

Sustainable Construction, Maintenance and Operations

TASK Element 2 (TE2): Sustainable Construction Literature Review

By

C4S at TRL Limited

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Sustainable Construction Literature Review

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Executive summary

The Highways Agency is responsible for the construction, maintenance and operation of the trunk road and motorway network; the strategic network of roads that are used to move people and freight around England. Construction and maintenance includes the building of new roads and structures (bridges, tunnels, etc.) and the continual repair and replacement of the worn components of existing features, whether they are the road surface, lights, road markings, signs, or traffic lights, etc. It is therefore of paramount importance that these activities are undertaken in a sustainable manner.

The definition of sustainable construction has been considered and its four main elements of sustainable construction and production, climate change and energy, natural resources and enhancing the environment, and creating sustainable communities identified. The role already played by the Highways Agency by the guidance given in Building Better Roads; Towards Sustainable Construction (2003) and more recently the development of the Sustainable Development Action Plan (2007) is discussed. To gain a wider understanding of sustainable construction practices and techniques and their relevance to the Highways Agency, this study has included the following phases:

International, EU and UK legislation

The relevance of legislative and strategic drivers applicable to sustainable construction and sustainable road construction at an international, European and UK level is comprehensively reviewed.

A number of countries at international level such as Japan have gone further than the UK and have chosen to legislate sustainable consumption as opposed to merely having a strategy in place to facilitate sustainable resource and waste management. Japan's Law for the promotion of effective utilization of resources 2000 aims to establish a sound material-cycle economic system therefore requiring the 3Rs (reduce, reuse and recycle) to be implemented from the design stage right through to the collection and recycling of used products.

New Zealand has a joined up holistic approach to its environmental legislation and recognises buy in from the public as being fundamental to achieving sustainability goals. New Zealand's Resource Management Act (RMA) 1991 sets out how the country should manage its whole environment and encourages citizens to plan for their own future. The RMA is focused towards managing the effects that man's activities have on the environment thereby ensuring the environment doesn't suffer as a result.

The state of art review of strategies and legislation in America and Australia has revealed there is a lack of clear direction and mandate from the respective Governments and so many states of America and Australia have their own policies. Australia does however recognise the issues of having such disjointed policies in one country and is therefore changing from state legislation and policies to national ones.

Each item of South African law is introduced with a preamble which not only sets the scene and scope of their legislation but which also details how the legislation affects its citizens. South African law is very much people focussed particularly on the less privileged and highlights the relevance of sustainable development issues. Taking such a people focussed approach to the implementation of legislation may be seen as a best practice for getting 'buy in', encouraging issue ownership and increasing compliance with legislation.

Denmark has a strong record for the use of recycled materials in road construction largely due to the government supporting regulation on waste management and its driving role in promoting recycling. The Danish government supports road contractors, producers of waste materials, and suppliers in working together to encourage the use of recycled materials. The government's general policy is that recycling should be done at the highest level that is technically and economically feasible. Danish waste legislation actively encourages the use of secondary and recycled materials in road building, whereas in the UK waste legislation is often seen as a hindrance to recycling activities due to its rigid nature and often impracticable implementation.

In the Netherlands, the government's policy on the use of recycled materials is advanced. The Dutch policy on economic growth and the environment is based on the principle that economic growth should occur only if pollution declines at the same time. It's a long term process that must involve all elements of society. For the Dutch, sustainable construction involves three main policies from an environmental perspective: the Waste Materials Policy, the Soil Protection Policy, and the Surface Mineral Policy. The Waste Materials Policy is based on the hierarchy of waste prevention, recycling, burning, and landfill. Among the provisions of the Soil Protection Policy is the concept of permitting a marginal amount of contaminants in the soil when using secondary materials. The objectives of the Surface Mineral Policy are to encourage the conservation of raw materials, stimulate the use of secondary materials, support the use of renewable raw materials, and ensure that adequate supplies of raw materials are available for construction.

Analysis of Highways Agency initiatives

An assessment of internal Highways Agency sustainability initiatives and documentation has been carried out to ascertain whether future research and development needs are within its policies and strategies. In-order to inform this gap analysis, a comparison has then been made of relevant legislative and strategic drivers in relation to documentation and operations of the Highways Agency. It has been concluded that gaps exist within policy and strategies in terms of resource and natural resource management, waste management, procurement, climate change and adapting to climate change and also sustainable communities including people's agenda as a whole. The significance of these subject areas in terms of current and future obligations has been highlighted to demonstrate their importance to the Highways Agency. However, the Highways Agency Biodiversity Action Plan should be seen as the best practice.

Gap analysis has also been carried out to establish what gaps are apparent in relation to incorporating sustainable construction within Highways Agency construction, maintenance and operations. The main gap identified is that until 2007 and the introduction of the Government draft Sustainable Construction Strategy which contains targets for all areas of sustainability, very few legislative or strategic drivers existed to facilitate the integration of sustainability within the construction industry. This gap can be seen across the entire construction industry and is by no means unique to the Highways Agency, as with all strategic drivers, unless some level of sanctions are imposed or there is a corporate willingness driving change, a convenient status quo will be maintained.

This report has highlighted the increasing number of strategic, legislative, political and environmental drivers which are intended to address every aspect of sustainability, the intention being for sustainability to be fully included within all aspects of construction. Of course, these drivers identify statutory and non-statutory targets which must or should be reached in-order to achieve the Governments overall aims on sustainability development, the Highways Agency has its role to play within this which it recognises. This study shows that there is need for a comprehensive guidance to implement sustainable construction. Since the publication of 'Building Better Roads: Towards Sustainable Construction' the Highways Agency has produced no such further publications highlighting their continued progression or how to implement sustainability agenda in relation to their operations and sustainable development.

Best practice in relation to HA's operations

To achieve best practice and identify a bespoke process to implement sustainability agenda in HA operations, a review of national, EU and international best practice has been undertaken so that lessons can be learned and knowledge can be appropriately transferred from other types of construction best practice into an HA context.

In partnership with number of suppliers, the HA have developed many initiatives which are specific to road construction, maintenance and operations but which have potential for use in many other construction applications. These include developing methods of quantifying the carbon sequestration potential of its soft estate and how to maximise the offset potential, the development of an aggregates delivery optimisation protocol with a view to minimising the social, economic and environmental impacts of aggregate deliveries along with the use of LCI (life Cycle Inventory) methodologies for assessing asphalt recycling techniques. These initiatives are very much focused towards lessening the impacts of the HA activities and contributing to the principles and policies of sustainable construction.

The sustainability policies and strategies of some of HA's service providers, namely Tarmac, A-One Integrated Highway Services, Carillion, Atkins, Costain Group PLC, Alfred McAlpine and Balfour Beatty have been investigated. The integration, implementation, application, performance measures and progress in relation to

sustainability within these organisations vary enormously. Of those reviewed, Balfour Beatty presents its sustainability objectives in a clear, concise manner and it is readily apparent how performance targets are formulated and achieved. Balfour Beatty, unlike many of the other companies, set clearly prescribed numerical targets in many sustainability subject areas. In terms of waste and resource use, A-one Integrated Highway Services have a strong focus towards waste reduction and recycling and also waste and resource data gathering which enables them to show recycling figures significantly above those proposed in the 2007 Sustainable Construction Strategy.

The review of the HA service providers has revealed a number of initiatives and examples of best practice, most of which focus on specific aspect of sustainability. In terms of all round sustainability, the most holistic best practice identified was the Porth Relief Road. Costain and its partners integrated sustainability within every aspect of this project and delivered some remarkable results which included, a 96% recycling rate, the long term employment of 46 locals, a 33% cost saving compared to the target price and Early Contractor Involvement was central to the procurement process and there key to the projects success. Fundamental to the achievements of this project was early engagement and consultant with those affected by the proposed scheme.

Future research needs

The progress already made by the Highways Agency towards the integration of sustainability throughout its operations is recognised, primarily in terms of the introduction of the Sustainability Development Action Plan in 2007.

In terms of promoting and delivering sustainable construction at an operational level, the findings indicated that, in the UK, WRAP (Waste and Resources Action Programme) offered the most extensive and comprehensive guidance, protocols and tools. No other such guidance which offers such prescriptive guidance was identified anywhere else in Europe or Internationally. WRAP offer extensive guidance in relation to recycling and reuse of many waste streams, construction procurement, the use of recycled content in refurbishment, waste minimisation, environmental impact assessment, the role of design and innovation in achieving sustainable construction and a whole range of supporting tool kits such as the Recycle Content Toolkit which helps practitioners to determine the recycled content of a new build.

1 Introduction

The Highways Agency is responsible for the construction, maintenance and operation of the trunk road and motorway network; the strategic network of roads that are used to move people and freight around England. Construction and maintenance includes the building of new roads and structures (bridges, tunnels, etc.) and the continual repair and replacement of the worn components of existing features, whether they are the road surface, lights, road markings, signs, or traffic lights, etc.

Construction, maintenance and operation activities on the strategic road network result in consumption of a large amount raw materials and energy and additionally generate large quantities of waste. The Highway Agency and its Service Providers have a responsibility to ensure that their activities and procurement of their services are undertaken in sustainable manner.

There are already advanced sustainable construction practices and techniques in operation within the UK, Europe, and further afield in terms of both roads and other types of construction. A state of art literature review has been concluded in-order to ascertain legislative and strategic drivers which influence and impact on sustainable construction at an International, European and UK level and which in turn has identified and informed best practice and techniques. Having highlighted best practice within the context of HA operations, opportunities will be sought to identify methods for knowledge transfer and capacity building amongst internal and external service providers.

1.1 What is Sustainable Construction?

“Sustainable construction is the application of the principles of sustainable development to the construction sector”.

Sustainable construction is one of many subsets of sustainable development and refers to the creation, construction, maintenance and operation of infrastructure and buildings which helps shape communities in a way that sustains the environment, generates long term wealth and enhances the quality of life. Sustainable construction also extends to subjects on the periphery of sustainability but which are directly applicable and contribute to the overall aims of sustainable development such as procurement, design and innovation.

1.2 What are the main elements of Sustainable Construction?

The Government set the scene and foundations for what should be considered within the context of sustainable development in its March 2005 strategy entitled “Securing the Future”. The four priority areas identified within this document have since been adopted and adapted within many other sustainability strategies and policies. As such many strategies, for instance the July 2007 Sustainable Construction draft strategy, have aligned their priorities and targets with those the government set out in “Securing the Future”.

The four main elements of sustainable construction are;

- Sustainable construction & production,
- Climate change and energy,
- Natural resources & enhancing the environment,
- Creating sustainable communities.

Sustainable construction is also impacted on by the ways in which the construction industry and its clients operate, therefore within this context sustainable construction, procurement, design and innovation should also be considered as they have an important role to play in realising the overall aims of sustainable development. However, sustainable procurement will be addressed in TE3 of this project.

1.3 Why Sustainable Construction is important issue for the HA (including maintenance and Operations)

Both the need and desire to change the methods and materials used in road pavement construction and maintenance, so as to contribute to sustainable development, have accelerated in the last 20 years. The 1992 Rio Earth Summit was the catalyst that brought sustainable development to the forefront of government policy in the majority of developed countries. In 2002, the United Nations' World Summit on Sustainable Development was held in Johannesburg and once again focussed world attention and directed action towards the difficult challenges of improving people's lives and conserving our natural resources in the face of an ever-expanding world population and its increased demands for food, water, shelter, sanitation, energy, transport, health services and economic security.

In comparison to other industry sectors the construction industry is vast. Its input into the UK economy every year is in the region of £100 billion which accounts for 8% of the UK's GDP and it employs some 2.1 million people. However, the buildings for which the construction is responsible for, are directly responsible for almost half of all UK carbon emissions, half the UK's total water consumption, produce one third of all landfilled waste and use 13% of materials resources. This therefore demonstrates the enormous role the construction industry has as a whole including the HA, in relation to introducing and developing the principles of sustainability across its business and through working with its service providers. Organisations within the public sector are responsible for procuring 40% of non-domestic construction and therefore have a role to play in relation to influencing the mainstream integration of sustainability within the built environment.

In road construction, there are several strategies that can be adopted to better conserve our natural, non-renewable resources. One strategy is to prolong the life of structures that incorporate these resources. Those measures that can be implemented, such as whole-life costing, construction of long-life pavements, pavement preservation (e.g. preventative maintenance) and even the adoption of stabilisation techniques for unpaved roads to reduce gravel loss. Another strategy,

the subject of this guide, is the reuse of recycled materials in road construction either by recycling existing pavement materials, or by the use of alternative materials, such as industrial by-products.

The Highways Agency is beginning to develop a more sustainable approach to its construction and maintenance operations. Guidance such as Building Better Roads: Towards Sustainable Construction (2003) and more recently the development of the Highways Agency Sustainable Development Action Plan (2007) have outlined the Agency's response to both sustainable construction and wider sustainable development issues. The release of the Eddington and Stern reports has further increased the importance of these issues.

2 Sustainable Construction – The International Perspective

Sustainable construction has been reviewed in New Zealand, Australia, Japan, South Africa, China, Hong Kong and the USA. The information has been obtained as a result of internet searches, literature reviews and personal contacts in the various countries. Each country is unique in their situation, for example, Japan is an island that has run out of space for landfill and has aspirations to be a zero net waste society. In contrast, South Africa is a developing country with enormous social and economic pressures and the legislation and strategies that are in place are focussed on this.

Section 2.1 sets the scene for sustainable construction in each of these countries looking at the overarching legislation that drives sustainability in various sectors. This includes topics such as climate change, renewable energy, air quality/emissions, waste management or resource management. Section 2.2 looks at how the legislation impacts on strategy at a national level so as to steer the activities of government departments for example, through the development of the New Zealand Transport Strategy. Section 2.3 aims to highlight examples of best practice and case studies for each of the countries focussed on.

2.1 Legislations and Policy Drivers – Current and Future

New Zealand:

The Environment Act (1986) established the Ministry for the Environment and the Office of the Parliamentary Commissioner for the Environment. The Commissioner is an officer of Parliament appointed for a five-year term to provide an independent check on the system of environmental management and the performance of public authorities on environmental matters. See further details in Appendix A on New Zealand.

The Resource Management Act (RMA) (1991) is the main piece of legislation that sets out how New Zealand should manage its environment. This is based on the idea of the sustainable management of resources, and encourages the citizens of New

Zealand (as individuals and communities) to plan for the future of their environment. The RMA is aimed at managing the effects that human activities have on the environment so that the environment does not suffer. This act provides a guide as to what's important in the environment but leaves the decisions about how to manage the environment in the hands of the local community. It encourages the local community and individuals to work with the local councils to decide how to manage the environment. Councils have one of the biggest jobs under the RMA. In New Zealand, there are three types of council: 12 regional councils, 69 city and district councils and four unitary authorities, which do the jobs of both regional and district councils.

Regional policy statements set the basic direction for environmental management in the region. Regional plans tend to concentrate on particular parts of the environment, such as the coast, soil, a river or the air. They set out how discharges or activities using these resources will be managed to stop the resources being degraded or polluted. District plans concern the use and development of land and contaminated land and set out the policies and rules a council will use to manage the use of land in its area.

The aim of The Land Transport Management Act (LTMA) (2003) is to contribute to the aim of achieving an integrated, safe, responsive, and sustainable land transport system. See further details in Appendix A on New Zealand.

The *Climate Change Response Act (2002)* puts in place a legal framework to allow New Zealand to ratify the Kyoto Protocol and to meet its obligations under the United Nations Framework Convention on Climate Change. The Act includes powers for the Minister of Finance to manage New Zealand's holdings of units that represent New Zealand's target allocation for greenhouse gas emissions under the Protocol. It enables the Minister to trade those units on the international market. It establishes a registry to record holdings and transfers of units. The Act also establishes a national inventory agency to record and report information relating to greenhouse gas emissions in accordance with international requirements.

The Energy Efficiency and Conservation Act (2000) is the legislative basis in New Zealand for promoting energy efficiency, energy conservation and renewable energy. The Act established the Energy Efficiency and Conservation Authority (EECA) as a stand-alone Crown entity with an enduring role to promote energy efficiency, energy conservation and renewable energy across all sectors of the economy. It also enables the preparation of regulations implementing product energy efficiency standards and labelling, as well as the disclosure of information to compile statistics on energy efficiency, energy conservation and renewable energy. Importantly, the Act also mandates development of a National Energy Efficiency and Conservation Strategy (see below for details).

New Zealand's Energy Efficiency and Conservation Act 2000 defines energy efficiency as "a change to energy use that results in an increase in net benefits per unit of energy".

Net benefits can include quantitative outcomes (for example, production levels in industry) and qualitative outcomes (for example, comfort, lifestyle and environmental benefits).

The National Energy Efficiency and Conservation Strategy (NEECS) (2001) was prepared as a requirement of the Energy Efficiency and Conservation Act 2000. The Strategy is organised around policies, objectives and targets, supported by a set of means (or measures). The purpose of the Strategy is to promote energy efficiency, energy conservation and renewable energy and move New Zealand towards a sustainable energy future.

The Energy Efficiency (Energy Using Products) Regulations 2002 introduced mandatory energy performance standards and energy labelling for a range of energy-using products in order to promote energy efficiency in New Zealand. The Minimum Energy Performance Standards (MEPS) (2002) regime refers to the setting of minimum energy performance criteria that must be met if a product is to be sold in New Zealand.

The aim is to prevent products that do not meet the minimum standard from coming onto the New Zealand market. The energy performance criteria and testing requirements are set out in national or international standards or handbooks. The regulations also require certain household appliances to carry an energy label at the point of sale, to assist consumers to make energy efficient choices.

New Zealand's commitments under the [Montreal Protocol](#) on substances that deplete the Ozone Layer are contained in the Ozone Layer protection Act (1996) and Ozone Layer Protection Regulations (1996). The ozone Layer Protection Act lays down the broad controls for ozone-depleting substances.

The Ministry for Economic Development is responsible for enforcing the legislation, and managing the permit system for imports and exports, while the Ministry for the Environment has overall responsibility for policy, and import and export permits and other aspects of enforcement.

The Ozone Layer Protection Regulations (1996) contain the rules relating to specific substances. Most of the controls are on importing bulk substances. The regulations also prohibit the import of dehumidifiers, refrigerators, freezers, air-conditioners, supermarket display cases, heat pumps and water coolers that contain CFCs except where they are part of another piece of equipment (for example, a fixed refrigeration system in a boat).

Australia:

It should be noted that all Australian Government websites are under review since the election in December 2007.

Australia has a National Strategy for Ecologically Sustainable Development (NSED) (1992) which provides broad strategic directions and framework for government to direct policy and decision-making. The Strategy facilitates a coordinated and co-

operative approach to ecologically sustainable development (ESD) and encourages long-term benefits for Australia over short-term gains.

The Renewable Energy (Mandatory Renewable Energy Target (MRET)) legislative framework is administered by The Office of the Renewable Energy Regulator (ORER), which is a statutory agency under the Environment and Heritage portfolio. The MRET legislation includes: the Renewable Energy (Electricity) Act 2000 (the Act), Renewable Energy (Electricity) Charge 2000 and the Renewable Energy (Electricity) Regulations 2001. The aim of the MRET is to increase renewable electricity generation from Australia's renewable energy sources by encouraging the generation of an additional 9,500 GWh of renewable energy per year by 2010. The MRET operates by imposing a legal liability to support renewable energy electricity generation on, generally, large wholesale purchasers of electricity.

The Australian Government's policy on environmental education is outlined in Environmental Education for a Sustainable Future: National Action Plan launched in July 2000. The National Action Plan was developed after considering comments on the discussion paper Today Shapes Tomorrow: Environmental Education for a Sustainable Future - A Discussion Paper (January 1999).

The Queensland Government introduced specific waste management legislation which commenced on 1 July 2000. The Environmental Protection (Waste Management) Policy 2000 and the Environmental Protection (Waste Management) Regulation 2000 clarify waste management practices in Queensland and provide improved environmental safeguards. Developed in conjunction with local government and industry, the legislation benefits Queensland communities through safer disposal practices and cost savings from improved planning and management of waste services.

These policies provide a strategic framework for managing waste in Queensland. It does this by establishing a preferred waste management hierarchy and principles for achieving good waste management. The waste management hierarchy moves from the most preferred to least preferred method:

- waste avoidance;
- waste re-use;
- waste recycling;
- energy recovery from waste; and
- waste disposal.

These principles and the waste management hierarchy provide a basis for waste management programs that may be required as a condition of approval for an environmentally relevant activity for industry, for voluntary industry waste reduction programs and for state and local government waste management strategic plans.

These agreements are designed to minimise the amount of waste generated by industry, promote efficient and cost-effective approaches to waste reduction and encourage greater responsibility for waste reduction within industries. Any State

Government departments and local governments that undertake strategic waste management planning are encouraged to carry out sustainable waste management practices.

The Ozone Protection and Synthetic Greenhouse Gas Management Regulations 1995 (as amended in 2005) contain controls relating to: import/export/manufacture licensing; manufacture and disposal of scheduled substances; refrigeration and air-conditioning; methyl bromide; and fire protection. Regulations developed under the Commonwealth Ozone Protection and Synthetic Greenhouse Gas Management Act 1989 (as amended in 2003) are replacing state and territory ozone protection legislation.

In order to clarify legislation centrally, and to move away from the situation where each state or territory prepares its' own legislation, the National Transport Commission (NTC) was put in place in 2004 with a broad charter that included the role of reforming road transport regulation and operations and also the reform of rail and intermodal regulation and operations. The NTC was established under the National Transport Commission Act 2003 and a commitment by the Federal, State and Territory Governments in the Inter-Governmental Agreement for Regulatory and Operational Reform in Road, Rail and Intermodal Transport. The Commission's role is to undertake research and consultation and prepare proposals for model legislation for the approval of Federal, State and Territory Transport Ministers who together form the Australian Transport Council (ATC).

A Memorandum of Understanding between the National Transport Commission (NTC) and the National Environment Protection Council (NEPC) established the Land Transport Environment Committee (LTEC) and its advisory group the Transport Emissions Liaison Group. The Land Transport Environment Committee is a small group of senior transport and environmental officials whose broad mission is to *improve the living environment for all Australians by reducing the environmental impacts of motor vehicle use*. The Motor Vehicle Environment Committee coordinates a joint NEPC/NTC work program, including overseeing the development of projects, project implementation and reporting mechanisms.

The Transport and Emissions Liaison Group (TELG) is the main consultative group which supports LTEC. It consists of representatives of government (National and State/Territory) transport and environment agencies, key industry groups (including organisations such as the Federal Chamber of Automotive Industries, Transport Industry Council, Australian Trucking Association and the Australian Institute of Petroleum), motoring associations and environment groups.

The National Greenhouse and Energy Reporting Act 2007 establishes a single, national system for reporting greenhouse gas emissions, abatement actions, and energy consumption and production by corporations from 1 July 2008.

The Australian Government has recently announced (Jan 2008) a new, national approach to planning, funding and implementing the nation's future infrastructure

needs. It is going to establish a new statutory advisory council, *Infrastructure Australia*, which will develop a strategic blueprint for the country's future infrastructure needs and - in partnership with the states, territories, local government and the private sector - facilitate its implementation. *Infrastructure Australia* will provide advice to Australian governments about infrastructure gaps and bottlenecks that hinder economic growth and prosperity. It will also identify investment priorities and policy and regulatory reforms that will be necessary to enable timely and coordinated delivery of national infrastructure investment. The first national infrastructure audit will be completed by the end of 2008 and will inform the development of first infrastructure priority list.

There are several policies that support sustainability in government in Australia. They are designed to achieve better environmental, social and economic performance in the public sector. The Australian Government has a policy of encouraging agencies to develop an environmental management scheme (EMS) and join the Greenhouse Challenge programme.

