e.g. reusing materials on site, reusing waste generated from one project as materials on another).	CEEQUAL, LCA
4	Identify suitable mitigation measures	Consider whether waste could be reduced through better design (links in with Table 1 – Material use). Consider waste hierarchy and whether waste could be reused or recycled instead of land filled.	
5	(if possible identify suitable enhancement measures)	Could the waste be used as a material on another project that would benefit that project?	
6	Re-assess the impact in light of the mitigation	Reconsider point 3.	
7	Re-assign the significance of the residual (i.e. after mitigation) impact.	Reconsider point 4.	

Significance

Significance would require further consideration, but could include:

- The percentage of waste being generated during construction, maintenance and operation being disposed of to landfill (against existing regional landfill capacity);
- The percentage of waste saved through the design process;
- The percentage of waste recycled or reused on site or off site during the construction process and,
- Assessment against sustainability objectives.

6.3 Issues to be considered /Limitations

There are number of issues that require some consideration in the development of an assessment process. These are issues are not definitive but are as a result of the preparation of this feasibility report. The issues identified below will need to be considered prior to the progression to the next stage of development of this project.

6.3.1 Spatial Aspect

Consideration needs to be made of the spatial aspect of the environmental assessment. There are two approaches that could be adopted. Firstly, as is the approach with the majority of topics assessed in DMRB, the assessment could just consider the environmental impacts at the project location (i.e. those that occur within, or in close proximity of the construction site. Secondly, and arguably more appropriate to this assessment, the assessment could include *all* impacts associated with the project including significant impacts at the source/disposal site, impacts associated with the type of construction materials used and the impacts of the transport of materials and waste. It should be noted that even with this approach some spatial parameters will be required as it is unlikely to be feasible to carry out the assessment from an overseas source and therefore there may have to be some reliance on sourcing materials from accredited sources (such as wood from FSC source).

6.3.2 Information Availability

Further consideration is required of the 'scope of work' for each topic at each stage of the assessment process. Currently a consequential approach is taken to assessment whereby depending on the information gathered and an assessment of the relevant impact will determine whether more assessment is required. The current DMRB stages are Scoping; simple; and detailed.

It is highly likely that in the early stages of carrying out the environmental assessment, some of the information required to complete the assessment may not known, such as the source of materials. Therefore in developing an assessment process it is may be appropriate to apply a simplified process in the early stages to assist in identifying the benefits of one option over another.

Even with this simplified process consideration is needed of the unknowns whilst carrying out the EIA process. For example the type and source of materials may not be known until just before construction and this is therefore beyond the timeframe of the EIA process within the current DMRB process.

6.3.3 Significance Criteria

The impact assessment will need further consideration, particularly with respect to identifying the existing environmental baseline situation (which may be the policy position, rather than a spatial position) and also the significance criteria. Significance levels will need to be defined to create a framework against which the magnitude of impact can be assessed. This approach will require some careful consideration to ensure a 'one fits all approach' is achievable recognising regional and site variations (e.g. a target relating to disposal of material to landfill will depend on both the capacity of the local landfill and the type of material generated from the site) and the need incorporate policy targets through the assessment process.

6.3.4 Usability

The assessment process could become too complicated and un-wieldy. It is therefore recommended that the process, once developed, is trailed on a few projects before being rolled out.

With regards to the issues outlined above it is recommended that in the next stage of this project a Workshop should be undertaken with selected individuals (HA Volume 11 Managing Editor, HA Waste Focal Point, HA Regional Environmental Advisors and Service Provider 'Waste Champions'. The purpose of the workshop will be to discuss and agree an approach on geographical scope and non-geographical scope, how to deal with unknowns, and arguably most importantly how to keep the process simple (do-able). In addition, the workshop should assist in the development of Tables 5-7. It is recommended that following this workshop, attendees are retained and act as a project steering group to assist with the development of any assessment process. In this way it will increase the 'fitness for purpose' of the assessment process developed.

This review has identified that there are a number of current methodologies available .It is also considered that it would be beneficial to the next stages of the project

6.3.5 Other Guidance

Consideration needs to be made of the assessment process in Volume 11, but also of any related design issues, which will come under Volume 10. Guidance needs to be in place to support the assessment process, including design issues, guidance on what is acceptable and advice on mitigation.

6.3.6 Alignment with WebTAG

Consideration needs to be given as to how the impacts of waste and resource efficiency will be reported to decision makers. At present an Appraisal Summary Table (AST) accompanies the assessment process to provide a summary of environmental (and economic and accessibility) topics and associate impacts. At present no reference to waste and resource efficiency is contained in WebTAG. Input into the NATA refresh, currently ongoing, is required to consider these issues.

7 Conclusions

This review has identified that there are currently a number of current and impending legislative and policy drivers relating to waste resource efficiency that are forcing these issues on to the agenda of the HA. A number of the strategies and policies reviewed are likely to have direct implications for the HA operations. Meeting specific targets for waste and climate change is likely to require the need for an approach for monitoring and reporting against targets which will include an approach to assessing impacts at the design stage of the project and implementing mitigation to minimise impacts.