In addition to this, the policies of most relevance to agency environmental sustainability include:

- The *Environment Protection and Biodiversity Conservation Act 1999*,
- Measures for improving energy efficiency in Australian Government operations,
- The National Packaging Covenant,
- Policy framework for Greening of Government.

It is important that Australian Government agencies demonstrate leadership to the Australian community by developing their own EMS as a step towards adopting best practice in managing environmental performance.

The Australian Government is also seeking to be at the forefront in environmental purchasing practice through:

- buying goods and services that seek to minimise possible environmental impact;
- working with industry to encourage continuous reduction in the adverse environmental impact of goods and services; and
- assessing the environmental impact of goods and services against informed and internationally recognised standards and methods.

Key Policies for Greening of Government:

Under section 516(a) of The Environmental Protection Biodiversity Conservation Act Act (the EPBC Act), Australian Government agencies have annual reporting obligations that require documentation of the effect of their actions on the environment. Agencies need to identify steps taken to minimise the impact of those actions and mechanisms for reviewing and increasing the effectiveness of mitigating measures. The Act protects the environment, particularly matters of National Environmental Significance (Protected matters). It streamlines national environmental assessment and approvals process, protects Australian biodiversity and integrates management of important natural and cultural places.

In September 2006, the Australian Government announced its Energy Efficiency in Government Operations (EEGO) policy, which aims to further reduce the energy consumption of Australian Government agencies, placing particular emphasis on maximising building energy efficiency

The Australian Government has encouraged agencies to demonstrate their commitment to energy efficiency and greenhouse reduction by joining Greenhouse Challenge Plus - a highly successful partnership between industry and government to reduce greenhouse gases. By joining Greenhouse Challenge Plus agencies may cut costs, boost productivity and build competitive advantage

The National Packaging Covenant is a self-regulatory agreement between industry in the packaging chain and all spheres of government that promotes a product stewardship and life cycle approach to address packaging waste.

As a signatory to the National Packaging Covenant, the Australian Government has agreed to undertake a number of actions including reducing waste through improved purchasing.

Agencies are therefore obliged to develop a purchasing policy that fosters the purchase of recycled goods and to improve environmental outcomes through the use and recovery of recycled packaging.

It is important to note that a number of states and territories have indicated that they intend to repeal their regulations to ensure there is no confusion. From the information that has been reviewed this seems to be a common theme as there is often state. This has already begun with the formation of the Land Transport Environment Committee.

South Africa:

Each piece of legislation in South Africa is introduced with a preamble that sets the scene for the impact of the legislation on the country and its people. Regardless of what the legislation is about, this introductory text is always very people-focused particularly on the poor and highlights the relevant sustainable development issues. An example of this text is given below:

National Environmental Management: Waste Management Bill (2006)

PREAMBLE

Whereas everyone has the constitutional right to have an environment that is not harmful to his or her health and to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that –

(a) prevent pollution and ecological degradation;

(b) promote conservation; and

(c) secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development;

And whereas waste management practises in many areas of the Republic are not conducive to a healthy environment and the impacts of improper waste management practises are often borne disproportionately by the poor, And whereas poor waste management practices can have an adverse impact both locally and globally; And whereas sustainable development requires that the generation of waste is avoided, or where it cannot be avoided, that it is minimised, re-used, recycled or recovered and only treated and safely disposed of as a last resort; And whereas the minimisation of pollution and the use of natural resources through vigorous control, cleaner technologies, cleaner production and consumption practises and waste minimisation is the key to ensuring that the environment is protected from the impacts of waste; And whereas waste is a resource and offers certain economic opportunities; And whereas additional legislation is necessary to strengthen the Government's strategies for the protection of the environment and the health and well-being of people.

The aim of this law is to regulate waste management in order to protect the health and the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development and to provide for national norms and standards for regulating the management of waste by all parts of government.

The National Environmental Management Act 107 of 1998 aims to provide for co-operative environmental governance by establishing principles for decision making on matters affecting the environment and to provide for the prohibition, restriction or control of activities which are likely to have a detrimental effect on the environment.

The National Environment Management Air Quality Act 39 of 2004 reforms the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development.

The document Climate Change Response Strategy for South Africa 2004 highlights how the country should be supporting national and sustainable development. (Sustainable development can be defined as development which meets present needs without compromising the ability of future generations to meet their needs. It encompasses the social, environmental and economic dimensions of development.) Consequently, South Africa's position is to view the climate change response as offering just one specific avenue of opportunity for achieving the sustainable development objectives of the national policies and legislation that are concerned with both development and environment issues. At the same time, international action on climate change can be viewed as a significant vehicle to redress the historic, inequitable and unsustainable north/south (developed/undeveloped countries) divide

of the world's economy and prosperity. There are many benefits to be derived in integrating climate change response programmes across national and regional boundaries, to serve common areas of interest and to maximise the utility of available resources.

The National Environmental Management: Biodiversity Bill: Protected Areas Act, 2002 (drafts 8 and 8b in progress) encourages partnerships between the state and government organisations, the private sector, local community and the private person, and encourages the involvement of local communities in biodiversity management and conservation.

The Policy for the Integration of environmental planning into the land reform process (2001) aims to ensure that the planning process involves all people affected and calls for collaboration between all levels and departments of government. It highlights the fact that the type of land use proposed must be economically and ecologically feasible.

The Department of Mineral and Energy: Environmental Management Plan (2001) states that mining entrepreneurs must take account of local communities when they are proposing new mineral extractions. The Department will provide environmental management guidance to small-scale miners to help them minimise their impact on the local community and environment.

China:

There is very little information publicly available on Chinese government policy. Limited information has been obtained from international news sites which monitor Chinese activity. However, there is some information available regarding Environmental and Energy legislation which is detailed below.

The Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution aims to prevent and control atmospheric pollution, thereby protecting and improving people's environment and the ecological environment, safeguarding human health, and promoting the sustainable development of economy and society.

The Environmental Protection of the People's Republic of China was developed for the purpose of protecting and improving people's environment and the ecological environment, preventing and controlling pollution and other public hazards, safeguarding human health and facilitating the development of socialist modernization.

The Law of the People's Republic of China on the Protection of Wildlife was formulated for the purpose of protecting and saving the species of wildlife which are rare or near extinction, protecting, developing and rationally utilizing wildlife resources and maintaining ecological balances.

The Law of the People's Republic of China on Prevention and Control of Water Pollution was enacted for the purposes of preventing and controlling water pollution, protecting and improving the environment, safeguarding human health, ensuring effective utilization of water resources and promoting progress of the socialist modernization drive.

The aim of the Law of the People's Republic of China on Conserving Energy (1997) is to promote energy conservation by all sectors of the society, increase the efficiency in the use of energy and its economic results, protect the environment, ensure national economic and social development, and meet the people's needs in everyday life.

The Law of the People's Republic of China on Prevention and Control of Pollution from Environmental Noise (1996) is enacted for the purpose of preventing and controlling environmental noise pollution, protecting and improving the living environment, ensuring human health and promoting economic and social development.

The Law of the People's Republic of China on the Prevention and Control of Environmental Pollution by Solid Waste (1995) aims to prevent and control environmental pollution by solid waste, safeguarding human health and promoting the development of socialist modernization drive.

The Law of the People's Republic of China on the Prevention and Control of Atmospheric Pollution (adopted on August 29, 1995, amended on April 29, 2000) was formulated for the purpose of preventing and controlling atmospheric pollution, protecting and improving people's environment and the ecological environment, safeguarding human health, and promoting the sustainable development of economy and society.

The Law of The People's Republic of China on Water and Soil Conservation (1991) was formulated for the purpose of the prevention and control of soil erosion, the protection and rational utilization of water and soil resources, the mitigation of disasters of flood, drought and sandstorm, the improvement of ecological environment and the development of production.

The Environmental Protection Law of the People's Republic of China (1989) was developed for the purpose of protecting and improving people's environment and the ecological environment, preventing and controlling pollution and other public hazards, safeguarding human health and facilitating the development of socialist modernization.

The Water Law of The People's Republic of China (1988) aims to manage the rational development, utilization and protection of water resources, control of water disasters, fully deriving the comprehensive benefits of water resources and meeting the needs of national economic development and the livelihood of the people.

The Mineral Resources Law of the People's Republic of China (adopted in 1986, amended in 1996) was enacted in accordance with the Constitution of the People's Republic of China, with a view to developing the mining industry, promoting the exploration, development, utilization and protection of mineral resources and ensuring the present and long-term needs of the socialist modernization programme.

Hong Kong:

Hong Kong comes under Chinese jurisdiction but has its own government and is more open and westward looking with its information. Chinese legislation applies to Hong Kong and what is available has been reviewed above.

Hong Kong has always had a high level of construction activity. While this is a sign of prosperity, the waste generated by the construction industry has always been a problem. The information below details the Government's waste management strategy, and what can be done to reduce waste production.

When determining management strategies for construction waste, the Hong Kong Government's objectives are to:

- Reduce waste generation.
- Maximise reusing and recycling.
- Reduce the intake of mixed construction waste at landfills.

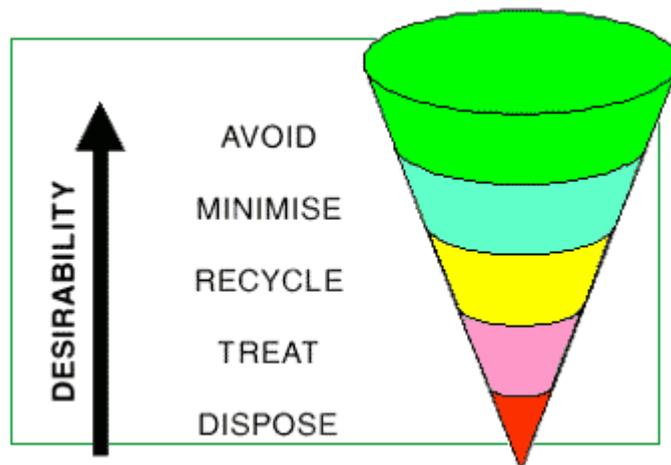
The overall strategy involves the maintenance of a well-managed public filling programme with sufficient facilities and access. But given the high level of waste generation, the emphasis is also placed on waste producers. This involves the Government encouraging the construction industry to:

- Sort mixed construction waste and not just dispose of it in a single place.
- Reuse and recycle as far as possible.
- Design better and construct more efficiently to minimise waste.

The Government aims to:

- Maintain a well-managed public filling programme with sufficient public fill reception facilities and barging points at convenient locations
- Encourage sorting of mixed construction waste
- Encourage reuse and recycling of construction waste
- Avoid and minimise construction waste through better design and construction management
- Introduce construction waste disposal charging scheme

The Hong Kong management strategy for construction waste is summarized as an inverted cone which is to avoid, minimise, reuse, recycle and finally dispose of waste with the desirability decreasing in this order.



The Hong Kong government's strategy for construction waste management are (i) to reduce the generation of construction waste, (ii) to maximise reuse and recycling and (iii) to reduce the intake of mixed construction waste at landfills.

The Hong Kong Government Waste Reduction Guidelines highlight the fact that, quite often, a lot of construction waste is generated due to a lack of consideration to waste reduction during the planning and design stage of a construction project. Guidelines are available on the following topics:

- Planning for waste reduction
- Low waste construction designs and technologies
- Raw material management
- Waste management
- Education and training

The Hong Kong Government has a Sustainable development division whose main tasks are to facilitate the integration of sustainable development into new Government initiatives and programmes and in the community generally, and to provide support to the Council for Sustainable Development upon its establishment.

The environmental goal of the Hong Kong Highway's Department (2006) is to accomplish public works efficiently and with due regard to the environment. The department's policy on the protection of the environment has been incorporated into its management policy since 2003 and is summarised below:

- Identifying environmental aspects in all stages of its work, controlling its impact and preventing pollution as far as possible
- Monitoring the performance of its contractors to ensure good quality of works and prevention or mitigation of potential environmental impacts arising on any projects
- Complying with relevant legal and other requirements
- Using resources efficiently and minimising waste arising from projects
- Identifying opportunities for continual improvement.

Japan:

Japan is a country that has the strategy of "Becoming a leading environmental nation strategy in the 21st century". This strategy presents the future direction of strategic environmental policy in Japan, and was decided upon by the cabinet on June 1, 2007. The strategy proposes to build a sustainable society through comprehensive measures integrating the three aspects of the society, specifically, A Low Carbon Society, A Sound Material-Cycle Society and A Society in Harmony with Nature.

It proposes eight strategies to be implemented with priority in the next one to two years and these are presented in the 21st Century Environmental Nation Strategy. Those most relevant to this report are detailed:

- Strategy 1, which focuses on climate change, proposes an initiative titled "Cool Earth 50," consisting of the three pillars to address this issue; long-term strategy, mid-term strategy, and launching a national campaign for achieving the Kyoto Protocol target.
- Strategy 2, which addresses conservation of biodiversity, proposes the Satoyama Initiative in order to build a society that is in harmony with nature. "Satoyama" indicates a society and framework which enriches the biodiversity of the area through traditional and sustainable use of natural resources.
- Strategy 3 focuses on sustainable material cycles through the 3Rs (Reduce, Reuse and Recycle) and proposes domestic and international actions to promote the 3Rs.

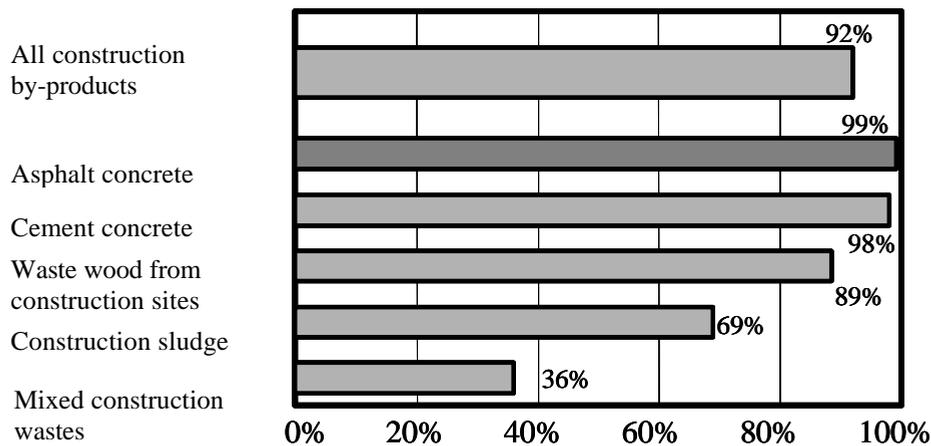
There are many laws in place to support this strategy and they are summarised below.

In Japan, the *Basic Environment Law*, which set out basic principles and directions for formulating environmental policies, was enacted in November 1993. The primary objective of the law is to protect the environment, by recognizing it as man's essential life-support system to be passed on to future generations. Japan is going to achieve this by building a society that is economically sustainable without stressing the environment, and contributing positively to the conservation of the global environment. In December 1994, an action plan called "*the Basic Environment Plan*" was adopted. It was the most important measure introduced under the Basic Environment Law. The plan systematically clarified the measures to be taken by the national and local governments, as well as actions to be carried out by citizens, businesses and private organizations by the beginning of the 21st century.

The following laws are relevant to construction.

The Construction Material Recycling Law (2000) is aimed at recycling and reuse of prospective construction materials in view of ensuring efficient use of resources. The Law requires contractors to sort out and recycle any wastes generated during the demolition work of a building and that the specified construction materials such as concrete (including pre-cast plates), asphalt/concrete and wood building materials are used. This policy includes numerical targets including the recycling rate of specified construction materials in 2010 be 95% and final disposal amount of specified construction material wastes generated in works ordered by the Government to be

zero in 2005. The graph below shows that even in 2002, the recycling rate in the construction industry was already very high.



Figure*** Recycling Ratio of construction by-products in Japan in 2002

The Law for the Promotion of Effective Utilization of Resources (2000) aims to establish a sound material-cycle economic system by:

- enhancing measures for recycling goods and resources by implementing collection and recycling of used products by business entities,
- reducing waste generation by promoting resource saving and ensuring longer life of products, and
- newly implementing measures for reusing parts recovered from collected used products and,
- introducing measures to address the reduction of industrial wastes by accelerating the reduction of by-products and recycling.

In Japan, this was felt to be a groundbreaking law as it required the 3Rs (reduce, reuse and recycle) to be implemented from the product design stage right through to the collection and recycling of used products.

The Fundamental Law for Establishing a Sound Material-Cycle Society (2000) facilitates the policies for the transformation of Japan into a sound material-cycle society comprehensively and systematically, thereby contributing to ensure healthy and cultured living for both the present and future generations of the nation. It does this by laying down the principles on the establishment of a sound material-cycle society, in keeping with the basic philosophy of the Basic Environment Law (1993). It also clarifies the responsibilities of the State, local governments, businesses and the public, and sets the scene for making policies for establishing a sound material-cycle society, including those for establishing Fundamental Plan for Establishing a Sound Material-Cycle Society. For the purpose of this Law, "a Sound Material-Cycle Society" means a society where the consumption of natural resources is minimized and the environmental load is reduced as much as possible, by restraining products from becoming wastes and promoting the appropriate recycling of products when they

have become recyclable resources, and ensuring the appropriate disposal of the recyclable resources not recycled, and ensuring that this is done appropriately.

The Basic Plan for Establishing the Recycling-based Society (2000) was enacted in order to promote a resource-recycling society. The law clearly acknowledges the responsibility of the central government, local authorities, corporations, and the public as waste producers

In 2002, the Japanese government announced the Environmental Conservation Initiative for Sustainable Development (EcoISD), an advanced plan of Initiatives for Sustainable Development toward the 21st century (ISD) proposed in 1997. In this plan, Japan presented a new policy emphasizing the importance of partnerships with developing countries, as well as the principles of ownership that Japan had pursued for a long time. It also defined the environment as being an area that needed more expertise. Specifically, under the Koizumi Initiative (the concrete actions to be taken by the Japanese government for sustainable development throughout the world, which was announced by Prime Minister Koizumi), Japan gave first priority to human resource development for sustainable development and raised the amount of aid in education to more than 250 billion yen over five years, and supported human resource development for 5,000 experts in the environmental sector.

The Japanese government adopted its implementation plan for the United Nations Decade of Education for Sustainable Development (UNDESD) on March 30, 2006. The Japanese Ministry of the Environment prepared the plan with input from the public. The purpose of the UNDESD is to incorporate the concepts of sustainable development into education. Japan played a leading role in proposing a resolution on the UNDESD, which was adopted unanimously at the 57th session of the UN General Assembly in 2002. The ten years of the UNDESD began in 2005. The major objectives set by the Japanese government are as follows:

- encourage every citizen and entity in the country to participate in initiatives to build a sustainable society in the period from 2005 to 2014;
- achieve progress in an integrated way on the environment, economy, and society, with a focus on environmental conservation;
- increase the awareness about challenges facing developing countries, and strengthen cooperation with them.

USA:

The Resource Conservation and Recovery Act (1976, amended 1984, 1992, 1996)(RCRA) is the USA's primary law governing the disposal of solid and hazardous waste. It was implemented to address the increasing problems the nation faced from the growing volume of municipal and industrial waste See Further details on RCRA in Appendix A – USA.

RCRA banned all open dumping of waste, encouraged source reduction and recycling, and promoted the safe disposal of municipal waste. RCRA also mandated strict controls over the treatment, storage, and disposal of hazardous waste. RCRA also

includes a Congressional mandate directing the Environmental Protection Agency (EPA) to develop a comprehensive set of regulations to implement the law. These regulations, or rulemakings, issued by EPA, translate the general mandate of the law into a set of requirements for the Agency and the regulated community.

Under the Clean Air Act (1970), EPA sets limits on certain air pollutants, including setting limits on how much can be in the air anywhere in the United States. This helps to ensure basic health and environmental protection from air pollution for all Americans. The Clean Air Act also gives EPA the authority to limit emissions of air pollutants coming from sources like chemical plants, utilities, and steel mills. Individual states or tribes may have stronger air pollution laws, but they may not have weaker pollution limits than those set by EPA.

The Energy Policy Act (2005) lays out the USA policy on every aspect of energy from energy conservation (including renewable energy sources and energy efficient products) to nuclear energy. It also recommends areas for potential research.

The National Environmental Policy Act (NEPA) (2005) requires federal agencies to integrate environmental values into their decision making processes by considering the environmental impacts of their proposed actions and reasonable alternatives to those actions. To meet this requirement, federal agencies prepare a detailed statement known as an Environmental Impact Statement (EIS). EPA reviews and comments on EISs prepared by other federal agencies, maintains a national filing system for all EISs, and assures that its own actions comply with NEPA.

The Pollution Prevention Act (1990) states that pollution should be prevented or reduced at the source whenever feasible; pollution that cannot be prevented should be recycled in an environmentally safe manner, whenever feasible; pollution that cannot be prevented or recycled should be treated in an environmentally safe manner whenever feasible; and disposal or other release into the environment should be employed only as a last resort and should be conducted in an environmentally safe manner.

2.2 The Road Construction Context

New Zealand:

The New Zealand Transport Strategy (NZTS) vision is that “By 2010 New Zealand will have an affordable, integrated, safe, responsive and sustainable transport system”. The existing strategy was put in place in 2002 and is now being revised, and is out for public comment and consultation. The revised strategy will be in place by the end of 2008.

The principles of the current NZTS are:

Sustainability: To ensure that transport is underpinned by the principles of sustainability and integration, transport policy will need to focus on improving the transport system in ways that enhance economic, social and environmental well-

being, and that promote resilience and flexibility. It will also need to take account of the needs of future generations, and be guided by medium and long term costs and benefits.

Integration: Transport policy will help create an efficient and integrated mix of transport modes. To facilitate integration, co-operation and collaboration between stakeholders will need to be encouraged. Transport policy will also need to ensure the efficient use of existing and new public investment.

Safety: To ensure that transport is underpinned by the principles of safety and responsiveness, policy will need to ensure high standards of health, safety and personal security for all people, including users, workers, and operators. It will also need to ensure there is a robust health and safety framework, complemented by an emphasis on individual and business responsibility.

Responsiveness: The diverse needs of urban and rural communities need to be recognised. Those who use transport, and those who are affected by it, will need to be encouraged to participate in transport policy development. Transport policy will need to foster the government's goals for partnership between the Crown and Māori; between central government and local government; and between government and citizens and communities, including business. See further details on NZTS's objectives in Appendix B.

In environmental terms, the NZTS indicates what is expected from the New Zealand transport sector:

- the transport system will have to reduce its negative impacts on land, air, water, communities and ecosystems
- the transport sector will have to make more efficient use of its resources, reduce its use of non-renewable resources,
- and shift over time from non-renewable to renewable resources.

Transit New Zealand (Transit) is the Crown Entity responsible for the state highways. The Board of Transit New Zealand operates much like a company board but the Government appoints it. The Board of Transit New Zealand directs both overall policy and prioritisation of activities within the country.

Transit's statutory objective is:

To operate the state highway system in a way that contributes to an integrated, safe, responsive, and sustainable land transport system.

Transits' Strategic Plan has five goals, which are closely aligned to the principles and objectives of the New Zealand Transport Strategy which was detailed in Section 2.1. They are to:

- Ensure state highway corridors make the optimum contribution to an integrated multi-modal land transport system.
- Provide safe state highway corridors for all users and affected communities.
- State highways will enable improved and more reliable access & mobility for people and freight.
- Improve the contribution of state highways to economic development.

- Improve the contribution of state highways to the environmental and social well-being of New Zealand, including energy efficiency and public health.

Transit has developed its' own Environment Plan details of which are given below:

The purpose of the Environmental Plan sets a framework for managing the interface between the environment and the state highway system in a way that improves environmental sustainability and public health in New Zealand.

To put it in context, this Plan responds to the Land Transport Management Act 2003 (LTMA) and the New Zealand Transport Strategy (NZTS). It also interprets the requirements of the Resource Management Act 1991 (RMA) and other environmental legislation and policy in the context of Transit's activities. The "sustainable development way of thinking and working", as articulated in the New Zealand Sustainable Development Programme for Action (2003), is reflected in this Environmental Plan. This includes:

- looking after people
- taking the long-term view
- taking account of the social, economic, environmental and cultural effects of our decisions
- encouraging participation and partnerships.

Crucially, from a highways point of view, the Transit Environment Plan applies to:

- all Transit activities, in the office and on the road
- all Transit staff, consultants and contractors when working for Transit.

Transits' environmental expectations are shared with their contractors via regular briefings and form part of the procurement process. This area is dealt with in more detail in TE3.

As part of Transits' Environment Plan, it has developed objectives for Resource Efficiency. These include: Managing energy consumption and waste associated with Transit's business in a cost-effective and sustainable manner and, making resource efficiency an integral part of all state highway activities. There is also an Implementation Plan for Resource Efficiency which indicates the steps that everyone within Transit, and its contractors, should take and who is responsible for each one. State highway construction and maintenance activities consume significant resources to ensure structures, surfaces and surrounding meet expected driving and safety standards. The processes involved in road building and maintenance activities that impact on natural resources include:

- Production and supply of road building materials (such as rock, gravel, concrete and bitumen)
- Use of fuel by construction and maintenance vehicles
- Use of paint for road markings
- Production and use of plastic and metal materials in road structures, signs, safety devices and markers

- Need for disposal facilities when resources no longer meet the required specification for use on highways or excavated fill is not of an adequate standard for reuse.

Transit sets annual performance measures for resource efficiency. Two of which are:

- the percentage of state highway corridors with corridor-specific waste reduction and resource and energy efficiency targets set, achieved and reported;
- the number of contracts incorporating waste reduction and resource and energy efficiency practices in their methodology.

The external influences on the Transit Environmental Plan are The Land Transport Management Act (LTMA) and the New Zealand Transport Strategy (NZTS), which emphasise the need for a sustainable land transport system. Included in this focus is the expectation that Transit will “exhibit a sense of social and environmental responsibility” in meeting its statutory objective of operating a state highway network that contributes to an integrated, safe, responsive and sustainable land transport system. In addition, the Resource Management Act (RMA) promotes the sustainable management of natural and physical resources. In this context, the state highway system is a physical resource that needs to be sustainably managed by Transit. The RMA has a particular focus on ensuring that the adverse environmental effects of activities are avoided, remedied or mitigated. The LTMA requires Transit to avoid, to the extent reasonable in the circumstances, adverse effects on the environment.

Transit's key objective, in relation to the Land Transport Management Act 2003 (LTMA) is “To operate the State highway system in a way that contributes to an integrated, safe, responsive, and sustainable land transport system”. In meeting its objective, Transit must exhibit a sense of social and environmental responsibility, which includes –

- a) avoiding, to the extent reasonable in the circumstances, adverse effects on the environment;
- b) taking into account the views of affected communities;
- c) giving early and full consideration to land transport options and alternatives in a manner that contributes to paragraphs (a) and (b); and
- d) providing early and full opportunities for specified persons and organisations to contribute to the development of its land transport programmes.

Transit's Waste and Energy Management Policy (WEMP) has been in place since August 2003 and supports Transit's commitment to sustainable road construction, management and administration. WEMP aims to ensure Transit meets its responsibilities under central government strategies to reduce waste and achieve energy and resource efficiency. The policy applies to both office operations and resource impacts of managing the network and, therefore, to the impacts of Transit's suppliers.

Australia:

Austrroads is the association of Australian and New Zealand road transport and traffic authorities. Austrroads members are the six Australian state and two territory road transport and traffic authorities, the Department for Infrastructure, Transport, Regional Development and Local Government, the Australian Local Government Association (ALGA), and Transit New Zealand. Austrroads' purpose is to contribute to the achievement of improved Australian and New Zealand transport related outcomes by:

- undertaking nationally strategic research on behalf of Australasian road agencies and communicating outcomes
- promoting improved practice by Australasian road agencies
- facilitating collaboration between road agencies to avoid duplication
- promoting harmonisation, consistency and uniformity in road and related operations
- providing expert advice to the Australian Transport Council (ATC) and the Standing Committee on Transport (SCOT).

Austrroads undertakes projects which assist road agencies to address current and emerging issues that have the potential to have a major impact on their operation. In pursuing its purpose, Austrroads' key principles are to:

- take an integrated approach to transport issues and work cooperatively with other modal interests
- develop partnerships and relationships with other similar organisations, industry and other stakeholders
- respect the position of individual members
- promote an innovative approach
- demonstrate good governance and conduct.

In undertaking projects, Austrroads gives specific consideration to the following:

- environmental sustainability and cultural heritage community consultation and engagement
- funding and financing options
- improving data availability
- integration between roads and other transport modes.

Austrroads Reports and Projects of interest to this review are:

Report: AP-R217/03 Environmental Considerations for Planning and Design of Roads + Reference CD ROM which provides a framework for planners and designers of roads to become informed on environmental impacts and current methods to minimise them.

Projects:

- Asphalt - Utilisation of Recycled Asphalt (T+E.P.N.518)

The aims of this project are:

To increase the utilisation of recycled asphalt as a replacement for virgin asphalt and thus —

- (i) make optimum use of limited aggregate and binder resources and
- (ii) reduce the cost of asphalt pavements.

Deliverables:

- (i) Report showing the effect of variation in Recycled Aggregate Product (RAP) binder viscosity on rutting and fatigue performance.
- (ii) Report describing a means of handling RAP composition variability and providing a fit for purpose product.
- (iii) Report on variations recommended to APRG 18 mix design procedures to incorporate RAP.

- Design of Long-Life Pavements

The aim of this project was to provide procedures for the design of long-life pavements including foundation design, pavement and surfacing design. It also aimed to develop a model to predict pavement wear variation with heavy vehicle tyre characteristics.

- Management of Scarce and Quality Resources

In order to ensure that Australia has future access to binder and aggregate supplies of suitable quality and in sufficient quantity to meet road making requirements, this project:

- measured properties of bitumen supplied to each State
- reports on bitumen property trends over time
- reviews alternatives to bitumen
- reviews Australian aggregate needs with emphasis on key surfacing properties
- develops a strategy for conservation and use of non renewable surfacing materials

Through the Austroads Pavement Technology Review Panel, Austroads provides the lead forum in Australia and New Zealand on road pavement technology, by managing pavement technology development and education, monitoring international innovations, harmonising standards and codes of practice, and facilitating information exchange and technology transfer among road organisations in the public and private sectors.

Austroads is developing a number of distinctive Guides, one of which will deal with Pavement Technology. The Guide to Pavement Technology includes a chapter on Recycled Materials (Part 4E), which covers the selection and testing of recycled construction and demolition wastes and industrial by-products for pavement construction. Part 9 of this document brings together useful publications and documents that might be of use to the practicing engineer. It includes the following Technical notes on:

- The Use of Recycled Crumb Rubber in Asphalt
<http://www.austroads.com.au/pdf/TechNotes/aprgTN10.pdf>
- Effect of Design, Construction and Environmental Factors for Long-Term Performance of Stabilised Materials
<http://www.austroads.com.au/pdf/TechNotes/aprgTN12.pdf>

- Insitu Deep Lift Recycling of Pavements using Cementitious Binders
<http://www.austroads.com.au/pdf/TechNotes/aprgTN05.pdf>
- Dry powdered polymer stabilising binder (fly ash)
<http://www.austroads.com.au/pdf/TechNotes/aprgTN14.pdf>
- Foamed bitumen sprayed sealing (to help cold recycling of asphalt)
http://www.austroads.com.au/pdf/TechNotes/Technical_Note_15.pdf

The ARRB Group, formerly the Australian Road Research Board, is a public company whose members are federal, state and local government authorities in Australia, Australian Local Government Association and the national authorities of New Zealand. ARRB's purpose is "Collaborating with the Road Industry to turn knowledge into practice". It promotes environmentally friendly concepts within the organisation. Initiatives include:

- recycling paper, plastic, glass, aluminium and batteries
- utilising rain water tanks
- subscribing ARRB vehicles with Green Fleet in order to offset carbon emissions by planting trees and
- making garden beds around offices drought resistant.
- The Australian Local Government Association (ALGA) is a small, highly effective, flexible, advocacy body that represents the collective national and international interests of Australian local government, as defined by constituent state and territory local government associations. For Further details on ALGA's priorities see Appendix B - Australia.

Key issues in the ALGA corporate strategy are to:

- Facilitate implementation of sustainable development principles in local government.
- Enhance the national role of local government in addressing major natural resource management issues.
- Enhance the national role of local government in addressing major environmental protection and heritage issues.

The Department for Transport, Energy and Infrastructure in South Australia was able to report significant achievements in 2006/07 including:

- 180,000 tonnes of fill material from the Bakewell Underpass project to be reused on future projects and 16,000 tonnes of concrete, steel and bitumen planings from the bridge has been recycled
- replacement ferries will have an alternative drive system which uses 40% less fuel than the existing system.

The role of the Australian Government Department of the Environment, Water, Heritage and the Arts is to focus on national environmental issues by:

- advising the Australian Government on its policies for protecting the environment and water resources
- administering environment and heritage laws, including the [Environment Protection and Biodiversity Conservation Act 1999](#)
- managing the Australian Government's main environment and heritage programmes including the \$3 billion [Natural Heritage Trust](#)
- implementing an effective response to climate change
- representing the Australian Government in [international environmental agreements](#) related to the environment and Antarctica.

South Africa:

The Department of Transport has a vision “Transport, the heartbeat of South Africa’s economic growth and social development!” It intends to lead the development of integrated efficient transport systems by creating a framework of sustainable policies, regulations and workable models to support government strategies for economic, social and international development.

The core values of the department are:

- Maintain fairness and equity in all our operations;
- Strive for quality and affordable transport for all;
- Stimulate innovation in the transport sector;
- Ensure transparency, accountability, accessibility.

The strategic objectives that the department aims to achieve in providing a policy framework, regulation and implementation models are:

- Competitive transport costs;
- Safety and security improvements;
- Reduce infrastructure backlogs;
- Improve access; and
- Reduce time in transit.

The South African National Roads Agency Limited (SANRAL) has detailed strategic tasks and objectives.

The tasks are to:

- Strategically plan, design, construct, operate, rehabilitate and maintain South Africa’s national roads in order to mobilise the economy;
- Generate revenues from the development and management of its assets;
- Undertake research and development to enhance the quality of life of all South African citizens, with particular emphasis on their social and economic well-being;
- Advise the Minister of Transport on matters relating to South Africa’s roads; and
- Finance, plan, construct, provide, operate and maintain roads in neighbouring countries upon request from the Minister of Transport and in agreement with the respective countries.

The strategic objectives of SANRAL are:

- The management of a national road network ensuring best value for money.
- To continuously improve the efficiency of business practices.
- To maintain market confidence.
- To carry out Government's targeted programmes to better the life of all citizens.
- Safer roads for all.
- To work in co-operative partnership with road users, transport providers, relevant authorities and the private sector.
- To be a good employer managing SANRAL's business efficiently and effectively and to seek continuous improvement.
- To achieve international best practices.
- To encourage innovation in knowledge and practice.
- To research, discover and excel.
- To market our solutions to road users.

Environmental Management at SANRAL is based on its commitment to enhancing eco-efficiency and identifying and managing or eliminating environmental risks. SANRAL aims to adopt the best practicable environmental management options in its operations, or to identify feasible alternatives. It is committed to trying to strike a balance between managing environmental impacts, and promoting the well-being and empowerment of host communities. SANRAL is also committed to rehabilitating and returning areas of operation, to their sustainable pre-operational state, so that they may still be viable for the use of future generations. SANRAL envisages these goals to be in support of the sustainability aims of respecting and maintaining natural capital and building human capital.

The SANRAL Environmental Management System (EMS) forms the framework for the implementation of the environmental policies and ongoing stewardship of resources, through the management of the proprietary environmental management system. All aspects of sustainable development are addressed at corporate level, the objectives of which are realized by a commitment to strive toward continual improvement and compliance with legal requirements.

The EMS is based on the SANRAL commitment to:

- Complying with relevant environmental legislation and the reduction of or (where possible) prevention of negative environmental impacts
- Continual improvement of environmental performance through regular review and monitoring
- Ensuring that development proceeds in a socially, environmentally and economically sustainable manner
- Pursuing the best practicable option by promoting integrated environmental management principles

In undertaking environmental impact assessments, the SANRAL is committed to conducting its planning and design, construction, operation and maintenance, in

accordance with the guidance of the competent authority and the requirements of the NEMA EIA regulations. By virtue of the nature of the activities and operations and their impact on the environmental media, the SANRAL also complies with the requirements of other relevant authorities such as the Department of Minerals and Energy as well as the Department of Water Affairs and Forestry, which provide the necessary authorizations and permits. The aim is to facilitate a mutually beneficial relationship between SANRAL and all its stakeholders. This is done by seeking to identify and inform interested parties, by providing regular updates and communicating to participants how their input affected decisions taken.

The SANRAL is committed to limiting pollutants within its road reserves, reusing and/or recycling resources, rather than waste, and mitigating and monitoring of any negative impacts on the environmental media. Strategies for enhancing eco-efficiency are considered from the design phase through to the construction and operational phases. Procedures for rehabilitation with respect to drainage requirements, water management plans and dust suppression are managed in line with EMP requirements. Energy saving measures are encouraged for all SANRAL operations; the use of energy efficient lighting is considered and design measure can include the reduction in the number of lights, with improved reflectors, which can result in energy savings of up to 50%. The use of solar panels as a full or partial energy source is also considered for cameras and for use in the Intelligent Transport System (ITS). SANRAL contractors undergo training with respect to environmental management procedures and they are encouraged to prevent littering, minimise domestic waste and reuse certain empty containers, where possible (construction sites are monitored by resident environmental control officers). Steel off-cuts and cables are recycled and construction waste is reused as underlying road fill material.

China:

There is no information in the public domain regarding the more specific details about the Department for Transport or the transport strategy for China. However, information obtained from various news sites indicates that the country has a hugely ambitious road building programme in place.

According to the plan of the Ministry of Communications of China, by 2010, the total highway mileage will achieve 2.1-2.3 million km, and 5 vertical and 7 horizontal national trunk highways will be completed. The expressway access rate among cities with population over 200,000 will reach 90%, and the total expressway mileage is expected to amount to 50,000 km.

China's Key Transport Infrastructure Projects for 2006-2010 include 14 expressways including one from Beijing to Hong Kong and Macao.

Over the past five years, China has spent more on transportation infrastructure than in the previous five decades of Communist Party rule. From 2001 to 2005, expressways grew by 15,350 miles, more than doubling the total length to 25,480 miles. The United States has 46,000 miles of interstate. By 2020, China is likely to overtake the United States. India has more road miles, but a third is unpaved.

China's high-speed expressways, with speed limits of 75 miles per hour, grew by 4,163 miles in 2005 alone and will stretch 3,107 miles farther this year. The United States built 41,000 miles of new highway from 1957 to 1969; China plans 30,262 miles this decade.

Recently, it was reported that during the 11th Five-Year Plan period (2006-10), the country's estimated investment in environmental protection will reach 1,375 billion yuan (US\$169.5 billion), accounting for 1.6 percent of the output of the national economy.

This means that China will double its total expenditure on protecting the environment in the coming five years. In the last two decades, fast economic growth has substantially raised the living standards of the masses. More and more Chinese people, especially those in urban areas, are complaining about the deteriorating environment.

Hong Kong:

No information is available on the specific transport strategy for the country.

Japan:

The mission Statement for the Japan Ministry for Landuse, Infrastructure and Transport (MLIT) is to create a strong foundation through policies designed to:

- support comfortable communities,
- vibrant economic society, everyday security,
- a beautiful environment, and regional diversity.

The MLIT has five goals:

1. Supporting joyful life
2. Enhancing Global Competitiveness
3. National Safety
4. Preserve and Create a Beautiful and Benign Environment
5. Enhancing Regional Diversity

Goal 4 is explored in more detail. Its Principal Policies are:

- Creation of a Recycling society
- Securing of Global Environment as a Basis for
- Human Survival
- Natural Environment
- Securing the Life Environment with Regards to
- Daily Life and Social Activities.

The MLIT has a Policy Bureau that is responsible for creating and promoting the MLITs basic plans and policy proposals and summaries of cross-bureau projects. It is also responsible for Environment Policy covering global warming countermeasures, the formulation of a sound material-cycle society by promoting recycling and the preservation of the natural environment such as marine pollution countermeasures.

The Road Transport Bureau of the MLIT is responsible for the treatment of environmental problems such as the prevention of air pollution by means of

implemented new long-term emission regulations. To counter global warming, it is aggressively promoting measures to control CO₂ emissions from vehicles bearing the Kyoto Protocol in mind. Efforts include applying "green" taxation to vehicles, thereby reducing the tax burden on the acquisition and possession of low-emission vehicles. It is also involved in developing next-generation EFVs (Environment Friendly Vehicles) in cooperation with manufacturers and research bodies such as universities

The National and Regional Planning Bureau at MLIT implements the plans for sustainable development of Japan, while taking advantage of each region's characteristics throughout the country. The principal roles of National and Regional Planning Bureau are to consider the ideal figure of Japanese land use and to make a comprehensive plan coordinating urban, industrial and transportation policies, in order to prepare the plan of Japan in the future.

The National Institute for Land and Infrastructure Management (NILIM) is a national research and experimental institute that performs technological policy research and work that must be performed directly by the national government, and is a part of the MLIT. It undertakes comprehensive surveys, testing, research, and development concerning the planning and drafting of policies and technical standards with relation to technology for infrastructures to use in order to develop and conserve the national land.

The Public Works Research Institute promotes research and development that are needed to improve civil engineering technologies and construction and management of infrastructure. The institute focuses on study projects, which are classified into three categories of "Ensuring safety", "Conserving and restoring healthy environments", and "Efficient construction of infrastructures. Current research topics of relevance to this review are:

- Research on improving infrastructure using new, untapped, and recycled materials.
- Research on improving the durability of structure and evaluating their performance.
- Research on evaluating the soundness of infrastructure stock and its remedial techniques.

More details on these projects are given in Section 2.3.

USA:

In its strategic plan for 2007, the Transportation Research Board (TRB) identified the following topic as being worthy of further research:

- Sustainability issues, ranging from global climate change and energy consumption to local air quality and related health issue.

(It should be noted that the TRB is funded by the National Cooperative Highways Research Programme (NCHRP)).

Many state Department of Transports have begun to include environmental commitments in their organization's overall mission and policies. Recently revised DOT mission statements usually reference the agency's commitment to maintaining the state's quality of life, and may explicitly mention the environment. Environmental policy statements are typically more lengthy expressions of a DOT's environmental commitments. Both usually extend to the organization as a whole, and include construction and maintenance. An example of this is given below for Maryland.

The Maryland State Highway Administration's (SHA) Environmental Mission is to provide their customers with a safe, well-maintained and attractive highway system that offers mobility and supports Maryland's communities, economy and environment. The agency's primary goal is to maintain excellence in the natural and human environment that it serves. For further detail on Maryland please see Appendix B-USA.

Each state in the USA has its own Department of Transport that undertakes pavement construction and maintenance. Consequently, each state has its own specifications for construction. Two examples of information available at a state-level are detailed below for Georgia and Texas.

The Georgia Department of Transport (DOT) has the following mission statement: to provide a safe, seamless and sustainable transportation system that supports Georgia economy and is sensitive to its citizens and environment. Georgia DOT Pavement specifications that include the use of recycled materials include the following:

- 402–Hot Mix Recycled Asphaltic Concrete - the maximum ratio of RAP material to the recycled mixture is 40 percent for continuous mix type plants and 25 percent for batch type plants.
- 403–Hot In-Place Recycled Asphaltic Concrete – the original road surface is heated up and milled, then combined with rejuvenator and repaved.
- 430—Portland Cement Concrete Pavement – in certain circumstances, flyash or Ground Granulated Blast Furnace Slag(GGBS) can be used as a cement substitute.

The Georgia DOT Air Quality Branch works with other state and local agencies to improve air quality in the state.

The Georgia Department of Natural Resources has a vision for Georgia's environment to be healthy and sustainable. It will ensure that natural resources are protected and managed to meet the needs of current and future generations. It will encourage all Georgians to understand the importance of a healthy and sustainable environment and act to protect and restore it.

Via the Georgia Department of Natural Resources website, the Georgia Industrial Materials Exchange website can be accessed, where unwanted materials can be exchanged and reused. The goal of the exchange is to develop an industrial ecology for manufactured materials so that one company's by-products can be used by

another company in lieu of “virgin” materials. The reuse of unwanted materials will save energy, conserve extractive resources, minimize disposal costs, and save landfill space.

The Texas Department of Transport prevents waste through workplace recycling, environmentally preferable purchasing and the use of recycled products and materials in roadway construction. These materials include recycled concrete aggregate, reclaimed asphalt pavement, tire rubber, fly ash from coal-fired power plants, and many others. Using these products and materials can reduce costs, support an environmentally sustainable economy, relieve material shortages, and enhance roadway value by increasing performance, safety, and durability.

Like Georgia, this state also has a comprehensive list of specifications and material information regarding the use of recycled material in construction. Case studies using recycled materials are shown in section 2.3.

The Federal Highway Administration (FHWA) encourages the use of recycled materials as part of its commitment to maintaining the quality of the natural environment. However, to ensure that the quality of the nation's infrastructure is maintained, or improved, the FHWA insists that engineering and environmental performance using recycled materials must be equal to or better than the performance using conventional materials.

The first project initiated in this high-priority area was the development of a guidance manual on the use of waste or by-product materials in pavement construction called *User Guidelines for Waste and By-product Materials (1996)*. The guide is split into the following sections:

- Introduction.
- Material-Specific Guidelines.
- Evaluation Guidance.
- Application Descriptions.

In 1997, the FHWA initiated four recycling research projects through cooperative agreements with a consortium headed by the University of New Hampshire (UNH). Each project is described briefly below.

Residual ASR Potential in Existing PCC - Alkali-silica reaction (ASR) is a deleterious reaction between reactive silica in some aggregates and alkali present in the concrete (PCC) water. Methods are being evaluated to more quickly assess a given concrete for its ASR potential.

Mix-Design for Cold In-Place Recycling - Cold in-place recycling (CIR) offers a number of opportunities to reuse reclaimed asphalt pavement (RAP) from low-volume roads nationwide. However, performance-based mix-design procedures are needed. Presently, to develop a performance-based mix design, the effects of density and air voids must be assessed. Traditional mix designs are typically based on the modified

Marshall method as described in the report from American Association of State Highway and Transportation Officials (AASHTO) Task Force #38.

Evaluation of the Use of Recycled Materials - While many recycled materials have historically been used in the highway environment; the use of recycled material is a relatively new concept in some states. Even among states with extensive experience in using recycled materials, considerable differences exist in the evaluation and permitting processes for the use of recycled materials under beneficial use determinations (BUDs) or similar mechanisms.

Predicting Long-Term Environmental Performance - The use of recycled materials in the highway environment frequently leads to several questions: How will this road with recycled materials perform physically and environmentally in 10 or 20 years? Will there be deleterious physical deterioration? Will there be a release of environmentally deleterious constituents if such deterioration occurs? This project aims develop predictive strategies that will help to answer these questions.

The development of the *Recycled Materials Information Database* began in 1998. The primary objective of the project was to provide a tool that could be used to store data about recycled material properties, applications, testing procedures, and reference information. The database was designed to be an interactive tool that would provide users with the means to update and print information, edit the text and tables within the database, update the information with new tables and maps to respond to new data inputs, or delete existing information. The major sections of the database for each material are:

- General Information.
- Production and Use.
- Engineering Properties.
- Environmental Properties.
- Applications.
- Laboratory Testing.
- Field Testing.
- References.