Drivers also currently exist within the HA's own policy documents. Objectives relating to the minimisation of waste and the efficient use of materials and energy across all of the HA activities is stated in a number of policy documents including the Sustainable Development Action Plan.

To date there is little by way of on the ground advice or guidance that can be used by Service Providers to support the delivery of key objectives. The majority of HA guidance in this area has focussed on conservation and use of reclaimed materials (DMRB Volume 7). No guidance is provided on waste management or energy efficiency. Unlike other environmental topic areas such as biodiversity, landscape, waste, etc environmental assessment guidance has not yet been developed by the HA, except for minimal waste guidance relating to borrow pits, and then this is caveated to allow contractors to change the source from that that has been assessed.

The review has identified a range of tools, products and methodologies that are currently available and can be used to support the development of an assessment approach applicable to the HA. The review identifies that there is no single methodology available in the marketplace that provides the holistic assessment required for the HA's projects. Therefore, the development of an assessment approach for the Highways Agency should be based on combining the outputs of the appropriate methodologies, tools and products in the marketplace to deliver a bespoke solution. Such tools likely to be of use are Environmental Product Declarations, Environmental Profiles Life Cycle Assessment and CEEQUAL,

A review of assessments undertaken as part of other projects/developments would tend to support the findings identified above. The review identified that whilst the consideration of waste is slowly becoming a standard part of the environmental impact assessment process, the lack of guidance has meant that there is no clear methodology available for the assessment. As such companies are applying different approaches. For the projects reviewed the approaches taken were not always very robust, and frequently did not include significance criteria. The assessments appear to be carried out on professional opinion. The consideration of material or energy use is not widely undertaken in the UK or overseas, although some organisations (particularly Government bodies) have started. For example the Environment Agency has started considering these issues in some of their projects and is now leading the way on energy use with the obligatory use of a carbon calculator on new projects at options appraisal stage as well as detailed design. The Environment Agency also has guidance on sustainable construction. London Underground Ltd/Transport for London is now also encouraging the study of sustainability issues on their projects through the setting of environmental objectives (although it is not known if this takes place on all their projects).

In concluding this review this report outlines a suggested approach that could be adopted by the HA for the assessment of significant impacts on the receiving environment as a result of resources used and waste arising in the construction and operation of the proposed Strategic Trunk Road Network . The approach outlined draws upon information gathered as part of the review of national assessment guidance and methodologies, and a review of approaches to assessment as carried out by other organisations. A number of further consideration are highlighted, including, the spatial extent to which the assessment relates, the availability of information to complete the assessment and the development of a significance criteria that can be used across all HA projects.

8 Recommendations

With regards to the issues outlined above it is recommended that in the next stage of this project a Workshop should be undertaken with selected individuals (HA Volume 11 Managing Editor, HA Waste Focal Point, HA Regional Environmental Advisors and Service Provider 'Waste Champions'). The purpose of the workshop will be to discuss and agree an approach on geographical scope and non-geographical scope, how to deal with unknowns, and arguably most importantly, how to keep the process simple (do-able). In addition, the workshop should assist in the development of Tables 5-7. It is recommended that following this workshop, attendees are retained and act as a project steering group to assist with the development of any assessment process. In this way it will increase the 'fitness for purpose' of the assessment process developed.

This review has identified that there are a number of current methodologies available. It is believed that a number of components of these methodologies are either directly transferable or are adaptable to meet the needs of the HA.

- Certificated Environmental Profiles provide information about the environmental performance of construction products to help designers, specifiers and purchasers to identify, compare and select products that will best fulfil the sustainability brief. It is recommended that prior to the next stage of development discussions are held with HA procurement and Model Contract for Highways Works (MCHW) Managing Editors to determine if such an approach can be applied to HA operations.

- The development of the HA CO_2 Calculator has potential to be used by the HA in the development of the assessment of certain impacts on energy as a resource. This carbon accounting tool is proposed to be used to provide indicative measures for the likely carbon emissions from each construction and maintenance operation which will enable a comparison of each process, which can then be factored into the HA decision making process. It is recommended a full review of the capabilities of the calculator is undertaken to determine how it could be incorporated into the assessment process. This review should be undertaken as a comparative exercise including WRAP CO2 Estimator, Environment Agency CO2 Calculator for Construction Activities and DfT CO2 Calculator.

It is recommended that prior to the development of the assessment process the approach to assessment carried out by other organisations is investigated further. A review of recent HA environmental assessment (not fully available at the time that this project was undertaken) would be beneficial to determine if any best practice within HA service providers exists. In addition, discussions with the EA could be useful.

To ensure that there is alignment with WebTAG it is recommended that early input into the NATA refresh, currently ongoing, is required to consider these issues.

9 References

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