The Recycled Materials Resource Centre (RMRC) is part of the FHWA and it aims to be an independent third party, collecting and evaluating data on recycled materials. The centre is a resource for FHWA and State transportation departments, and develops and maintains the information they need. The centre also carries out extensive research into all areas of recycled materials and their performance.

Certain materials such as RAP (recycled asphalt product), RCP (recycled concrete product) are widely used in highway construction in the USA. The use of many other waste materials has been done on an ad hoc basis and frequently limited to regional or state demonstrations driven more by local pressures to avoid disposal of the wastes. There is a need to bring together Federal and State interests and initiatives to address this situation.

2.3 Implementation and best practice

This section of the report aims to highlight where best practice has been identified at an international level.

New Zealand:

Transit has published Best Practice Guidelines for the use of Alternative materials in Road Construction with respect to Environmental issues (2006). This provides guidance on the management of runoff or leachate that may have been in contact with alternative materials. It also makes the point that sound environmental management is required for all construction activities, not just those involving alternative materials.

The report, Use of reclaimed tyre rubber in asphalt (2006), reviews research work carried out on behalf of Transit to assess the suitability of tyre rubber for use in asphalt pavements. New Zealand produces approximately 3million waste tyres each year.

Case Study: Long-term pavement performance

In 2000, New Zealand embarked on a Long-Term Pavement Performance (LTPP) programme with the establishment of the 63 LTPP sites on the State Highway network. These sections were chosen across New Zealand based on a design matrix that allowed for expected ranges of climatic and soil conditions, traffic volumes, the strength of the pavements and its age / condition to be considered. The programme will enable engineers to refine and tailor their maintenance techniques road designs to suit the various climates found within the country.

<http://www.transit.govt.nz/technical/ltpj.jsp>

Case Study: Reuse of existing pavement in Inglewood

By recycling the existing pavement, Transit reduced the need for new aggregate when reshaping a section of State Highway 3 in Inglewood. Transit used the 'in-situ stabilisation' technique to create an improved surface for resealing. Recycling saved material and reduced labour costs by about \$30,000. Construction time, and disruption to the local community, was reduced from 8 days to 4 days.

<http://www.transit.govt.nz/planning/waste-energy.jsp>

Resource efficiency (recycling pavements, saving material, money and time) and energy efficiency are encouraged. A recent highways project, the Northern Motorway extension, installed energy efficient carriageway lighting. Flat glass lanterns were chosen to minimise light pollution, while the carriageway lighting system was designed to minimise the number of lights required overall.

Australia:

The Eyre Highway (in South Australia), was rehabilitated in 1998 using in-situ stabilisation which involves pulverising the existing pavement, adding a variety of binders (such as cement, lime, flyash) to improve the pulverised material resulting in the new road surface.

The paper, Australian experience on subgrade stabilisation and pavement recycling, reviews the development of stabilisation and recycling techniques in Australia. It also summarises all the different stabilisers that are used and discusses the benefits of each one.

There are several ARRB publications that are relevant to sustainable construction and they are listed below:

- Environmental practices for sealed and unsealed roads by *G.Giummarra, M. McArthur, J.McRobert, G.Sheridan and E.Styles*. ENV001 (2002)
- Asphalt recycling: results of a user survey and the design of asphalt mixes incorporating recycled asphalt by *J. Oliver*. Research Report ARR 347 (2000).
- Pavement materials in road building: guidelines for making better use of local materials by *P. Robinson, E. Oppy, G. Giummarra*. PAV001 (1999).

These highlight the breadth of work going on in working towards sustainable construction in Australia.

South Africa:

The paper by Steyn (2006) discusses several experiments that have been carried out in South Africa where existing base layers of pavements were reworked and rehabilitated using various different processes. These processes include the addition of various stabilisers such as cement, lime, foamed bitumen and bitumen emulsion. These sections have performed to different levels of success, with some of them providing very long service lives. The paper investigates the current status of recycled base technology in South Africa, providing an insight into the level of use, predominant technologies used, contributions made to the technology and current challenges faced. The paper reports that recycled roadbases have been used in pavements in South Africa for more than 30 years, using various stabilisers and combinations of stabilisers.

Generally, recycled base pavements have performed well and have proved to be an economical method for rehabilitation of both prematurely failed pavements and pavements that have reached the end of their original design lives.

Many contributions have been made to the technology in terms of design methods, understanding of the basic material properties, development of laboratory equipment and practical construction of the layers. Despite this, there are still a number of issues that are being researched to enable a more economical use of the technology and more appropriate understanding of the material and its performance. These

efforts are continuing and being well supported by the various roads authorities and stakeholders in the country.

Personal communication from D. Rossmann indicates that in recent times new initiatives are underway in South Africa to look at the issue of permitting the use of reclaimed asphalt in the manufacture of hot mix asphalt. Current thought is that 10% can be added without any extra equipment or binders. The use of crushed and screened slag (from the steel/chrome manufacturing process) is becoming more common but is only cost-effective in areas where there are huge stockpiles of these materials. In South Africa, transport costs are highly significant in pavement construction, so alternative materials are only cost-effective if their source is near to the construction site. This is one of the biggest constraints for the country in their aim to recycle and make sustainable use of materials although there is a strong move to follow the philosophy of sustainability.

Hong Kong:

Areas of research that are currently being undertaken with a view to reducing environmental impact include:

- The use of porous asphalt
- Reuse of construction and demolition materials
- Design and use of energy efficient devices
- Trials of a common utility enclosure - this involves creating an underground structure that provides a common passage for utility services eliminating the need for excavations by utility companies.

Japan:

The Public Works Research Institute is promoting research and development that are needed to improve civil engineering technology and the construction and management infrastructures. The institute focuses on three categories of project: ensuring safety, conserving and restoring healthy environments, and the efficient construction of infrastructures. Current research of relevance to this review is detailed below:

Research on improving infrastructure using new, untapped, and recycled materials - Public requirements for future infrastructure are high-performance, low-cost structures by using advanced materials and construction methods, and a recycling type of construction system with uses waste materials. This research project focuses on developing high-strength steel re-bar, fibre reinforced plastic for civil engineering structures and improving material recycling technology by using non-standard aggregates, organic wastes, and other industrial wastes

Research on improving the durability of structure and evaluating their performance - Infrastructure should be more efficiently constructed to cope with the decreasing funds available for newly built infrastructures because of the falling birthrate, aging society, and increase in maintenance and rebuilding costs due to the deterioration of old infrastructures and the increase in stock of infrastructures. Technologies are being

developed to upgrade the durability of infrastructures to reduce the life-cycle costs. Methods are being developed to evaluate the performance of structures (such as earthquake resistance) and quality control techniques for such methods, to promote creative technological innovation by facilitating the development and application of new technologies and materials while adopting performance standards.

Research on evaluating the soundness of infrastructure stock and its remedial techniques -

Japan has extensive built infrastructure and is faced with the problem of steadily increasing maintenance budget. The PWRI, is developing technologies to establish a new maintenance concept and systems which minimizes the life cycle cost of structures;

- Technologies to detect the soundness of structures accurately
- Technologies to repair and strengthen deteriorated structures effectively according to damage level
- Model of strategic planning to maintain structures with most efficiency under limited budgets.

Japan is a country that recycles and reuses a very wide range of materials. Almost all pavement materials are recycled and reused. Alternative waste materials that are recycled for use in pavements include:

- Iron and steel slag- a material specified in JIS (Japanese Industrial Standard) for roads.
- Fly ash- specified as usable in the "Pavement Construction Manual" published by JRA (the Japan Road Association) in February 2006.
- Municipal waste and sewage sludge molten slag- presented as examples in the "Pavement Recycling Manual" published by JRA in February 2004.
- Glass- presented as an example in the "Pavement Recycling Manual" published by JRA in February 2004.
- Waste tyres- presented as an example in the "Pavement Recycling Manual" published by JRA in February 2004.

In addition to those materials listed above, which are seen as proved as pavement materials in Japan, there are many other materials under study and/or in trial stage for use for roads, streets, sidewalks and footpaths. They include, among others, lumber chips, shells, tiles, earth wares and porcelain.

USA:

The Long-Term Pavement Performance program (LTPP) is the largest pavement performance research program ever undertaken, gathering data from 2,000 pavement test sections over a 20-year test period. The Federal Highway Administration (FHWA) has operational responsibility for the studies and maintains a resource web site for current and historical information. The programme has been running for 10 years now and valuable insights, innovations, and products will emerge from the LTPP studies in the next several years.

Texas has a programme of recycled materials demonstration projects. A brief outline of each one is given here.

Texas DOT monitors and report results from 12 field tests of recycled materials used in road construction. The main objectives of this project are to (1) clearly document engineering and economic benefits of recycled materials, and (2) disseminate knowledge of recycled materials beyond those directly involved in each field test. The recycled materials are being used in a variety of situations such as road base, hot mix asphalt, pipe bedding and embankments. The materials being monitored include: glass cullet, bottom ash, shingle, plastic, crumb rubber and tyre chips.

In 1997, the use of printer toner in Hot Mix Asphalt Pavements has been investigated in the district of Waco, Texas. A significant amount of printer toner is wasted every year. A conservative estimate is 25,000 tons per year. The toner industry pays more than \$70 per ton for landfill disposal. Toner is approximately 85% styrene polymer and 5% to 15% carbon. Research concluded that waste toner could be successfully recycled into asphalt. Waste toner was found to improve the strength of asphalt, acting as a beneficial modifier. Specifications, methodology, and procedures for practical implementation were developed. The Texas DOT is applying for a United States patent on the process used for incorporating toner into hot mix asphalt.

The Odessa District is experiencing good success with the Asphalt-Rubber hot mix overlay and Asphalt-Rubber Open Graded Friction Courses (OGFC). The crumb rubber generated from discarded shredded tires reacts with the heat from asphalt and forms a durable and flexible binder. Advantages include a increased resistance to reflective cracking, rutting, oxidation as well as better tire to road gripping while reducing noise levels.

Case studies from other parts of the USA are given here showing what wide use is being made of recycled materials.

In Boston, approximately 3.8 million yards of concrete containing 30% of coal fly ash is being used in the Boston Central Artery/Tunnel project. Coal fly ash is being used because of its resistance to alkali reactivity and low heat of hydration. Additionally, using fly ash instead of cement will prevent approximately 335,000 tons of greenhouse gases from being released

Cold in-place recycling of asphalt pavement took place in Missouri where a process was developed in which the full depth of asphalt and base material was pulverized and then mixed with fly ash and water to form a strong, economical sub base that was then covered with an asphalt wearing course. This technique reduced energy consumption and transport costs and avoided sending any material to landfill.

3 Sustainable Construction – European Perspectives

3.1 Legislation and Policy Drivers – Current and Future

Section 3 of this report focuses on identifying relevant European strategic drivers and legislation across all areas considered within the context of sustainability. Sustainable road construction within the European setting has also been researched and examples of best practice case studies identified.

The European Commission's, '*Sustainable Construction: Final report*' May 2001

The Commission's Communication on the competitiveness of the construction industry [COM(97)539], agreed at a meeting of representatives of the European Commission, on 31st May 1999, to a list of priority actions for improving the competitiveness of the construction industry. One of these actions was to, "*develop a strategy for the use and promotion of:*

- *environmentally friendly construction materials;*
- *energy efficiency in buildings; and*
- *construction and demolition waste management in order to contribute to sustainability".*

As a result of this recommendation the EU prepared an 'Agenda for sustainable construction in Europe'. Its central aim is to promote a 'European Agenda' for sustainable construction, to ensure Member States do not produce disparate national action plans of their own. It encourages Member States to produce their own action plans and strategies for sustainable construction. The sustainable construction final report proposes a programme of actions and recommendations which will be addressed at both European and national levels. The appendices to the report contain copies of national plans for 'sustainable construction' that were available at the time the report was written.

The terms of reference for the sustainable construction report were to develop strategies for environmentally friendly construction materials, energy efficiency in buildings and construction and demolition waste management.

The main recommendations made from this report are aimed at carrying forward the agenda for sustainable construction in the member state and they include:

To carry out studies and review work already carried out on whole life costs;

- Clients and public clients must take the lead in promoting sustainability in construction through sustainable procurement;
- That a set of sustainability performance indicators be agreed to;
- All member states should be encouraged to develop and publish plans and programmes for sustainable construction;
- A review of various software tools to determine which are useful, any shortcomings or improvements needed;
- The actors of the industry should raise awareness about sustainable construction aimed at the general public, and clients; and
- More research and development in the field of sustainable construction.

EU Legal drivers - Waste management context

Waste Framework Directive (Council Directive 2006/12/EC)

The Waste Framework Directive is the overarching Directive for waste and sets the basis for the regulation of waste and the legal definition of waste in Europe. Its main objective is to protect human health and the environment from the collection, transport, treatment, storage and tipping of waste. It establishes the waste hierarchy (reduce, reuse, recycle and disposal), the 'Duty of care' for handling waste, it outlines the principles of the polluter pays, and self-sufficiency in waste disposal amongst Member states, it encourages waste avoidance by promoting cleaner technologies and the use of products that can be reused or recycled and it encourages Member States to draw up waste management plans.

Status: Newly codified version is current and will remain in force until the revision of the FWD is carried out. The European Commission is proposing to revise the Waste Framework Directive (WFD) (2006/12/EC) and related EU legislation.

Relevance to HA work: the WFD has been transposed into UK law through Part II of the Environmental Protection Act 1990 and amendments and the Waste Management Licensing Regulations. The WFD defines waste and these definitions are valid in the UK.

Landfill Directive (Council Directive 1999/31/EC)

The Landfill Directive has as an objective of reducing the effects on the environment and risk to human health from the landfilling of waste. It sets targets for all Member States to reduce the amount of biodegradable municipal solid waste sent to landfill and requires members to draw up strategies to this effect. It also sets out regulations for the management and design of landfills and categorises landfills into three different types hazardous, non-hazardous and inert.

Status: current. During the first reading of the revised WFD targets to ban concrete and all recyclable waste from landfill from 2015 and 2020 have been proposed.

Relevance to HA work: the Landfill Directive has been transposed into UK law through the Landfill Regulations, which sets the criteria for the disposal of all waste, including inert and hazardous waste.

Hazardous Waste Directive (Council Directive 91/689/EC)

The Hazardous Waste Directive (HWD) defines hazardous waste and outlines a European wide framework for the management and regulation of hazardous waste. It defines hazardous waste according to its constituents and if they include one or more fourteen properties as set out in the Annex of the Directive. Member States are required to record and identify hazardous waste and must ensure that different

categories of hazardous waste are not mixed. Hazardous wastes are listed in the European Waste Catalogue (EWC 2002), where all wastes are listed accordingly to the generic industry, process or waste type.

Status: Current. The European Commission is proposing through a revision of the WFD to incorporate the Hazardous Waste Directive within the WFD and repealing the HWD.

Relevance to HA work: The Special Waste Regulations were first developed to implement the HWD at the UK level. These regulations were replaced in July 2005 by the Hazardous Waste (England and Wales) Regulations and the List of Wastes (England) Regulations.

Integrated Pollution Prevention and Control Directive (Council Directive 96/61/EC)

The Integrated Pollution Prevention and Control Directive (IPPC) aims is to prevent and control pollution from a wide range of industrial and agricultural activities, by preventing or at least reducing emissions to air, water and land. It establishes a system of permits issued by competent authorities and defines the obligations which highly polluting industries must comply.

Status: Current.

Relevance to HA work: the IPPC Directive has been transposed into law in the UK through the Pollution Prevention and Control (England and Wales) Regulations 2000 (see below), and imposes the requirement for all installations (new and existing) to be compliant by the end of October 2007.

Communication from the Commission to the Council and the European Parliament of 21 February 2007 on the Interpretative Communication on waste and by-products [COM(2007) 59 final - Not published in the Official Journal].

This communication is a guidance document for use by responsible authorities to determine whether a given material in a production process context, is waste or not. It clarifies what a production residue and by-product is. It identifies various factors to help clarify when a material is a waste such as if no other use than disposal can be found, if the intended use has a high environmental impact, where the treatment method is a standard waste treatment method, or the producers perceives the material to be waste. The commission lists examples of products which are waste and which are not.

Status: Current and recent.

Relevance to HA work: Limited impact as by-products used as secondary aggregates (e.g. slag) or binders (e.g. pfa) might or might not be defined once and for all as waste, and this will determine if the material becomes subject of or excluded from Waste Management Licensing Regulations.

End of waste project

The DG Joint Research Centre (JRC) and the Institute for Prospective Technological Studies in Seville are working on a project within the framework of the Thematic Strategy on prevention and recycling of waste, to develop a methodology to determine end of waste criteria using three pilot case studies, these include:

- Aggregates (recycled or secondary);
- Compost; and
- Scrap metal (iron and steel, aluminium).

Status: started in September 2006, on-going and to be completed in 2008.

Relevance to HA work: WRAP has started work on quality protocols aimed at providing waste processors with a tool that allows them to substantiate a claim that a waste has ceased to be waste. The Quality Protocol for Inert Wastes (WRAP, 2006) on the production of Aggregates from inert waste has been widely used in the UK since 2003.

Commission Communication of 21 December 2005: "Taking sustainable use of resources forward: A Thematic Strategy on the prevention and recycling of waste". [COM (2005) 666 - Not published in the Official Journal].

The European commission has proposed a new strategy on the prevention and recycling of waste. This strategy is one of seven Thematic Themes of the 6th Environmental Action Plan. The objective of this strategy is to improve the management of waste by setting out guidance for reducing the negative impact on the environment caused by waste throughout its life-span. It aims to make Europe a recycling society.

The strategy aims to remove barriers to waste being used as a potential resource. The strategy also encourages the adoption of life-cycle thinking. One of its objectives is to simplify the existing waste legislation. It will do this by merging the Waste Framework Directive with the Hazardous Waste Directive and the Waste Oil Directive (see Com (2005) 667 final below). It also aims to set recycling standards that require Member States to develop national waste prevention programmes and to promote the recycling sector.

Proposal for a Directive of the EU parliament and the Council on waste (presented by the Commission) - COM (2005) 667 Not Published in the official journal.

This proposal presented by the EU Commission in December 2005 on the proposed new WFD seeks to merge the Hazardous Waste Directive and the Waste Oil Directive into the new WFD. It also clarifies certain concepts (recovery and end of waste). It also required Member States to develop national waste prevention programmes.

Status: Under negotiation between the Commission and Member States. DEFRA organised a consultation on the revised WFD, which closed in January 2007, to collect the UK views on the proposed changes. The consultation was closing at the time of writing and a summary of the responses was therefore not available. The consultation document, however, highlights the UK position (indicated between brackets in the following list) on those changes most likely to have an impact on the HA and its supply chain:

Article 5: Requirements for all waste to undergo waste recovery;

Article 11: End of waste, including recycled or secondary aggregates and compost. The Commission would be able to adopt by comitology implementing measures specifying the environmental and quality criteria that would both be needed to ensure that a waste has ceased to be waste. (This would reinforce for example the work of WRAP and other stakeholders on the Quality Protocols);

Waste Directive;

- Article 21: introduction by comitology of EU-wide minimum standards for permits for all waste disposal and recovery operations, similar to those for the ELV, WEEE, landfill and Waste Incineration Directives; and
- Article 22-24: exemptions to be based on Best Available Technique.

A first reading has taken place within the European Parliament. The MEPs have proposed some amendments of which approval by the EU commission was pending at the time of writing.

Impact on the Supply chain and on the HA: The UK will need to implement the new WFD not later than two years after its entry into force (date to be defined but likely to be within the next two to three years). The consequences on the HA and its supply chain will depend on the final text of the WFD.

EU Legal Drivers- Sustainable Development context

Communication from the Commission of 21 December 2005 - Thematic Strategy on the Sustainable use of Natural Resources [COM (2005) 670 - not published in the Official Journal].

The strategy on the sustainable use of natural resources is one the seven thematic strategies to come out of the Sixth Environment Action Programme adopted in 2002. It seeks to implement the concept of life cycle and the impact of resource use in associated policies. By implementing life cycle based policies it aims to reduce the environmental burden of each stage of the life cycle of resource use (the extraction, or harvesting, use and ultimately disposal). The aim is to improve the eco-efficiency

of resource use and to prepare the way for sustainable modes of production and consumption. The strategy applies to all resource-consuming sectors aimed at improving resource yield, reducing the environmental impacts of resource use and finding alternatives for polluting resources.

The strategy plans to set up a natural resource data centre to improve the knowledge on the use and environmental impact of resources. By 2008, the Commission intends to develop indicators for monitoring and evaluating progress towards achieving the strategy's goals. All member states are obliged to prepare measures and programmes (i.e. on education, training and economic incentives) at a national level.

Communication from the Commission of 11 January 2006 on a Thematic Strategy on the Urban Environment [COM(2005) 718 final - Not published in the Official Journal].

The European Commission adopted the Thematic Strategy on the Urban Environment in January 2006. The strategy is one of seven under the 6th Environmental Action Programme. The aim of this strategy is to improve the quality of the urban environment by making cities more attractive and healthier places in which to live, work and invest and by reducing their impact on the environment.

The strategy makes recommendations for actions in four areas: urban management, sustainable transport, construction, and urban design. The strategy aims to support and encourage local authorities to adopt an integrated approach to urban management. The strategy also aims to reinforce existing EU environmental policy and legislation at the local level. One of the strategy's objectives is to encourage all Member States, regional and local authorities to develop sustainable construction programmes in their cities.

Status: Current and on going.

Relevance to HA work: NOT sure. Might be more higher level for governments to address.

Communication from the Commission to the Council and the European Parliament Integrated Product Policy - Building on Environmental Life-Cycle Thinking (Com 2003) 302

This communication describes a strategy for making products more environment-friendly. Two approaches are outlined:

- establishing general conditions which will improve the environment-friendliness of products throughout their life cycle;
- concentrating on products which have the greatest potential for improvement from an environmental standpoint.

To implement the strategy the communication recommends:

- the creation economic and legal framework including measures such as taxes and subsidies, standardisation, voluntary agreements and public procurement;

- the promotion of life-cycle thinking: this includes making life-cycle data available, integrating a product dimension in environmental management systems and promoting IPP within companies and in relation to specific products;
- Communicating of product information to consumers: this includes incorporating environmental criteria in public procurement and corporate purchasing, and measures concerning eco-labelling.

The communication also recommends the development of a handbook on greener procurement for public authorities and an exercise to identify products with the greatest potential for improvement from an environmental standpoint.

The communication encourages Member States to draw up publicly available action plans for greening public procurement. The action plans should state targets and measures for reaching these targets. They should be drawn up for the first time by 2006 and then reviewed every three years. The action plans will not be legally-binding but will help to raise awareness of green procurement.

Status: The requirement to develop a National Action Plan on green procurement is new and each member state is at a different stage of development in regards to this. By the end of 2006, 10 Member States had adopted national plans and 10 more are working towards it. A table summarising the current situation in each Member State in terms of legislation, targets, guidelines, local initiatives and NAPs is available on the European Commission, Green Public Procurement website:

http://ec.europa.eu/environment/gpp/national_gpp_strategies_en.htm

Relevance to HA work: Any green procurement policies developed at the UK level for government bodies to implement will have a direct impact on the Highways Agency work. See for example DEFRA's, 'Transforming Government Procurement' (published January 2007), and the UK Government 'Sustainable Procurement Action Plan' endorsed in March 2007. The UK government has also published updated mandatory environmental product standards to ensure Departments purchase the most sustainable products. Government departments will now be looking for measures to meet sustainable procurement targets and for supplies that comply with government product standards.

EU Sustainable Development Policy drivers

Renewed Sustainable Development Strategy: European Council

The renewed EU Sustainable Development Strategy adopted by the European Council in June 2006, builds on the Gothenburg Strategy of 2001. The EU Strategy for Sustainable Development 2001 sets as an objective to break the link between economic growth, the use of resources and the generation of waste. One of the recommendations from the 2006 review is that the EU should develop an action plan to promote sustainable production and consumption.

The renewed EU Sustainable Development Strategy sets out a policy framework for improving the quality of life in the EU, while using resources efficiently and to create sustainable communities. It is based on the three pillars- economic, social and environmental, working together to ensure sustainable development. The strategy identifies objectives and actions in seven areas; climate change and clean technology; sustainable transport; sustainable consumption & production; conservation and management of natural resources; public health; social inclusion, demography and migration; and global poverty and sustainable development challenges.

The renewed strategy recognises the need to work with partners outside the EU and the need for global solidarity on this issue. It also seeks to better integrate sustainable development in policy-making at all levels. To do this the strategy requires all EU institutes governments of Member States to ensure major policy decision are based on a Impact Assessment (IA) assessing the social, environmental and economic dimensions of sustainable development.

Status: A progress report on the SDS was released in October 2007. The report found that there have been a number of policy developments in key areas identified in the revised 2006 SDS, but there has been no substantial concrete action as yet. The next progress report is in 2009.

Relevance to HA work: Any policy changes or mandatory requirements adopted at the UK government level to meet EU sustainable development objectives may have an impact on Highways Agency work, especially in the area of waste management, resource and energy use, and climate change, these will need to be translated into action.

EU legal drivers- Climate Change context

Communication from the Commission, of 10 January 2007, entitled: "Limiting Global Climate Change to 2 Degrees Celsius - The way ahead for 2020 and beyond" [COM(2007) 2 final - Not published in the Official Journal].

This communication outlines concrete steps to limit the effects of climate change through both short and medium term measures targeted at developed (the EU and other industrialised countries) and developing countries. This includes measures on energy and international agreements. The EU is committed to a target to limit the global average temperature increase to 2 degrees Celsius compared with pre-industrial levels.

The communication proposes that the EU set a target in international negotiations for reducing greenhouse gas emissions for developed nations by 30% compared to 1990 levels by 2020, this is necessary to ensure the world temperature do not rise above the 2°C (the level that is believed to cause irreversible damage). It also proposes that the EU reduce its own greenhouse gases (GHG) by at least 20% by 2020.

The communication also sets out actions to reduce greenhouse gas emissions at the EU level, through: setting emission reduction targets; improving the EU's energy

efficiency by 20% by 2020; increasing the share of renewable energy by 20% by 2020; developing an environmentally safe carbon capture and geological storage policy; strengthening the European Emissions trading Scheme; and tackling emissions of non-CO₂ gases. It also proposes increasing funds for more research into clean technologies and to increase our knowledge on climate change.

The Commission adopted an Energy Action Plan for the period 2007-2009 at the same time it adopted this communication.

Status: The key elements of this communication were endorsed by EU Environment Ministers on 20 February 2007. The communication was considered by EU leaders at the spring European Summit of March 8 and 9, 2007. It acknowledged that the target of 2°C reduction in GHG was needed and that an integrated approach to climate and energy policy was the best way forward to achieve this objective. It also endorsed the elements identified by the Environment Council of February 2007 including the EU's objective of 30% reduction in GHG by 2020 and to contributing to a global comprehensive agreement for the period beyond 2012.

EU legal drivers- Energy Policy context

Communication from the Commission, dated 10 January 2007, on an Energy Policy for Europe [COM(2007) 1 final - Not published in the Official Journal].

This communication brings together a package of measures for managing energy needs. The communication describes the current energy situation and outlines a set of European Energy Policy Measures (the 'energy' package). The two main concerns for Europe are the security of supply and climate change from emissions.

The Commission has identified the need to set an internal energy market allowing consumers to choose suppliers at a fair and competitive price. It also proposes an integrated and interconnected market and the EU proposes to be a driving force in developing international energy policy.

The communication also sets out:

- Targets to reduce greenhouse gases;
- Steps to ensure security of supply;
- Measures to reduce energy consumption through its Action Plan for Energy Efficiency (2007-2012);
- Measures to increase the use of renewable energy resources (through its renewable energy roadmap) and;
- Steps to develop energy technologies through increasing research in the energy sector.

Communication from the Commission of 19 October 2006 entitled: Action Plan for Energy Efficiency: Realising the Potential [COM(2006) 545 - Not published in the Official Journal].

In this communication, the Commission outlines long and short term actions it will take to achieve a 20% reduction in energy consumption by 2020. This will help reduce the EU's impact on climate change and dependence on fossil fuel imports. The Action Plan includes measures to improve the energy performance of products, buildings and services and runs from 1st January 2007 to 31st December 2012.

The Action Plan targets the residential and commercial building sector, the manufacturing industry, and transport. Some of the actions identified include:

- Adoption of Eco-design minimum standards to improve energy efficiency in 14 product groups;
- Strengthening the rules on labelling;
- Extension of the Energy Performance of Buildings Directive to cover small buildings to promote 'passive' houses;
- Encouraging the promotion of cogeneration and decentralised generation centres;
- Plans to set a binding target to reduce polluting car emissions to achieve the threshold of 120g of CO₂/km by 2012; and

Plans to extend the greenhouse gas emissions trading scheme to the air transport sector.

EU legal drivers- Water management context

Water Framework Directive (WFD)

On 23 October 2000, the "Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy" or, in short, the EU Water Framework Directive (WFD) was adopted.

The WFD sets the objectives for the protection of water for the future. Its overall objective is the development of a consistent water management regime across Europe. This objective will allow for a consistent means to reduce pollution and improve conditions of aquatic ecosystems, promote sustainable use of water and help reduce the effects of floods and droughts. It is a single piece of framework legislation that aims to replace seven other pieces of water legalisation to rationalise and streamline the management of water in a more holistic way.

The keys aims of the WFD are to:

- expand the scope of water protection to all waters, surface waters and groundwater;
- achieve "good status" rating for all waters by a set deadline this include rivers, lakes, groundwaters and coastal waters;

- introduce a new regime of water management based on river basins;
- introduce a "combined approach" of emission limit values and quality standards;
- introduce adequate price incentives to get people to use water efficiently;
- involve the citizen more closely; and
- streamline legislation.

The Directive identified two areas where specific legislation was needed: groundwater and priority substances. The new Groundwater Directive was adopted by the European Parliament and the Council in 2006 however, a proposal for a Directive on Priority Substances is still under negotiation. In July 2006, the Commission adopted a proposed Directive setting environmental quality standards for the priority substances. Two additional recent legislative proposals will broaden the scope of the EU water policy, these are a Directive on the assessment and management of floods and a Marine Strategy Directive.

Status: Current and on going. The next important milestones are the development of the river basin management plans and the water pricing plan. The River base plans developed by Member States are due by December 2009, these will help to make real improvements for the whole water system in the form of programmes of measures. The plans must be operational by 2012 and deliver the environmental objectives of the Directive by 2015. Member States are also required to have a water pricing plan in place by 2010.

EU legal drivers- Protection of nature and biodiversity context

Communication from the Commission of 21 December 2005 - Thematic Strategy on the sustainable use of natural resources [COM(2005) 670 - not published in the Official Journal].

This is a 25 year strategy aimed at the sustainable use of natural resources throughout their life cycle (includes their extraction or harvesting, use and ultimate disposal). The strategy is based on a life cycle approach and is an important part of the EU's strategy to achieving sustainable development. Central to its objectives is to reduce the environmental impacts by the use of natural resources while at the same time improving resource productivity and economic growth across Europe, referred to as decoupling. The strategy seeks to integrate the life cycle approach into all environmental and non-environmental policies that consume resources. It has already been applied to the thematic strategy for waste and in the areas of transport and energy. This should help to improve eco-efficiency of resource use and encourage more sustainable methods of production and consumption.

To achieve this objective, the strategy includes actions to:

- Improve our knowledge base of European resource use and environmental impact through the development of a natural resources data centre, run by the commission;
- By 2008 the commission intends developing indicators for monitoring and reporting progress in all Member States towards the strategies goals;
- Member States are required to prepare measures and programmes at the national level (e.g. training, education and economic incentives); and
- Raise awareness among stakeholders and citizens of the significant negative environmental impact of resource use.

Status: the strategy has been adopted and is current.

Directive 2004/17/EC of the European Parliament and of the Council of the 31 March 2004 coordinating the procedures of entities operating in the water, energy, transport and postal services (Directive 2004/17/EC) and 2004/18/EC of the European Parliament and of the Council 31 March 2004 on the coordination of procedures for the award of public works contracts, public supply contracts and public service contracts (Directive 2004/18/EC).

These two Directives together repeal Directive 71/304/EEC. The Procurement Directive is split into two parts: one part concerns the procurement procedure, this is addressed by Directives 2004/18/EC, which sets out the procedures for awarding of a public supply contract and the other part is Directive 2004/17/EC, which sets out procurement procedures of entities operating in the water, energy, transport and postal services.

The Procurement Directive aims to simplify the procurement process, facilitate electronic procurement, make the awarding of contracts more transparent, combat corruption and organised crime, and to make the criteria for awarding contracts and selecting tenders clearer. The Directive applies only to public procurement contracts whose value is above certain thresholds. The Directives also mention the possibility of adopting environmental considerations in technical specifications and award criteria, and in contract performance clauses.

Status: Current

Soils

EU Thematic Strategy for Soil Protection, including proposals for a Soil Framework Strategy

This thematic strategy for soils protection consists of a Communication from the European Commission to other European Institutions and is a proposal for a frame Directive and an accompanying Impact Assessment. The thematic strategy comprises the three components detailed below.

The [Communication \(COM\(2006\) 231\)](#) sets the main frame. This communication explains why further action is needed to ensure a high level of soil protection, it sets

the overall objective of the Strategy and explains what kind of measures must be taken. It also establishes a ten-year work program for the European Commission (EC).

The proposal for a framework [Directive \(COM\(2006\) 232\)](#) sets out common principles for protecting soils across the EU. Within this common framework, the EU Member States will be able to decide how best to protect soil and how use it in a sustainable way on their own jurisdiction.

The Impact Assessment ([SEC \(2006\) 1165](#) and [SEC\(2006\) 620](#)) contains an analysis of the economic, social and environmental impacts of the different options that were considered in the preparatory phase of the strategy and of the measures finally retained by the Commission.

The European Council met on 20th December 2007 to discuss the strategy and proposed Framework Directive, however, Environment Ministers were unable to reach a political agreement for EC proposals for the Directive. The Framework Directive was originally proposed in September 2006 at the same time as the EC adopted the Thematic Strategy for Soil Protection.

EU Legal Drivers- Construction Products Directive (CPD)

The Construction Products Directive (Council Directive 89/106/EEC) of 21 December 1988, amended by Directive 93/68/EEC of 22 July 1993.

This Directive aims to remove technical barriers to trade of construction products in the EU to allow for the free movement of products in European Member State and for products coming into the EU from other countries. This is often caused by national differences in the essential requirements. The CPD defines a construction product as being, 'any product which is produced for incorporation in a permanent manner in construction works (which includes both buildings and civil engineering works) and it applies to any such product for which one or more of the essential requirements defined by the directive are relevant'. The CPD covers for four main elements:

- A system of harmonised technical specifications (i.e. a harmonisation of methods of test, the method of declaration of product performance values, and the method of conformity assessment);
- An agreed system of attestation of conformity for each product family;
- A framework of notified bodies; and
- The CE marking of products.

The CPD requires the production of harmonised product standards (hENs) covering the requirements set out in the mandate and necessary to meet the requirements of the Directive. The mandated requirements which must be complied with for the CE marking are listed in Annex ZA this includes the clauses in the standard which cover mandated characteristics, the attestation of conformity system which must be followed, and part three which contains information which must accompany the CE marking.

CEN (Comité Européen de Normalisation) submits the harmonised product standards to the European Commission, which then adds the standard in the Official Journal of

the European Union (OJEU) for manufactures to make use of. Standards sited in the OJEU can be used to obtain CE marking for products under the CPD.

Member States must take steps to ensure only products, which are fit for the intended use, are placed on the market. 'Fit for intended use', means that products must satisfy the essential requirements referred to in Article 3 of the CPD. The essential requirements for the works i.e. the building or civil engineering, not the products themselves, are given in annex I of the CPD, these include:

- Mechanical resistance and stability;
- Safety in case of fire;
- Hygiene, health and the environment;
- Safety in use;
- Protection against noise; and
- Energy economy and heat retention.

The mandates also sets the system of attestation of conformity for the products they cover. In the UK, Ireland and Sweden CE marking is not compulsory.

Status: Current

EU research and development reports on sustainable construction

European Construction Technology Platform (ECTP), February 25, 2005. *Challenging and Changing Europe's Built Environment: A vision for a sustainable and competitive construction sector by 2030.*

The European Construction Technology Platform (ECTP) is an initiative to engage the construction sector including contractors, authorities, architects, designers, purchasing bodies, full range of suppliers, clients and users- to identify common priorities. The ECTP has developed a vision for a sustainable and competitive sector by 2030. The vision is:

"In the year 2030, Europe's built environment is designed, built and maintained by a successful knowledge- and demand- driven sector, well known for its ability to satisfy all the needs of its clients and society, providing a high quality of life and demonstrating its long-term responsibility to the mankind's environment. Diversity in age, ability and culture is embraced. Equalization of opportunities for all is an overarching principle; construction has a good reputation as an attractive sector to work in, is deeply involved in research and development, and whose companies are well known for their competitiveness on the local and regional as well as global levels."

The document outlines a number of objectives and research targets aimed at reaching this vision. The objectives are aimed at three main goals: meeting clients/users requirements, becoming sustainable and transforming the construction sector. Under each heading research targets are proposed according to major strategic research priorities.

European Construction Technology Platform (ECTP), July 20th, 2007. *Strategic Research Agenda for the European Construction Sector, Implementation Action Plan*. Version 1.

This document outlines an Implementation Action Plan (IAP) of the research areas identified in the Strategic Research Agenda (the above document), aimed at meeting the ECTPs vision of the construction sector in Europe. This document sets out how the research themes should be implemented. It also explains how the ECTP and its stakeholders would go about facilitating this process and which parties to involve. The IAP identifies the most important research areas which should be focused on during the period 2007-2013.

There are 13 research areas identified, these are grouped around 3 pillars, as follows a) meeting client/user requirements; b) becoming sustainable; c) transformation of the construction sector. From the 13 main areas of the research, a set of 9 major priorities was selected for inclusion in the implementation plan. These include:

- A. Technologies for healthy, safe accessible and stimulating indoor environments for all;
- B. Innovative use of underground spaces;
- C. New technologies, concepts, and high-tech materials for efficient and clean buildings;
- D. Sustainable management of transports and utilities networks;
- E. A living culture heritage for an attractive Europe;
- F. Improve safety and security within the construction sector;
- G. New integrated processes for the construction sector;
- H. High value construction materials.

Priorities A and B focus on the 'meeting client requirements' research area. Priorities C-G focus on the 'becoming sustainable' research area and Priorities H and I are concerned with the 'transformation of the construction sector' research area.

For each research area the IAP provides information on:

- The scope of each priority and its rationale;
- The main development issues, in terms of innovations;
- The expected impact;
- The state of the art;
- The vision and the objectives;
- The synergies with other priorities;
- The expected costs of each research activity;
- Major recent projects in each priority.

EU Sustainable Construction programmes and networks

E-Core (European Construction Research network) Strategy for Construction RTD

E-core (European Construction Research Network) is an umbrella network for the thematic networks on the construction sector. E-CORE was set up to contribute towards establishing a European Research area on the construction industry.

The strategy for Construction RTD (Research and Development) has been developed by a group of E-core members from different backgrounds, it was adopted in 2005. The Strategy has been developed so that it is consistent with European aspirations.

The over-arching aim of the strategy is to maximise the contribution of construction and the built environment to sustainable development in all its aspects: environmental, social and economic. This will require construction:

- To interact more effectively and more sympathetically with Society;
- To rise to the challenge of higher expectations by individuals and communities; and
- To focus on delivery of services, rather than of physical products.

The strategy identifies the changes needed in the construction sector to achieve the European aspirations as they relate to the Lisbon competitiveness and growth agenda and a sustainable construction sector. As part of the E-core agenda the European Construction Technology Platform (ECTP) was developed and they are charged with developing a vision for 2030 for the construction and built environment and to translate the strategy into action.

3.2 The Road Construction Context

Forum of European National Highway Research Laboratories (FEHRL), *New Road Construction Concepts: Vision 2040*

The European Commission has set up a project called the New Road Construction Concepts (NR2C). The project has as its aim to generate future-orientated initiatives to accessibility problems and issues related to road infrastructure. A vision forms the aim of NR2C that is '*to identify and specify the research required in the field of road engineering to guarantee comfortable and reliable ground transport in a sustainable and environmental-friendly way for the coming decades.*'

NR2C has two main objectives, these are:

- To define long-term views of road infrastructure; and
- To study or imagine specific innovations in each of the three fields- urban, interurban, civil engineering structures- aimed at generating solutions.

The project is seeking to identify conceptual and technical answers to the mobility and transport demands of the future. Input for the NR2C vision 2040 was based on nine European country's visions and other organisations identified in a workshop. The vision is a description of the how the future may look in the year 2040 and how society thinks about use, design, construction and maintenance of infrastructure for the coming decades. The report identifies recommended research programmes that will help achieve the vision.

The report is based on four construction concepts these include: reliable infrastructure; green infrastructure; safe & smart infrastructure and human

infrastructure. The vision focuses on changes in road construction concepts as a result of future needs and demands. The design, construction, maintenance and rehabilitation of roads in the future is also a central theme addressed in the vision report.

EU research papers on sustainable road construction

International Road Federation (IRF) Research Council, Dec 2007. *Sustainable Roads Discussion Paper* (Brussels programme Centre).

This paper argues that progress has been made in the road transport sector to reduce its environmental footprint from road construction, while continuing to generate new opportunities for road sector stakeholders. The paper aims to dispel the myth that building more roads can only come at the expense of the environment.

In recent times there has been growing support for the need to reduce carbon related emissions in order to reduce the impacts of global warming. At the same time, there have been many studies linking the social-economic benefits of roads such as reducing poverty, which reinforces the ongoing construction of new roads around the world adding more and more cars to the road networks. However, the report suggests that the relationship between road construction and CO₂ emissions is complex. The report states that there is no single instrument to capture the direct and indirect environmental effects of roads and balance them against other transport alternatives (e.g. building a ring road versus constructing a metro line). However, the report suggests that there are ways to reduce greenhouse gas emissions through road infrastructure construction methods, see example below.

REDUCE EMISSIONS- A Norwegian study released on 19 March 2007 has found conclusive evidence that road realignments and upgrades reduce car emissions. Taking three baseline scenarios, the emissions of CO₂ were found to be reduced by up to 38% while local pollutants dropped by a staggering 75%. The same study indicated that in a majority of cases, the changes did not generate new car trips, putting an end to one of the most enduring transport myths.

In terms of sound environmental road design the report outlines the following elements:

- The importance of optimising route planning through the use of environmental impact analyses. Environmental impact assessments for large-scale infrastructure programmes provide an opportunity to engage all stakeholders and to make sure environmental considerations are taken into account.
- The use of recycled and environment-friendly construction materials. Powdered rubber tyres, glass and broken concrete are used widely in underlayers and surfaces of roads, helping to reduce overall energy consumption and CO₂ emissions by up to 10%. However, polluting products are still used in many member states due to lack of information, and confusing European regulation on waste management;

- Habitat fragmentation- for new developments this can be mitigated by finding optimal alignment of roads in the landscape helping to minimise conflicts and the need for mitigation. In existing roads, planting of shrubs along roads and the use of animal over/underpasses can help reduce impacts on wildlife. In some instances habitat creation as a form of compensation when habitats are lost, may be appropriate to achieve 'no nett loss'.
- Avoiding water pollution- Mitigation measures can include use of porous surfaces, adopting intelligent spraying of de-icing solutions, providing adequate drainage to ensure contaminated water is captured and treated.
- Making use of Intelligent Transport Systems (ITS)- Such as real time traffic information allowing motorists to make informed route choices, which in turn can help to decrease congestion and contribute to energy savings and environmental protection.
- Quieter roads- Traffic management strategies combined with road infrastructure improvements can help reduce noise. Solutions include pavement properties, and acoustic barriers which can reduce noise levels by 5 to 10 dB (A).

US Department of Transport, Federal Highways Administration, 2000. *Recycled Materials in European Highways Environments, Uses, Technologies and Policies*, part of the International Technology Exchange Programme.

This report was published by the American Federal Highway Administration of US Department of Transport. The document is a summary of a scanning tour conducted by a USA delegate in 2000 to five European countries. The objective of the tour was to review and document innovative policies, programs, and techniques that promote the use of recycled materials in the highway environment. The delegate met with representatives from transportation and environmental ministries, research organisations, and industries in Sweden, Denmark, Germany, the Netherlands, and France. These countries were chosen as they all have active research policies and programmes promoting the use of recycled materials in highway construction. The report identifies recommendations for the US situation covering four areas: recycling for sustainable road construction, economics, engineering and environment.

Key findings of the report include:

EU policies and practices on reuse of waste materials is highly developed demonstrating that recycling happens where it is economical to do so;

- Within the EU factors such as lack of virgin material, public opposition to aggregate mining, high transport costs, opposition to landfilling and high population densities have all encouraged recycling;
- All the countries visited had recycling policies specifically promoting sustainability;

- Factors encouraging recycling include regulations including bans on landfilling, landfill taxes, natural aggregate taxes, and in some cases subsidies to assist recycling;
- There are clear engineering and environmental performance standards for both virgin and recycled materials, which allows the recycled materials to compete competitively with natural materials;
- There is a high level of public awareness and participation in recycling programmes as well as good public education programmes to encourage recycling in all countries visited;
- Where tests and standards do not exist government often supports recycling by sharing the risk;
- The Dutch have a policy of sustainable development in highway and other construction that embraces the use of recycled materials.

Other Useful findings

Denmark has a strong record for the use of recycled materials in road construction largely due to the government supporting regulation on waste management and its driving role in promoting recycling. The Danish government supports road contractors, producers of waste materials, and suppliers to work together to encourage the use of recycled materials. The government's general policy is that recycling should be done at the highest level that is technically and economically feasible. The Danish government also supports research for the use of recycled materials in road construction. The Vejteknisk Institut (Danish Road Institute - DRI) has developed specifications, standards, and guidelines for using recycled materials in road construction.

In Germany, The Closed Substance Cycle and Waste Management Act (1996) established the philosophy that producers must take responsibility for the entire life cycle of the products they manufacture. Under this act only residue waste that cannot be reused or recycled can be disposed. Since 1999, companies above a certain threshold must submit life-cycle plans to encourage recycling.

In the Netherlands, the government's policy on the use of recycled materials is advanced. The Dutch policy on economic growth and the environment is based on the principle that economic growth should occur only if pollution declines at the same time. It's a long term process that must involve all elements of society. For the Dutch sustainable development involves three main policies from an environmental perspective: the Waste Materials Policy, the Soil Protection Policy, and the Surface Mineral Policy. The Waste Materials Policy is based on the hierarchy of waste prevention, recycling, burning, and landfill. Among the provisions of the Soil Protection Policy is the concept of permitting a marginal amount of contaminants in the soil when using secondary materials. The objectives of the Surface Mineral Policy are to encourage the conservation of raw materials, stimulate the use of secondary materials, support the use of renewable raw materials, and ensure that adequate supplies of raw materials are available for construction.

In terms of engineering, the Dutch do not use traditional test to evaluate performance of recycled products. Instead they use full-scale testing to determine the risks of using recycled materials.

Most of the countries visited use industry by-products in road construction. Materials sited that are most often used include: old asphalt, blast furnace slag, mining waste, building and road demolition waste, waste-to-energy bottom ash, coal bottom ash, crushed concrete and bricks, power plant residues etc. These materials are commonly used in: hot mix asphalt, concrete filler, unbound base course and embankments, as an aggregate, and in earthworks.

The quantity of recycled material used in road construction varies between countries however in some cases it is as high as 100%. See boxes below for examples of recyclable materials used in road construction in Europe.

In Germany, a larger country with much industry and high aggregate availability, the following rates are recorded:

Blast furnace slag — 100 percent, with 9.2 million tons (8.3 million metric tons) used and produced.

Steel slag — 92 percent, with 4.9 million tons (4.4 million metric tons) used and 5.3 million tons (4.8 million metric tons) produced.

Coal bottom ash — 97 percent, with 3 million tons (2.7 million metric tons) used and 3.1 million tons (2.8 million metric tons) produced.

Coal fly ash — 88 percent, with 3 million tons (2.7 million metric tons) used and 3.4 million tons (3.1 million metric tons) produced.

Municipal solid waste combustion bottom ash — 69 percent, with 2 million tons (1.8 million metric tons) used and 2.9 million tons (2.6 million metric tons) produced.

In Denmark, with a high population density and low natural aggregate availability, reports the following rates:

Steel slag — 100 percent, with 0.066 million tons (0.06 million metric tons) used and produced.

Crushed concrete — 81 percent, with 0.95 million tons (0.86 million metric tons) used and 1.17 million tons (1.06 million metric tons) produced.

Coal bottom ash — 100 percent, with 2 million tons (0.18 million metric tons) used and produced.

Coal fly ash — 100 percent, with 1.17 million tons (1.06 million metric tons) used and produced.

The Netherlands, a populous country with more limited aggregate resources and a high degree of industrialization, has a 100-percent recycling rate in several categories, including:

Blast furnace slag — 100 percent, with 1.32 million tons (1.2 million metric tons) used and produced.

Steel slag — 100 percent, with 0.55 million tons (0.5 million metric tons) used and produced.

Coal bottom ash — 100 percent, 0.09 million tons (0.08 million metric tons) used and produced.

Coal fly ash — 100 percent, with 0.94 million tons (0.85 million metric tons) used and produced.

C&D waste — 100 percent, 10.1 million tons (9.2 million metric tons) used and produced.

Municipal solid waste combustion bottom ash — 100 percent, with 0.9 million tons (0.8 million metric tons) used and produced.

Source of text in table: US Department of Transport Federal highway Administration, 'Scanning European Advances in the Use of Recycled Materials in Highway Construction' by Katherine Holtz and T. Taylor Eighmy found on the Turner-Fairbank Highway Research Centre website under *Public Roads* Magazine July/August 2000 Vol. 64 No. 1

<http://www.tfhrc.gov/pubrds/julaug00/recycscan.htm> accessed 17th January 2008.

Road Pavements of the World Association (PIARC), July 2007. *Review of the growth and development of recycling in pavement construction*; Report prepared by the Working Group 2 Maintaining Pavements in the Technical Committee 4.3.

This report is a summary of information from different countries on the topic of recycling in the pavement construction industry. Its main objective is to identify barriers to the use of recycled and alternative materials in road construction and make recommendations on systems and approaches to assist in overcoming these barriers. The report states that recycling has benefits in terms of achieving long term goals of minimising the use of natural resources and in developing a more sustainable approach to construction.

The main barriers that inhibit the use of recycled and alternative materials identified in the report include: a lack of client awareness, legislation and waste regulation, economics, appropriate test methods, supply and demand, planning, quality control measures, standards and specifications and environmental concerns. The report also finds that recycling is often perceived to be uneconomic.

The main factors that contribute to overcoming these barriers to recycling in road construction include: client education regarding the benefits of recycling, implementation of appropriate regulatory and legislation measures aimed at improving the economics of recycling.

Drivers found in some countries towards recycling in the road construction sector include legal incentives like placing recycling criteria in contracts, increasing landfill taxes and aggregate levies.

The report also found that cold recycling is a viable alternative to the conventional approach and this method has been successfully used across the world for decades. Recent plant technology developments have also led to this method being used increasingly in heavily trafficked areas. The report showed that experience with hot mix recycling of surface course materials back into a new surface course layer has proven to be successful and makes use of a premium quality material.

The report makes the following recommendations to overcome the barriers to recycling:

- Through legislation encourage public bodies to procure eco-friendly solutions in road construction projects;
- Disseminate more information to the road construction industry on the use of recycled materials and alternative materials and publicise successful demonstration projects;
- Issue guides, standards and specifications to support the implementation of recycling techniques;
- Decision makers should demand minimum levels of recycling in contract specifications;
- Establish legal incentives to recycling such as landfill taxes;
- Promote advanced planning and area-wide coordination for the use of recycled and alternative materials.

Case studies found in the report:

In Austria, the road maintenance programme uses milling operations on roads with heavy traffic and consequently, produces an increased volume of asphalt granulate. This material is of high quality and is used in the new layer as it is found to be more cost effective than transporting it to a mixing plant for addition into a new mixture.

SAMARIS (Sustainable and Advanced Materials for Road Infra-Structure) *Competitive and sustainable growth programme, Deliverable 5- Existing national regulations applied to material recycling*. February 2004.

This research paper addresses the need to develop an assessment methodology for the engineering and environmental performances of alternative materials in the context of their use in roads. This gap is an obstacle for the use of alternative materials in road construction.

The first part of the report provides a status report on alternative materials, this includes a definition of alternative materials and a definition of waste, hazardous waste, inert wastes and secondary raw materials at the European Community level and at each member state level, it also indicates whether the European reference is followed or not by each state.

The first part of the report found that the European legislator has developed useful definitions and guidelines of waste, hazardous waste and inert waste, for the majority of the states. In regards to the definition of secondary raw materials, the states feel they need to follow the European model. The EU definition is very specific but does not relate to road construction, consequently some states have developed their own definition.

The second part of the report provides a definition for nine alternative materials, representing the most important deposits and applications in road construction. In this part, the report outlines the status, the main figures relating to their use, state by state and the applications in which they are used in road construction.

The report found that municipal solid waste bottom ash, as well as coal fly ash and building demolition crushed concrete are produced in 6 to 7 states. Furnace slag, electric arch furnace slag and vitrified blast furnace slag are produced in 5 states. Crystallized blast furnace slag is produced in 4 states, road crushed concrete in 3 states and 2 indicted production of decontaminated soils. The main application of these materials is also shown in the report.

Part three of the report provides for each material and state by state, a list of management documents that can be used for their production, its characterisation or its use. The report found that there are few management documents covering engineering properties assessments and a lack of documents for the assessment of environmental properties for many materials. It also found that the documents were largely about the characterisation of materials and with their use rather than with production. This has been a problem for end-users as well as for producers, as it has made the production of products that meet the end-users specification difficult. Thus it is in both their interest that an agreed set of criteria for engineering and environmental specifications is developed.

The report highlighted the variety of state toolboxes available for the assessment of alternative materials. Different practices and rules exist among the European states. This information can be shared to help produce an integrated engineering/environmental approach for assessment of alternative materials. These documents can also be used to help develop a framework of evaluation for alternative materials assessment.

International Roads Federation (IRF), Research Council Nov 2007. *'The Social Economic Benefits of Roads in Europe'*. (Brussels programme Centre).

This report summaries the social and economic benefits of road infrastructure at all levels of society in Europe. It argues that national governments are not spending enough on road networks and this will in the future have an impact on Europe's goal of *'complete and undistorted internal market fully guaranteeing the free movement of goods, people, services and capita'*. It argues that there is a strong correlation between efficient road networks and the opportunities for economic and social advancement.

One key finding is that road related turn-over and employment make it one of the most important sectors in Europe. The report looks in detail at who uses roads and why and what is begin transported and where. One finding here is that road transport accounts for 44% of all freight movement within the EU. Road transport is also important for individuals' mobility allowing people to access more parts of the EU, resulting in social benefits.

Road transport is a key element to the success of European businesses, supply chain management and the economy. The freight industry employs 318,000 people in France alone. The freight sector is growing fast across Europe. In terms of the impact of roads on the economy, estimated revenues of the road sector in the EU 25 is EUR 2,290.4 billion, which is equivalent to approximately 22% of the EU 25 GDP. It is estimated that as many as fifteen million EU citizens work directly or indirectly for the road sector (automotive suppliers, petrol industry, car insurance companies, etc.), representing approximately 5% of the total EU 25 workforce.

The construction of roads also generates significant economic activity. This can be demonstrated by a report commissioned by the French Senate in 1995, which found that an investment of EUR 150 million in roads creates an average of 3,245 jobs, 1,210 are directly related to the road construction works, 575 are linked to activities prior to the construction and 660 are related to the production of construction materials and 800 jobs result from construction-related investment revenues.

Roads also represent the largest item in national budgets. Vehicle-related taxes represented up to 10.2% of the total fiscal income of some EU Member States. For 2007, the total amount of revenue for the road sector in the 15 EU states was roughly equivalent to EUR 360 billion.

Roads have an affect on the geographic distribution of economic growth. This was illustrated in a study carried out by the Dutch Directorate for Traffic and

Infrastructure, where the impacts of roads on regional economies in the Netherlands were measured and found that high job densities were located near major road arteries.

Roads also contribute to the creation of new jobs and economic prosperity of regions. A study in 2000, in the Valencia Region of Spain, looked at the positive impact of the A7 motorway. The study found that the A7 contributed to as much as 1.5% of the overall regional GDP growth in the year 2000. The social-economic benefit in the Valencia region is estimated to be EUR 251 million for the year 2000 alone. It also found that the A7 had an impact on society through an increase in citizen's wealth, higher property values and the accelerated expansion of the industrial base in the areas along the motorway.

Other key impacts of roads include access to education and training, healthcare, leisure, impacts on the environment and an impacts distribution of poverty. Each of these is discussed further in the report.

In terms of roads and sustainable development, the report argues that the environmental impacts of roads are improving. Road transport is becoming less polluting due to modern fuels, and new manufacturing and building techniques. The introduction of new European emission threshold of 130g CO₂/km by 2010 for light duty vehicles and tighter standards for cars, vans and trucks (Euro 5/6) will also help to reduce harmful pollutants emissions.

Through improving road performance it is possible to reduce greenhouse gas emissions for example, a study in Norway published in 2007, concludes that better alignment coupled with sufficient width and infrastructure capacity giving traffic the possibility to flow steadily, leads to a decrease in CO₂ emissions.

The issue of noise impacts is also improving. The noise from individual cars has already been reduced by 85% since 1970 and the noise from lorries by 90%. Road construction methods are also helping to reduce noise impacts such as through the use of enhanced acoustic performance road surface material (for instance the use of two-layer porous asphalt).

EU Sustainable road construction programmes

SILVIA –“Sustainable Road Surfaces for Traffic Noise Control”. The objective of this programme is to produce a tool to help decision-makers plan traffic noise control measures. The project examined three areas these include setting up classification and conformity-of-production procedures of road surfaces with respect to their influence on traffic noise; investigating and improving the functional and structural durability of low-noise pavement construction and maintenance techniques; and developing a full life-cycle cost/benefit analysis procedure for traffic noise abatement measures. The main final tool produced is the ‘European Guidance Manual on the Utilisation of Low-Noise Road Surfacing’.

Website: <http://www.trl.co.uk/silvia/index.htm>

SAMARIS- "Sustainable and Advanced Materials for Road InfraStructure" is a RTD and Demonstration research project from the Growth program of the 5th Framework Programme. The project deals with pavements and highway structures.

Website: <http://samaris.zag.si/>

NR2C- "New Road Construction Concepts". The project is developing initiatives for road construction that are future-oriented. The project is focused on long-term action and includes physical trial projects and demonstrations, in which long-term visions are linked to short-term actions.

Website: <http://nr2c.fehrl.org/>

Spens- "Sustainable Pavements for European New member States". This project is aimed at developing appropriate tools and procedures for the rapid rehabilitation and maintenance of roads in the EU New Member States. The overall objective is to search for materials and technologies for road pavement construction and rehabilitation that would:

- behave satisfactorily in a typical climate;
- have an acceptable environmental impact;
- be easy to incorporate within existing technologies; and
- be cost-effective and easy to maintain.

Website: <http://spens.fehrl.org/>

Slience- This project is aimed at developing holistic methodologies and technologies to improve surface transport noise in urban areas. The project examines issues of noise control at the source, noise propagation, noise emission and the human perception of noise.

Website: <http://www.silence-ip.org/site/>

Arches- "Assessment and Rehabilitation of Central Highway Bridges". The objective of this project is to reduce the gap in the standard of highway structures between the Central and Eastern European Countries, including the New Member States, and the rest of the EU, in a sustainable way. This will be achieved by developing tools and procedures for a more efficient assessment, faster, cost-effective and long lasting rehabilitations of substandard highway structures.

SAMCO- "Structural Assessment, Monitoring and Control". This is a network of industries, consultants, and other organisations interested in transfer of knowledge and technology in the field of assessment, monitoring and control of structures, in particular transportation infrastructure.

Website: <http://www.samco.org/>

EU Standards in road construction using recycled materials

This section summaries a number of standards in the construction industry used in different EU countries. The information in this section has come from SAMARIS

(Sustainable and Advanced Materials for Road InfraStructure) (2004). Deliverable 5. *Literature Review of Recycling of By-products in Road Construction in Europe*.

Denmark

Ludvigsen, K (2003). *Recycling of construction and demolition waste in Denmark*.

This document revises the Danish legislation on recycling, the treatments for the production of aggregates according to the nature of the initial material and the different types of recycled materials used in Denmark. Potential applications and important characteristics for the materials listed are included. Some of the materials listed include crushed concrete, bricks, crushed ceramic products and recycled bituminous mixture.

France

Lrep, Unicem et al (2001). *The technical Guide for the Use of Regional Materials in Ile-de-France. Recycled Concrete and Demolition Waste*.

This document is a guide on recycling of construction and demolition materials based on the experiences of use in Ile-de-France. The guide covers the following topics: sources and production, development and production, potential uses and application conditions, quality approach and application references. The guide aims to assist contractors in using alternative materials for road construction, without compromising the quality of the works.

Germany

Highways and Traffic Research Institute (1999). *TL Min-StB 99: Technical Specifications for Mineral Aggregates in Road Construction*.

These specifications cover the technical requirements and the testing methods for the mineral aggregates used in road construction. The specifications include natural aggregates, industrial sub-products and recycled aggregates. The specifications include particular considerations for every type of material. Some of the materials covered include: crushed bedrock, gravel and sand, crushed gravel, blast furnace slag, steelwork slag, coal fly ash and metal chamber granulate.

The Netherlands

The Netherlands Information and Technology Centre for Transport (CROW) (2001). *Recycled materials in road construction*.

This guide covers legislation and policy for the use of secondary materials in road construction in the Netherlands and the possibilities for the development of sustainable construction. The second part of the guide includes a catalogue of the secondary materials that are considered. The catalogue includes information on engineering and environmental considerations for every secondary material. Some of the materials included are reclaimed asphalt, waste incinerator bedding slag, dredge spoil, blast furnace slag and crushed concrete.

3.3 Implementation and best practice

EU examples of sustainable road construction

Austria

Herald Piber, July 2007. *'Recycled Pavement Designs for Road Bases in Austria'*, found in 'Review of the growth and development of recycling in pavement construction' prepared by the Working Group 2 Maintaining Pavements of the Technical Committee 4.3 Road Pavements of the World Road Association (PIARC).

In Austria, reclaimed asphalt road bases have been in extensive use for 15 years. This process is established in three regulations, which describe:

- The design of pavements;
- The requirements of the material and
- The road base.

The pavement design is described in RVS 3.63. The thickness of the reclaimed asphalt must not be more than 10cm because there is a risk that the road may otherwise decay on hot days. Application of this construction type is limited to rural road networks, cycle tracks and pedestrian areas, where a thin asphalt layer of 4cm or a surface dressing is required.

The Austrian regulation RVS 8S.01.31 describes production requirements and testing of the asphalt granulate (AGR). Production can either be by crushing large clods of asphalt or by milling the asphalt courses. The requirements are the grading of the asphalt pieces, the grading of the extracted grains, shape of asphalt pieces, the cleanness, frost susceptibility and the binder content.

The Austrian regulation RVS 8S.05.17 is the guideline for the basic material, the construction, the requirements of the material and the road base, the test procedures and quality evaluation. The reclaimed asphalt road base can be constructed at a temperature above 5°C, the ground cannot be frozen. The thickness of the layer is determined by sticks, geometrically correct levelling or by nuclear density gauge.

The quality of the reclaimed asphalt granulate has to be proved by the construction company using a suitability test. The client is responsible for the final material testing.

The use of reclaimed asphalt granulate has been found to be more cost effective than delivering it to a mixing plant to be used in a new mixture. This method is also economical viable for low volume roads.

Italy

Elenora Cesolini (ANAS Spa). *'The History and applications of hot recycling in Italy'* found in, 'Review of the growth and development of recycling in pavement construction', July 2007, prepared by the Working Group 2 Maintaining Pavements of the Technical Committee 4.3 Road Pavements of the World Road Association (PIARC).

This paper gives a brief history of hot recycling technologies and processes in Italy, including using stationary off-site plants and in-situ. Of interest is a joint project between ANAS (Italy) and Green ARM (Japan) to assess the use of the AR2000 (travelling continuous asphalt recycling plant). This plant was chosen because it has a good capacity to heat and mill dense graded asphalt concrete without damaging the aggregate.

The AR2000 is a recycling plant comprised of four joined together parts, these include: preheaters to heat the deteriorated old asphalt using heated air to about 600 degrees Celsius; Preheater/hot miller, this unit provides additional heat to softened the asphalt without damaging the old mixture; Posheater/dryer/mixer, this unit uniformly heats and mixes the milled old asphalt mixture with a percentage of corrective hot-mix asphalt and transfers the recycled old asphalt to its pugmill for final mixing.

The mixture is kept hot while it is transferred to a conventional paver for laying, followed by compaction.

The project has experienced some limited problems with this technique on the sample road where it was applied, but overall the results have been good. Interest in this road building technique is growing. The performance of recycled hot mix is now considered to be as good as that obtained from conventional hot mix. As such, recycled hot mix asphalt concrete can be considered as an alternative to a conventional overlay/reconstruction.

Sweden

Jacobson, Torbjorn, 2007. *'Recycling of asphalt containing coal tar and crushed asphalt for the motorway E4 at Markaryd'*, Vti Swedish National Road and transport Research Institute.

This report discusses the use of recycled materials in the construction of two sections of the E4 motorway. During 2004 to 2006 a new part of the E4 motorway in the south of Sweden was constructed using 100,000 tons of reclaimed asphalt. The reclaimed asphalt material came from a former part of the E4 which had been excavated when building the new motorway. At the northern part of the motorway, 30,000 tons of asphalt containing tar was recycled with a cold recycling technique using foamed bitumen. Without adding of new bitumen, in the south, 70,000 tons of crushed asphalt pavements was recycled. In both cases, the recycled material was used as road base, replacing traditional materials.

The report argues that the recycled road base layers show good properties so far and that the techniques used have great technical and economical potential savings even on high traffic roads. Analysis of the road base layers show that the recycled materials have tightened to produce good strength and acceptable durability. Tests have also shown that compaction after completion rate of the motorway is low.

The asphalt containing tar was encapsulated using a foam technique in a plant close to the road construction site. The excavated tar asphalt was stored close to the road covered by a tarpaulin before it was recycled. This helped to reduce leaching of tar, dust and escape of smells.

One finding after monitoring the road performance is that both sections could have been constructed with less layer thickness and still produced the same length of life as conventional building techniques. Another finding was that both the recycled road bases got a considerably better bearing capacity compared to conventional road bases using crushed aggregate.

Guidelines have been developed by the Swedish Road Administration for handling, storage and recycling of asphalt mixes containing tar. However, guidelines for dimensioning road bases layer when using recycled crushed asphalt should be developed. This case study has shown that foamed asphalt in a cold mixing process can be used on heavily trafficked roads.

EU Projects in the area of Environmental Indicators

PRESCO – ‘European Thematic Network on Practical Recommendations for Sustainable Construction’. The network seeks to facilitate the exchange of experience and the transfer of knowledge. It is a project funded by the EC and one of the thematic networks under E-CORE. It has an objective of defining a European Code of Practice for sustainable construction. The code contains accepted guidance for the construction of sustainable buildings for residential, commercial and industrial use. The code includes not only environmental aspects, but also social inclusion of elderly and disabled people. The code contains recommendations for how to put sustainable construction into practice. During the 4.5 years of activity, more than 200 recommendations have been developed and discussed. A second activity of the PRESCO-network is comparing and benchmarking LCA-based, environmental assessment and design tools.

LENSE: ‘Methodology Development towards a Label for Environmental, Social and Economic Buildings’. The main objective of this project was to develop a methodology for the assessment of the sustainability performance of existing, new and renovated buildings. The method was tested on ten buildings in eight EU countries.

Website: <http://www.lensebuildings.com/>

CRISP: ‘European Thematic Network on Construction and City Related Sustainability Indicators’. CRISP is a three year European Thematic Network consisting of 24

members from 16 European countries, dealing with Construction and City Related Sustainability Indicators. The group aims to coordinate research work in defining and validating such indicators and implementing them to measure the sustainability of construction projects (buildings and built environment). The CRISP network was led by CSTB (coordinator) and VTT, respectively the French and Finnish Building Research Institutes. The main deliverable of the Network is the CRISP indicator database.

The main objectives of the Network are:

- to define a framework and general methodology for construction and city related sustainability indicators;
- to stimulate and co-ordinate the development and use of such indicators;
- to gather and organise indicators within a database including information on validation, testing, criteria of use, etc; and
- to widely disseminate the results of the research carried out.

The main result of the CRISP network was the collection of sustainability indicators and their related systems into a database, made available for the end-users on the Internet. The database contains more than 500 indicators and 40 systems of indicators.

By bringing these indicators together in one place the CRISP programme will contribute to improving the quality of life in urban communities and promote sustainable development assessed in economic, architecture, environmental, social and cultural terms. The database will benefit planners, developers, designers, authorities, contractors and materials producers by having an authoritative, and agreed source of information on indicators. This allows them to incorporate performance targets, tools and standards into their construction programme to help improve the sustainability of the built environment (A European Thematic Network on construction and city related sustainability indicators. Final Report Publishable part EVK4 - CT 1999 – 2002 (co-ordinator: Luc Bourdeau). 2004)

CRISP website: <http://crisp.cstb.fr/default.htm>

Procurement in sustainable construction

Procurement aspect of sustainable construction is considered in this research project commission an important aspect and therefore it is discussed separately in TE3 Sustainable Procurement Report.

4 Sustainable Construction – UK and Highway Agency Perspectives

4.1 Legislation and Policy Drivers – Current and Future

The purpose of this section of the report is to identify and review all UK legislation and strategic drivers which refer to all aspects of sustainability and also to sustainable road construction. Gap analysis has been then carried out to ascertain where gaps exist within Highways Agency internal policies, strategies and guidance. With a view to informing further research needs and strategy gaps for which Highways Agency to concentrate its future activities, the sustainability initiatives and best practice of its service providers have been identified.

Legislative Drivers

Sustainable Consumption

The Control of Pollution (Amendment) Act 1989

Under the Control of Pollution (Amendment) Act 1989 (COP(A)A) all vehicles must be registered if they carry waste for profit expect for certain clearly defined exceptions. COP(A)A also applied to movements of waste by road, rail, air, sea and inland waterways but not to waste moving through pipelines.

COP(A)A created the offence of carrying Controlled Waste without being registered to or from any place in Great Britain. Those who are registered to carry waste are only one of five groups who are authorised to receive a transfer of waste under s34 of the Environmental Protection Act 1990 (see below).

The registration is that of a carrier (the company or individual who is the registered owner of the vehicle) and not of the vehicle itself. A breach of COP(A)A may result in the loss of registration and the seizure of vehicles.

With a view to assisting those handling waste to ensure they are handing their waste to an 'authorised' person, details of those registered to carry waste (and licensed and/or permitted but not currently exempt) are easily accessible through the Environment Agency's Public Register on-line. The Environment Agency and Waste Collection Authorities (WCAs) have regulatory powers to request waste transfer documentation is produced for inspection within 7 days, through the Clean Neighbourhoods and Environment Act (see below), fixed penalty notices (FPNs) may be issued for non-compliance.

Environmental Protection Act 1990 (EPA)

Part II of the EPA was enacted to provide an effective and comprehensive regime for dealing with waste on land. The EPA as amended by the Environment Act 1995, created a regulatory framework which has been further expanded and enhanced by detailed secondary legislation.

The main changes introduced by the EPA 1990 are summarised below;

- Established a statutory Duty of Care applicable to anyone who imports, produces, carries, keeps, treats or dispose of controlled waste;
- It introduced a strict clearly prescribed licensing system, particularly in relation to qualifications for license holders, licence conditions and surrender of licenses and exemptions;
- It made headway to prescribe and organise the functions of the regulatory bodies.

Alongside waste, the EPA also enables provisions in relation to Noise and Atmospheric emissions, this is discussed below in the relevant sections.

The Environment Act 1995 (EA)

The EA introduced a new definition of 'Directive Waste' to give effect to the EC Waste Framework Directive (75/442/EEC), as amended. The principle change made by this legislation was to transfer waste regulatory functions from the WRAs (Waste Regulations Authorities) to the Environment Agency (EA). On a strategic level, s92 of the EA inserted s44A into the EPA which empowered the Secretary of State with the responsibility for producing a national waste strategy and also introduced new provision concerning producer responsibility for waste.

The Duty of Care Regulations 1991 & s34 of the EPA

Section 34 of the EPA sets out the statutory requirement for the Duty Of Care which applies to controlled waste. The s34 EPA Duty of Care applies to anyone who imports, produces, carries, keeps, treats, disposes of or is a broker of Controlled Waste. Any person carrying out an activity with waste has a duty to take all reasonable and applicable measure to:

- Enable others further down the waste management chain, by written description, amounting to a simple contract or transport terms, to avoid contravention of s.33 of the EPA (illegal deposit of waste)
- Ensure that waste transfer occurs only to an authorised person or for authorised transportation purposes
- Prevent the escape of waste during its transportation
- Prevent any person whom they may or may not know from illegally depositing, treating, keeping, recovering or depositing of the waste.

Under the Duty of Care Regulations 1991 all movements of Controlled Waste must be accompanied by a Duty of Care Waste Transfer Note (WTN). The WTN must contain enough information to allow the waste to be handled safely and recovered or disposed off in accordance with the law. Furthermore, Regulation 19 of the Landfill Regulations 2002 amended the Environmental Protection (Duty Of Care) Regulations 1991 so that waste must be identified on the WTN by reference to the appropriate six-digit code in the European Waste Catalogue (EWC). WTNs must be kept all records of waste movements (difference time scales apply to Hazardous Waste) for at least two years from the date at which the waste was transferred and/or received.

Waste Management Licensing Regulations 1994 (as amended) (WMLR)

The licensing of waste management facilities is regulated under ss35-44 of the EPA and the WMLR (as amended). A waste management license is needed for the treatment, keeping and/or disposal or recovery of Controlled Waste. A license is not needed if the activity is:

- Deemed to be a Low Risk Activity by the Environment Agency
- Is listed as exempt under schedule 3 of the WMLRs
- Is covered by the Integrated Pollution Prevention and Control (PPC) permitting regime. IPPC permitting has been gradually progressively replacing waste management licenses.

There are two types of waste management license:

- A mobile plant license used for the treatment, recovery or disposal of controlled waste (for instance on-site treatment of aggregates and soils)
- A site specific license for the treatment, storage, recovery or disposal of Controlled Waste.

Waste Management licensed can be further broken down into fixed or bespoke licenses. A fixed license will specify the waste management activities and the maximum amount of waste which can be accepted onto the site. Each fixed license will contain the same conditions and a set of risk criteria must have been met. If an activity is carried out on site which does not meet the risk criteria or standard set of condition (pre disclosed on the Environment Agency webpage) a bespoke license should be obtained. A fixed license is easier to obtain as a working plan is not required and as less administration is required. However, other than the completion of documentation and submission of the appropriate fee, the person 'holding' the license must be 'fit and proper' and there must not hold a criminal record, the operation must be management by a technically competent person and must pass financial health check (credit rating check).

Schedule 3 of the WMLR (as amended) provides a list of waste management activities which are exempt from the need to have a waste management license. Exemptions tend to include, but are not limited to;

- Storage of waste on the site of production pending recovery or disposal elsewhere
- Specified recovery operations (disposal operations are normally subject to PPC).

Although exempt from the need for a license most exemptions are still subject to prescribed conditions such as waste type (by EWC), quantity over a given period, time limit for storage, pollution control methods and methods of recovery. Some of the more recent exemptions are chargeable, require planning permission, are annually renewable and require the submission of detailed site plans. Exempt activities must still also be carried out in way which does not endanger human health or the environment, pose unacceptable risk to water, air, soils, plants and/or animals, must not cause a statutory nuisance and must be detrimental to the local amenities. The Environment Agency divide exemptions into two categories, those which are said to be simple and those which are complex.

The Landfill (England & Wales) Regulations 2002

The Landfill regulations (SI 2002/1559) came into force on 15th June 2002 and implemented the Landfill Directive (99/31/EC).

Under the Landfill Regulations (as amended), the Environment Agency were charged with classifying landfill site as either being hazardous, non-hazardous (active waste such as municipal solid waste) or inert (such as glass and bricks). Operators of a designated site may only take in the waste permitted by their permit. Certain non-hazardous sites are able to except 'stable non-reactive hazardous waste' (such as asbestos and gypsum) within separate cells.

Waste acceptance procedures and monitoring procedures are defined in schedule 1 to the regulations and require that all waste (unless technically impossible, for instance some inert wastes) must undergo pre-treatment and waste characterisation prior to disposal or recovery. The level of characterisation and pre-treatment required is dependant on the type of waste and destination of the waste, for instance WAC (Waste Acceptance Criteria) is required for the disposal of materials to landfill.

The Clean Neighbourhoods and Environment Act 2005 (Chapter 16)

This Act was adopted by Royal Assent in April 2005. The Act includes and covers provision relating to a range of subjects such as litter, abandoned vehicles and general waste.

This Act permits the Secretary of State to make regulations to implement Site Waste Management Plans (SWMPs) for construction sites meeting certain fiscal criteria, it is currently thought that SWMPs will be required for all projects in excess of £300K in England and Wales. The introduction of SWMPs aims to introduce, encourage and improve resource efficiency within the construction industry, heighten awareness to Duty of Care and help reduce fly tipping. Regulatory change implementing SWMPs under the Clean Neighbourhoods and Environment Act is expected in April 2008.

The Hazardous Waste (England & Wales) Regulations 2005

The hazardous waste regulations and the List of Wastes (England) Regulations 2005 came into force in July 2005 replacing the Special Waste Regulations 1996.

These regulations (and the associated guidance) define what is to be classified as hazardous, for those familiar with the Special Waste Regulations, the Hazardous Waste Regulations introduced new waste to tighter regulatory control (for instance fluorescent tubes). Other requirements brought about these regulations include;

- A requirement for all those producing hazardous waste to register with the Environment Agency;
- The use of a Consignment Note to describe and accompany movements of hazardous waste;
- The provision of quarterly returns by consignees to the Environment Agency detailing waste received

The Environmental Permitting Regulations 2007 (Expected 6th April 2008)

The proposed regulations are aimed at streamlining environment permitting through the integration of both the waste management licensing and Pollution Prevention and Control (PPC) regimes. They intend to reduce the administrative burden of regulation on industry and regulators without compromising the environmental and human health standards delivered by the former regimes. The draft regulations and a full Regulatory Impact Assessment are available with the actual regulations expected to be enacted in April 2008. As of yet no information is available from the regulator in relation to how the regulations will be implemented.

The Environmental Permitting Regulations 2007 (Transposition of EU Directive 2006/21/EC on the management of waste from the Extractive Industries ('The Mining Waste Directive'))

The Government's current preferred option is to transpose the before mentioned Directive into UK law via the proposed Environmental Permitting Regulations 2007. A number of serious metalliferous tailing dam failures and recent case law have led to the drafting and adoption of this Directive. This directive regulates the management of waste from mining and quarry industries for the purpose of preventing harm to the environment and human health. This Directive is of importance because estimates from the EU Waste Statistics (2150/2002) show non-hazardous waste arising from the UK mining and quarrying sectors (94 million tonnes) accounts for a massive 29% of the UK's total non-hazardous waste arisings.

Following two important pieces of ECJ case law on the topic of waste or non-waste in relation to extractive mining waste, *Palin Granit Oy (C-9/00)* and *AVestPolarit case (C-114/01)* there may be scope for items currently seen as waste to become none waste, for instance certain aggregates or mineral dusts.

The Finnish company *Palin Granit Oy* applied for a license to manage a granite quarry. Surplus stone was held by the local administrative court to be a waste, even though the company planned to use it as a gravel fill, for embankments or coastal defence works in the future. The storage for the surplus stone was held to be landfill, requiring a separate license. There was no environmental or public health threat, and the stone certainly had economic value.

The ECJ ruled that 'waste is what falls away when one processes a material or object and is not the end-produce which the manufacturing system directly seeks to produce'. *Palin Granite Oy* argued that the left-over stone was sorted ready for further use, so it was not discarded and therefore not a 75/442 waste. Nevertheless the ECJ, while accepting that this interpretation was consistent with that of the 75/442 Directive, decided that the definition of waste should be open to a wider interpretation to fulfil the purported objective of avoiding pollution. The reuse must be a certainty, not just a possibility. The irony of this case is that the court held that the location of the storage, the material composition and the absence of a risk to human health and environmental health were irrelevant. Which is not the original intent of the European Parliament or Commission.

Source: *Palin Granite Oy vVehmasslon Kansanterveystyon Kuntayhman* [2002] 2 CMLR 24, case C-90/00. (The practical Guide to Waste Management Law Hawkins & Shaw – ISBN 0727732757

Avesta Polarit Chrome Oy, a Finnish mining company extracted chrome by boring and crushing rock and ore, annually averaged at 8 million tonnes for 100,000 tonnes of ore. The company appealed that the left-over rock and sand was not within the 75/442 Directive (as amended by the 91/156 Directive). The ECJ followed the decision in *Palin Granite* in that a test was applied as to whether the holder of the residual rock discarded or intended to discard the left-over rock.

The comparison of the left-over rock and whether it was any risk to human health or the environment were not relevant criteria. If, however, the company decided to use rock and sand for refilling their mine galleries, and could identify the materials for this specific purpose, then it would probably not be defined as waste.

Source: *Avesta Polarit Chrome Oy, case C-114/01*. (The practical Guide to Waste Management) 71
Law Hawkins & Shaw – ISBN 0727732757

- § Landfill Tax Regulations 1996 (SI 1996 No. 1527), as amended - deal with the more detailed implementation aspects of the tax, such as registration and accounting procedures; and
- § Landfill Tax (Qualifying Material) Order 1996 (SI 1996 No. 1528) - defines the categories of waste to which the lower rate of tax applies.

The Water Act 2003 (chapter 37)

The Water Act received Royal Assent on 20th November 2003. The four broad aims of the Act are:

- The sustainable use of water resources;
- Strengthening the voice of consumers
- A measured increase in competition; and
- The promotion of water conservation

The Water Act amends the Water Resources Act 1991 to improve long-term water management by for instance, but not restricted to, creating two new forms of abstraction license and replacing licensing exemptions based on water use with a new exemption threshold of less than 20 cubic metres of water per day. The Water Act also introduces provisions for better operation and regulation of the water industry by amending the Water Industry Act 1991 to, for instance, allow water companies to prepare and publicise drought plans and give both the Authority and Council a new duty to contribute to sustainable development. The Water Act also includes various amendments to facilitate streamline arrangements for flood defence organisation and funding.

The Sustainable Energy Act (October 2003)

This Act contains a number of sections, all of which are linked to the promotion and achievement of a sustainable energy policy. Many of the provisions within the Act refer to the residential accommodation, and include but are not limited to the following;

- To designate and take reasonable steps to achieve at least one energy efficiency aim for residential accommodation;
- The Secretary of State must set targets for the use by the Government of electricity generated using Combined Heat and Power (CHP); and

A duty on local authorities when so directed to give preference to measures that would also contribute to tackling fuel poverty.

The Energy Bill 2007-08

The Energy Bill was introduced in the House of Commons on 10 January 2008. The Energy Bill will implement the legislative aspects of the Energy White Paper Meeting on the energy challenge.

The Energy Bill will update the legislative framework by putting in place new legislation to:

- Reflect the availability of new technologies (such as CCS and emerging renewable technologies).
- Correspond with the changing requirements for security of supply infrastructure (such as offshore gas storage).
- To ensure adequate protection for the environment and the tax payer as our energy market changes.

The Energy Bill, alongside the Planning and Climate Change Bills, will ensure our legislation underpins the long term delivery of the energy and climate change strategy. In terms of sustainability and content of the Bill it will strengthen the Renewables Obligations to driver greater and more rapid deployment of renewables in the UK. It is hoped this will increase the diversity of the UK electricity mix, thereby improving the reliability of our energy supplies and help lower the carbon emissions from the electricity sector.

Atmospheric Emissions

Noise Emission Legislation (Emission from Construction Sites)

In addition to the controls contained within the EPA, other main statutory provisions controlling noise can be found in Part III of COPA 1974. COPA includes a number of measures which enable Local Authorities to control various aspects of noise including noise from construction sites. 'Construction' extends to the erection, construction, alteration, repair or maintenance of buildings, structures or roads. Where it appears to a local authority that any of these activities are being, or are going to be, carried out on premises, then the authority can serve a notice imposing requirements as to the way in which the work is to be carried out. These powers can be exercised

without an actual nuisance existing. The Notice may for instance specify operational conditions such as, but not limited to;

- Plant or machinery which must or must not be used
- Permitted hours of operation
- Noise levels by reference to the time of the day or part of the day

The local authority must serve the notice on the person who appears to either carrying out or going to carry out the works. It is an offence to fail to comply with such a Notice without reasonable excuse.

Air Emissions Legislation (Emission from Construction Sites)

Dust is not covered in the Air Quality Standards Regulations 2007 (SI 2007 No.64). Generally, dust is only a cause of annoyance or a 'nuisance' when it forms a noticeable deposit on a surface or causes disruption when suspended in the air. The amount of dust that constitutes a nuisance is hard to quantify as the perception of dust deposits is subjective. This is reflected in the absence of legislated standards or widely accepted guidance thresholds to define a Statutory Nuisance due to dust.

Relevant legislation dealing with Statutory Nuisance is given in Part III of the Environment Protection Act 1990. Under the provisions of the Act where a local authority is satisfied that a Statutory Nuisance exists, it is under a mandatory duty to serve an Abatement Notice requiring abatement or cessation of one or more activities deemed to be causing the nuisance. A nuisance may occur if, for example, dust from a construction site is repeatedly deposited on cars, windows or washing or causes disruption when suspended in the air.

ODS Regulation No. 2037/2000 (as amended by EC Regulation 1804/2003) & The Environmental Protection (Controls on ozone – depleting substances)(Amendment) Regulations 2008

Council Regulation No 2037/2000 on Ozone Depleting Substances (ODS), the "2000 Regulation" which came into effect on 1 October 2000, requires the removal of controlled ODS from refrigeration equipment before such appliances are scrapped. Although a European Regulation and therefore directly applicable in UK enabling Regulations were produced, namely, Environmental Protection (Controls on Ozone-Depleting Substances) Regulations 2002 (SI 2002 No.528), the "2002 Regulations" these have since been amended in 2008. This UK secondary legislation allows for the sanctions and penalties to be imposed.

The 2002 regulations give further effect to the 2000 Regulation and to the provisions of the Montreal Protocol on substances which deplete the ozone. The 2000 Regulation required the removal of controlled ODS (which includes prescribed CFCs, Solvents, foam blowing agents and fire fighting fluids) from refrigeration equipments before such appliances could be scrapped. For industrial and commercial application this requirement came into effect immediately (2000), followed by the same requirement for domestic appliances on 1st January 2002. The requirements to

remove ODS also includes ODS impregnated foam found in fridge doors as well as cooling system refrigerants.

Climate Change

The Climate Change Bill

The draft Climate Change Bill was published on 13 March 2007 for pre-legislative scrutiny and public consultation. On 29 October 2007 the Government published its response to the parliamentary scrutiny and public consultation in the Command Paper *Taking Forward the UK Climate Change Bill*. The Command Paper sets out how the Climate Change Bill will be strengthened and made more transparent. The Bill was introduced into the House of Lords on 14 November 2007, the aim is to receive Royal Assent by spring or early summer 2008.

Key provisions and targets of the Climate Change Bill include:

- This Bill puts into statute the UK's targets to reduce carbon dioxide emissions through domestic and international action by at least 60 per cent by 2050 and 26-32 per cent by 2020, against a 1990 baseline.
- This target will be reviewed, based on a report from the new independent Committee on Climate Change on whether it should be even stronger still, and the implications of including other greenhouse gases and emissions from international aviation and shipping, in the target.
- Five-year carbon budgets, which will set binding limits on carbon dioxide emissions ensuring every year's emissions count. Three successive carbon budgets (representing 15 years) will always be in law – providing the best balance between predictability and flexibility. These budgets will be backed by strong annual accountability and independent scrutiny.
- Emission reductions purchased overseas may be counted towards the UK's targets, consistent with the UK's international obligations. This ensures emission reductions can be achieved in the most cost effective way, recognising the potential for investing in low carbon technologies abroad as well as action within the UK to reduce the UK's overall carbon footprint.

Design & Innovation

The Building Regulations 2000

Part L (L1A & L1B) relating to the conservation of fuel and power took effect on 6th April 2006 and deals with the energy efficiency requirements in the Building Regulations 2000 (as amended by SI 2001/3335 and SI 2006/652). The energy efficiency requirements are conveyed in Part L of Schedule 1 to the regulations and are detailed below;

Reasonable provision shall be made for the conservation of fuel and power buildings by;

- a) limiting heat gains and losses;

- i) through thermal elements and other parts of the building fabric:
and
- ii) from pipes, ducts and vessels used for space heating, space cooling and hot water services;
- b) providing and commissioning energy efficiency fixed building services with effective controls; and
- c) providing to the owner sufficient information about the building, the fixed building services and their maintenance requirements so that the building can be operated in such a manner as to use no more fuel and power than is reasonable in the circumstances.

Part L2B in relation to the conservation of fuel and power in existing buildings and other dwellings also came into effect 6th April 2006.

Biodiversity

Conservation (Natural Habitats, & c.) Regulations 1994

The Habitats Directive, Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora was adopted in 1992. Under this directive Special Areas of Conservation SACs are identified with the aim of conserving 253 habitat types, 200 animals and 434 plant species listed under the Habitats Directive. In the UK this Directive has been transposed into National law by means of the Conservation (Natural Habitats, & c.) Regulations 1994 (as amended). These National Regulations, known more commonly as the Habitat Regulations, came into force on 30 October 1994. The Regulations require the designation and protection of 'European sites' and the protection of 'European protected species'.

Wildlife & Countryside Act 1981 and Conservation (Natural Habitats, & c.) Regulations 1994

The Wild Birds Directive, Council Directive 79/409/EEC provided the framework for the conservation and management of the interaction of humans with wild birds within Europe. The Directive requires Member States to take measures to conserve the habitats of certain particularly rare species and of migratory species and to classify areas as Special Protection Areas (SPAs). The Directive sets a variety of objectives to protect wild birds. In the UK, the provisions of the Birds Directive are implemented through the Wildlife & Countryside Act 1981 (as amended) and the Conservation (Natural Habitats, 7 c.) Regulations 1994.

The People Agenda

Disability Discrimination Act 1995 (DDA95)

This act makes it unlawful to discriminate against people in respect of their disabilities in relation to employment, the provision of goods and services, education and transport. Employers are still however able to have reasonable medical criteria which they can apply prior to employing someone, and to expect adequate performance from all employees once reasonable adjustments have been made. The DDA also places duties on service providers and requires "reasonable adjustments" to be made when providing access to goods, facilities, services and premises.

Race Relations Amendment Act 2000

The Race Relations Amendment Act 2000 places a direct duty on public sector bodies to eliminate unlawful discrimination and promote equality and opportunity and good race relations between different racial groups. The Race Relations Act was originally enacted in 1976 and made it unlawful to discriminate on racial grounds in relation to employment, training, education, provisions of goods, facilities and services but only for certain specified activities. The main purpose of the 2000 Act is to extend the 1976 Act in relation to public authorities, outlawing race discrimination in those functions, not previously covered, places a duty a specified public authorities to work towards the elimination of unlawful discrimination and to promote equality, to ensure the Police deal with acts of race discrimination and to amend an exemption under the 1976 for purposes of safeguarding national security.

Strategic Drivers

Overall sustainability strategic drivers

Securing the Future – delivering UK sustainable development strategy

This is the UK's overall strategy addressing all aspects of sustainable development. The strategy aims to enable all people throughout the world to satisfy their basic needs and enjoy a better quality of life without compromising the quality of life of future generations. This strategy builds on the 1999 strategy with a more explicit focus on environmental limits. The strategy has four agreed priorities, these being, sustainable consumption and production, climate change, natural resource protection and sustainable communities, and sets indicators which are more outcome focused, with commitments to look at new indicators such as those of wellbeing.

Building a Better Quality of Live – A Strategy for more Sustainable Construction

This strategy was published in April 2000 and although dated, many of the objectives and inherent issues to be addressed within the construction industry remain true to the construction industry of today. The objectives of this Strategy are;

- Promotion of awareness and understanding of what sustainable construction is,
- Setting out how the Government expects the construction industry to contribute itself to the overall aim of sustainable development,
- To illustrate how government polices will help bring about change.

To stimulate action by businesses to set targets, to monitor these targets and progress towards sustainable construction and show continuous improvement.

Strategy for Sustainable Construction (Draft December 2007)

The draft strategy has been developed within the framework of the guiding principles outlined in the UK Government Strategy for Sustainable Development published in March 2005 "Securing the Future" and within the context of "Rethinking Construction" which is the industry's principal change agenda.

Within the four priority areas for action identified in "securing the future", the vision or sustainable construction is:

Sustainable Consumption and Production

- An industry which will design better products and services reducing the environmental impacts from the use of energy, resources and hazardous substances.
- An industry which will reduce, and ultimately eliminate waste in construction through improved design, procurement, and greater re-use and recycling of resources.
- An industry where there will be re-use of existing built assets and the construction of new, long lasting, energy conscious and future-proof (adaptable and flexible) buildings and structures which are easy to maintain, operate and deconstruct.

Climate change and energy

- An industry which minimises carbon emissions during construction.
- An industry which builds buildings which have a lower carbon footprint in use, leading to the construction of zero carbon buildings.
- An industry which builds innovative solutions to climate change challenges for the future.

Natural resources and enhancing the environment

- An industry which facilitates conservation of water resources in new construction and refurbishment projects.
- It is industry which recognises that Green Infrastructure plays a valuable role in delivering a range of social, environmental and economic benefits to society.
- An industry which is proactive in creating, managing and enhancing wildlife habitats and natural landscapes.

Creating sustainable communities

- An industry which employs and nurtures a committed, skilled and adaptable workforce working in an environment of zero accidents and incidents with appropriate arrangements for education and training, employment, health and safety.

The strategy also extends to the ways in which the construction industry and its clients operate and encompasses issues such as procurement, integrated teams, design and innovation. The strategy includes milestones and targets for improve in all aspects of sustainability.

Sustainable Development Strategy & Action Plan for Civil Engineers

This strategy aims to build on past achievements in supporting a civil engineer's contribution towards sustainable construction. The strategy has been prepared by the Institution of Civil Engineers (ICE), the Association for Consulting and Engineering (ACE), the Civil Engineering Contractors Association (CECA), CIRIA and the Construction Products Association. The vision for the civil engineering industry is given as:

"Our vision is for the civil engineering industry and profession to play its full role in the creation and maintenance of sustainable communities in harmony with their natural environment"

Underpinning this vision are four strategic aims which will be used to guide the approach to civil engineering:

- Promotion of strong leadership within civil engineering
- The principles of sustainable development should be embedded into everyday work activities and decision making
- Capacity should be built within the industry and profession to allow for sustainable development
- To create and influence a policy framework which demands more socially and environmentally responsible behaviour.

A number of actions with associated timescales are detailed to deliver the aims set out above and include;

- Promotion of Civil Engineering Environmental Quality Assessments and Awards Schemes (CEEQUAL) to clients, contractors and designers in order to encourage environmental excellence within projects
- To investigate the opportunities and challenges to achieve sustainability and their impact on civil engineering
- Organise climate change workshops and reports to identify priority action areas for the sector
- Production and roll out of case studies showing best practice around social aspects of corporate responsibility
- Active participation in the formulations of relevant government strategies.

Developing a strategic approach to construction waste – 20 year strategy draft for comment

This document has been produced by a partnership consisting of BRE, AEAT and BREW. The purpose of this document is to steer all future government policy and to provide support to the construction sector, and in the longer term to dictate the future direction of the construction industry in terms of resource efficiency, waste management and its overall environmental impact.

The approach to developing the strategy has been to;

- Have a forward look at construction in terms of threats and possible opportunities in relation to waste and resource use

- Develop and suggest long improvements which on the whole are based on baseline data
- Model a method for achieving these targets in the short, medium and long term, and
- To identify data and action needs to support development and implement this strategy.

In tabular form the strategy draws upon future strategic and legislative drivers along with other drivers, such as climate change, and possible changes to the ways of working within the construction industry to anticipate what potential impacts there might be for the construction industry. Carrying on from these points, the strategy offers a futuristic view to 2025 of what might have happened to the construction industry in what can only be described as a positive and negative view point which clearly highlights the need for change now.

Although highlighting that there are historically little baseline data available on resource use or waste arisings across the construction this strategy then proposes short, medium and long term targets across the construction and uses the following types of construction to illustrate and put the proposal into context;

- Construction waste – new build housing
- Refurbishment waste – housing
- Demolition waste – all sectors.

The consultation date for this draft strategy concluded on 10th November 2006.

Sustainable Consumption

Minerals Policy Statement 1 : Planning and Minerals (MPS1)

MPS1 sets out the Government's overarching policies which apply to all minerals. The overall aim of the guidance is to ensure an adequate and continuous supply of minerals in the long term. This document also outlines a number of policies which promote and encourage the use of recycled and secondary aggregates.

Waste Not, Want Not – A Strategy for tackling the waste problem in England

This strategy states that the overall aim of waste policy should be to ensure that, by 2020 England has a world class waste management system that allows the nation to prosper whilst reducing harm to the environment and preserving resources for future generations. This means:

- reducing growth in waste volumes to less than growth in GDP;
- fully covering the true costs of disposing of waste in the prices of products and services;
- implementing waste management options that deliver the overall aim at least cost.

It is recognised that a robust strategy is needed to realise this overall aim and that strategy needs to be underpinned by three key principles:

- the 'waste hierarchy' provides a sensible framework for thinking about how to achieve a better balance between waste minimisation; recycling; incineration and landfill;
- measures taken to advance the strategy should take full account of the balance of benefits and costs; and
- sustainable waste management is not just a responsibility of government but also of individuals, businesses and other stakeholders.

Waste Management Strategy for England 2007

Since the waste strategy in 2000, England has made significant progress. Recycling and composting of waste has nearly quadrupled since 1996-97, achieving 27% in 2005-06. The recycling of packaging waste has increased from 27% to 56% since 1998. Less waste is being landfilled, with a 9% fall between 2000-01 and 2004-05.

The main elements of the 2007 Waste Strategy for England are to:

- incentivise efforts to reduce, re-use, recycle waste and recover energy from waste;
- reform regulation to drive the reduction of waste and diversion from landfill while reducing costs to compliant businesses and the regulator;
- target action on materials, products and sectors with the greatest scope for improving environmental and economic outcomes; stimulate investment in collection, recycling and recovery infrastructure, and markets for recovered materials that will maximise the value of materials and energy recovered; and
- improve national, regional and local governance, with a clearer performance and institutional framework to deliver better coordinated action and services on the ground.

The strategy highlights the potential within the construction industry who are the largest single source of waste arisings in England, to increase resource efficiency in construction and waste. The key objectives of WS2007, specifically in relation to commercial and industrial waste are:

- To decouple waste growth (in all sectors) from economic growth and put more emphasis on waste prevention and re-use;
- To increase diversion from landfill of non-municipal waste and secure better integration of treatment for municipal and non-municipal waste;
- To secure the investment in infrastructure needed to divert waste from landfill and for the management of hazardous waste;

To get the most environmental benefit from that investment, through increased recycling of resources and recovery of energy from residual waste using a mix of technologies.

Best Practice Case Study – Tyre Reuse

The construction of the Plant Growth Facility at the University of Cambridge utilised recycled tyres within a retaining wall structure. The retaining wall was required to provide acoustic and visual screen to hide external mechanical plant. In total around 600 tyres were used, replacing the need for 30m³ of concrete that would have otherwise been required and finding a good home for waste tyres. Each layer of tyres were laid overlapping the previous layer and held together by steel pins running down through the vertical spaces of the tyres. The tyres were packed with loamy gravel from the foundations, retaining approximately 200m³ of soil that would have otherwise been transported off site.

In addition to the use of tyres, the project also specified:

Landfill Tax

The Landfill Tax is the Government's primary fiscal instrument to encourage waste reduction, recycling and to promote alternative means of waste management other than landfill.

Introduced in 1996 and administered by HM Revenue and Customs, the rate of landfill tax for active wastes has risen to a rate of £24 per tonne in the financial year 2007-08. The Government announced in its 2007 budget that landfill tax will rise by £8 per tonne per year to reach £48 per tonne by 2010/11. A lower rate of £2 per tonne applies to those inactive (or inert) wastes listed in the Landfill Tax (Qualifying Material) Order 1996.

Where a disposal to landfill contains both active and inactive materials, tax is due on the whole load at the standard rate. However, as long as it does not lead to any potential for pollution, the presence of an incidental amount of active waste in a mainly inactive load can be ignored, and the whole load can be treated as taxable at the lower rate.

HMRC will normally accept the following mixed loads as qualifying for the lower rate:

- § a load of bricks, stone and concrete from the demolition of a building that has small pieces of wood in it and small quantities of plaster attached to bricks as it would have not been feasible for a contractor to separate them;
- § a load of soil that contains small quantities of grass;
- § inactive waste such as mineral dust packaged in polythene bags for disposal;
and
- § a load of soil and stone from street works containing tarmac would qualify but a load of tarmac containing soil and stone would not qualify.

Exemptions from Landfill Tax payment include dredgings from inland waterways, naturally occurring wastes from mining and quarrying operations, pet cemeteries, waste arising from the clearance of contaminated land and disposed of to landfill may

also qualify for exemption from taxation. Exemption from tax may also be claimed for the restoration of landfill sites using inert waste and the filling of quarries using inert material, however, both under clearing prescribed circumstances.

Inert Waste Regulation Review (informal Consultation until March 2008)

Defra, the Welsh Assembly Government and the Environment Agency are undertaking a review of the regulation of inert waste. The aim is to adopt a more proportionate and risk-based regulatory approach to the inert waste recovery and disposal operations.

The Quarry Products Association published a Position Statement in June 2006 - of particular concern was the need to ensure that inert waste remains available to restore exhausted mineral extraction sites. In November 2006, the Davidson Review recommended that Government and the Environment Agency should conduct a full review of the regulation of inert waste.

It was recommended that the review should cover:

- the appropriate use of inert waste exemptions [derogations] in EC legislation;
- the creation of a more level playing field between different activities involving inert waste (proportionate to the risk posed);
- how the implementation of the waste acceptance criteria might be made more efficient;
- inconsistencies with the landfill tax regime; and
- the quality of guidance, including the issue of when an activity should be classified as recovery or disposal.

The Government's states its aim is to regulate in a way that minimises burdens on business, whilst securing outcomes which maximise resource efficiency and protect the environment and human health. To do this, they are reviewing the existing regulatory regimes and in particular the requirements of the Landfill Directive (1999/31/EC) and how they impact on inert waste management and identify how they can be improved and simplified.

White Paper Energy Efficiency: The Government's Plan for Action

The Energy White Paper set energy efficiency at the heart of UK energy policy, identifying improved energy efficiency as the most cost effective way to meet all of our energy policy needs. Overall energy efficiency is at the heart of the UK's energy policy announcing the goals of 60% reductions in carbon emissions by 2050 and 20% by 2010. This plan sets out how this will be achieved with particular focus on now until 2010. The key elements of the plan include;

- The Decent Homes programme will continue to improve the energy standards in social housing and the introduction of new fiscal incentives in the householder sector.

- Revision to Part L of the Building Regulations in 2005 with a view to further raising the standard of new and refurbished buildings and implementation of the Energy Performance Buildings Directive.
- Launch of the EU Emission Trading Scheme to signal the advent of an increasingly carbon-constrained world.
- Leadership in the public sector. Central Government estates are to lead by example by cutting their own carbon emission through targets.
- The Market Transformation Programme will continue to raise product standards raising standards through EU-wide agreements
- Support local government and regional assemblies to develop innovative approaches to energy efficiency.

“Our Energy future – creating a low carbon economy”

This white paper addresses those challenges posed by energy usage in the modern economy. The paper addresses the ways in which we produce our energy and the effect and threat posed such as climate change. The paper gives a new direction for energy policy and highlights the importance of the need for urgent global action to tackle climate change. The Government are putting the UK on a path to leadership by putting the UK on a path to a 60% reduction in its carbon dioxide emissions by 2050. Four goals have been identified for Government energy policy:

- to put ourselves on a path to cut the UK's carbon dioxide emissions - the main contributor to global warming - by some 60% by about 2050, as recommended by the RCEP (Royal Commission on Environmental Pollution), with real progress by 2020;
- to maintain the reliability of energy supplies;
- to promote competitive markets in the UK and beyond, helping to raise the rate of sustainable economic growth and to improve our productivity; and
- to ensure that every home is adequately and affordably heated.

Energy white paper: meeting the energy challenge

This White Paper, published on 23 May 2007, sets out the Government's international and domestic energy strategy to respond to these changing circumstances, address the long term energy challenges we face and deliver our four energy policy goals:

- to put ourselves on a path to cutting CO₂ emissions by some 60% by about 2050, with real progress by 2020;
- to maintain the reliability of energy supplies;
- to promote competitive markets in the UK and beyond;
- to ensure that every home is adequately and affordably heated.

It shows how the Government are implementing the measures set out in the Energy Review Report in 2006, as well as those announced since, including in the Pre-Budget Report in 2006 and the Budget in 2007.

The Carbon Reduction Commitment

The Carbon Reduction Commitment (CRC) is a new scheme, announced in the Energy White Paper 2007, which will apply mandatory emissions trading to cut carbon emissions from large commercial and public sector organisations (including supermarkets, hotel chains, government departments, large local authority buildings) by 1.1 MtC / year by 2020. The CRC is the new name for the Energy Performance Commitment proposal on which the Government consulted in 2006.

Water Strategy “Directing the Flow”

“Directing the Flow – priorities for future water policy” was published by the Government in November 2005. The document set out the Government’s strategic vision for the direction of water policy, it put in place broader Government objectives in England and identified the main future priorities and direction for inland and coastal water environment, water resources and the water and sewerage industry. The strategy is a high level document and it is intended that this will undergo continual review. This strategy sets out how water policy is linked to other policy areas such as

- Agriculture and fisheries;
- Land use;
- Climate Change;
- Biodiversity;
- Leisure and recreation; and
- Flood management.

Water Strategy (Expected early 2008)

The Government aim to publish the new Water Strategy in early 2008. The Water Strategy is expected to affect everyone in England, whether directly or indirectly as it will influence the policy framework for how water is supplied, consumed and utilised. It will address direct water use (from the tap and abstractions) and will also address a range of activities which have an effect on the quality of the water environment for instance farming and fishing.

Soils

Soils Action Plan & Proposed Soil Strategy 2008

The soil action plan as detailed below for England 2004-2006 provided a foundation, however, Defra recognises there is still the need for improvement in relation to how we manage our soils and deliver a wide range of benefits to society. The proposed Soil Strategy for England will take stock of the progress made under the Soil Action Plan as well addressing emerging priorities for soil carbon management, overall soil protection and the recycling of organic wastes to land. It is anticipated that this strategy will be released in Spring 2008 for consultation.

The First Soil Action Plan for England 2004-2006 pulls together previous work and ongoing work in relation to soils and identifies 52 actions for the Government and its Agencies to progress with the aim of protecting and managing soils for a range of land uses. This action plan complemented the Environment Agency’s report ‘State of Soils In England and Wales’. These two documents together will provide a steer for the UK’s contribution and work to the proposed European Thematic Soil Strategy.

The actions proposed in the First Soil Action Plan for England work towards a common vision that recognises the several vital functions that soils perform for society:

"Our vision is to ensure that England's soils will be protected and managed to optimise the varied functions that soils perform for society (e.g. supporting agriculture and forestry, protecting cultural heritage, supporting biodiversity, as a platform for construction), in keeping with the principles of sustainable development and on the basis of sound evidence."

In order to achieve this vision, the Government aims are to ensure:

- Soil managers will look after their soils with a view both to their own and society's short-term needs and to the interests of future generations
- The regulatory, legislative and political framework will provide appropriate protection of soil as an irreplaceable natural resource and empower and encourage people with soil to manage it properly
- A better understanding of, and access to, information on the state of our soils and the physical, chemical and biological processes which operate on and within them.

Within the Actions Plan, issues, many of which are cross-cutting across Government Departments, are listed under eight headings:

- Protecting Soils in the Planning System
- Minimising Contamination of Soils
- Predicting and Adapting to the Impacts of Climate Change on Soils
- Soils for Agriculture and Forestry
- Interactions between Soils, Air and Water
- Soils and Biodiversity
- Soils, the Landscape and Cultural Heritage
- Soils in Minerals Extraction, Construction and the Built Environment.

Soils in the Built Environment – A Strategy for the Construction Sector (Defra July 2005)

This strategy was produced to help devise a strategy for the delivery of the construction related action from Defra's First Soil Action Plan for England 2004-2006, Actions 4, 15, 47 and 50.

The strategy provides Defra with prioritised actions, these are shown below;

Short Term Actions;

- Collection of best practice guidance and information specifically targeted at the construction sector and relation to soil issues in the built environment and to make the guidance available central from the Defra website;
- The production of a set of 'Rules of Thumb' for the inclusion into voluntary schemes such as BREEAM;
- The production of a soil 'Toolbox Talk' for site operatives (based on the Rules of Thumb);
- Collaboration with the BRE, and the CCS to include soil issues into BREEAM, CEEQUAL and the CCS respectively;

Medium Term Actions;

- Incorporate soil issues into planning policy as a legislative driver to better soil management and protection.
- Encourage soils to be identified as a resource that needs protecting within the EIA framework through liaison with planning authorities and the ODPM.
- Collaboration with CIRIA and other industry bodies to disseminate best practice guidance and protection.

Long Term Actions;

- A UK wide database could be set up to identify local sites with excess top soil and those sites in the vicinity that need to import top soil;
- Classification, standardisation and increased commercialisation of alternatives to top soil, including manufactured mixes including compost and structural soils.
- Collaborate with leading Universities and Colleges that train future construction project managers, engineers and consultants.

Climate Change

The Climate Change Levy

The climate change levy is a tax on the use of energy in industry, commerce and the public sector, with offsetting cuts in employers' National Insurance Contributions and additional support for energy efficiency schemes and renewable sources of energy. The aim of the levy is to encourage users to improve energy efficiency and reduce emissions of greenhouse gases.

Climate Change Agreements allow energy intensive business users to receive an 80 per cent discount from the Climate Change Levy, in return for meeting energy efficiency or carbon saving targets. The Climate Change Levy is administered by HM Revenue and Customs. It is hoped that the levy will play a major role in helping the UK to meet its targets reducing greenhouse gas missions.

The levy was introduced in April 2001. Rates of levy are 0.15p/kWh for gas and 0.98/kg for liquidified petroleum gas, 0.44/kWh for electricity and, 0.12p for any other taxable commodity. There are also several exemptions from the levy, including but not limited to: electricity generated from new renewable energy (e.g solar and wind power) and fuel used by good quality combined heat and power schemes.

Planning Policy Statement : Planning and Climate Change

This planning policy statement sets out how planning, in providing for new homes, jobs and infrastructure needed by communities, should help shape places with lower carbon emissions and resilient to the climate change now accepted.

The Planning White Paper has emphasised the fundamental importance of planning in delivering sustainable development in a changing global context. It is central to the delivery of the new homes that are needed; it supports the business development necessary to create jobs and prosperity; and, enables the delivery of the infrastructure which provides access for everyone to essential transport, energy and

water and underpins sustainable communities. In making this contribution to a prosperous economy and to a high quality of life for all, planning has a key role in helping to tackle climate change. Used positively, it has a pivotal and significant role in helping to:

- secure enduring progress against the UK's emissions targets, by direct influence on energy use and emissions, and in bringing together and encouraging action by others;
- deliver the Government's ambition of zero carbon development;
- shape sustainable communities that are resilient to and appropriate for the climate change now accepted as inevitable;
- create an attractive environment for innovation and for the private sector to bring forward investment, including in renewable and low-carbon technologies and supporting infrastructure; and
- capture local enthusiasm and give local communities real opportunities to influence, and take, action on climate change.

The planning system can therefore be used to support the reduction of carbon emission from domestic and non-domestic properties.

Atmospheric Emissions

Emissions Trading Schemes

Emission trading is emerging as a key driver to reduce greenhouse gas emissions. The rationale behind emission trading is to ensure that the emission reductions take place where the cost of the reduction is lowest therefore lowering the overall costs of combating climate change. Emission trading is particularly suited to emissions of greenhouse gases. The Government has given companies flexibility in determining how and where the emissions reduction will be achieved. Participating companies are allocated allowances, each allowance representing a tonne of the relevant emission. Emission trading allows companies to emit in excess of their allocation of allowances by purchasing allowances from the market.

The UK Emissions Trading Scheme ended in December 2006, with final reconciliation completed in March 2007. The UK ETS was the world's first economy-wide greenhouse gas emissions trading scheme.

Thirty-three organisations ("Direct Participants" (DPs) in the scheme) voluntarily took on emission reduction targets to reduce their emissions against 1998-2000 levels. They committed to reducing their emissions by 3.96m tonnes of carbon dioxide equivalent (CO₂e) by the end of the Scheme. Over the lifetime of the scheme DPs have achieved emissions reductions of over 7.2 million tonnes of CO₂e. DPs have gained valuable experience in developing emissions reduction strategies in addition to learning about the mechanics of trading. Defra has appointed the Environment Agency to administer and regulate the scheme in England and Wales.

Biodiversity

Working with the Grain of Nature – A biodiversity Strategy for England

This strategy aims to ensure that biodiversity considerations become embedded in all the main sectors of economic activity whether public or private. The strategy sets out a programme for the next five years for the main policy sectors, with a view to making the necessary changes to conserve, enhance, and work with nature and ecosystems rather than against them.

Chapters 4–7 of the Strategy set out a series of actions that will be taken by the Government and its partners to make biodiversity a fundamental consideration in:–

- Agriculture: encouraging the management of farming and agricultural land so as to conserve and enhance biodiversity as part of the Government's Sustainable Food and Farming Strategy
- Water: aiming for a whole catchment approach to the wise, sustainable use of water and wetlands
- Woodland: with the management and extension of woodland so as to promote enhanced biodiversity and quality of life
- Marine and coastal management: so as to achieve the sustainable use and management of our coasts and seas using natural processes and the ecosystem-based approach
- Urban areas: where biodiversity needs to become a part of the development of policy on sustainable communities, urban green space and the built environment

The Strategy also looks at ways of engaging society as a whole in understanding the needs of biodiversity and what can be done by everyone to help conserve and enhance it.

Best Practice

The Highways Agency issued its Biodiversity Action Plan for the trunk road and motorway network in March 2002, investing £15m and setting targets for species and habitats.

A Key Defra objective of this strategy is:

To protect and improve the rural, urban, marine and global environment and lead on the integration of these with other policies across Government and Internationally. Under this objective, key targets are to care for our natural heritage, make the countryside attractive and enjoyable for all and preserve biological diversity by;

- Reversing the long-term decline in the number of farmland birds by 2020, as measure annually against underlying trends; and
- Bringing into favourable condition by 2010 95% of all nationally wildlife sites.

UK Biodiversity Action Plan (UK BAP)

During 1993 the UK Government consulted over 300 organisation in-order to debate the key issues raised at the Convention of Biological Diversity. This consultation launched 'Biodiversity : The UK Action Plan' in 1994. This plan outlines how the UK will deal with biodiversity conservation in response to the Rio Convention.

The overall goal of the plan is to enhance biological diversity within the UK and to contribute to the overall conservation or global biodiversity. The underlying principles are as follows;

- When biological resources are used, their use should be sustainable
- Non-renewable resources should be used wisely
- Individuals and communities must be engaged along with Government process to ensure conservation or biodiversity
- All Government programmes, policies and actions should embrace biodiversity conservation
- A sound knowledge base should be used as the foundation for conservation practice and policy
- Decisions should be guided by the precautionary principle.

Conserving Biodiversity – The UK Approach

The vision of the Biodiversity Partnerships is:

“Our vision is that in our countryside, towns and seas, living things and their habitats are part of healthy, functioning ecosystems; we value our natural environment, a concern for biodiversity is embedded in policies and decisions, and more people enjoy, understand and act to improve the natural world about them.”

This same vision has been adopted by the UK Government as a common vision for biodiversity conservation. This approach builds upon the framework for sustainable development and considers central to the vision is the recognition that interconnections between living species, their particular habitats and the services they provide is dependant on us preserving them.

This approach addresses the issue of climate change and the effects this will have on biodiversity and also highlights the importance of the UK having a non-native species strategy in place to be implemented in 2010 recognising the seriousness of invasive non-native species on other components of biodiversity and social and economic interests.

The People Agenda

Sustainable Communities - Building for the Future

This strategy highlights the need for a wider vision of strong and sustainable communities which flows from the Government commitment to sustainable development. The strategy highlights the way that our communities develop, economically, socially and environmentally, and measures to respect the needs of future generations as well as succeeding now.

The strategy highlights that the key requirements of a Sustainable Community are:

- A flourishing local economy to provide jobs and wealth;
- Strong leadership to respond positively to change;

- Effective engagement and participation by local people, groups and businesses, especially in the planning, design and long term stewardship of their community, and an active voluntary and community sector;
- A safe and healthy local environment with well-designed public and green space;
- Sufficient size, scale and density, and the right layout to support basic amenities in the neighbourhood and minimise use of resources (including land);
- Good public transport and other transport infrastructure both within the community and linking it to urban, rural and regional centres;
- Buildings – both individually and collectively – that can meet different needs over time, and that minimise the use of resources;
- A well-integrated mix of decent homes of different types and tenures to support a range of household sizes, ages and incomes;
- Good quality local public services, including education and training opportunities, health care and community facilities, especially for leisure;
- A diverse, vibrant and creative local culture, encouraging pride in the community and cohesion within it;
- A "sense of place";
- The right links with the wider regional, national and international community.

This strategy sets the framework for action to be taken and, together with accompanying regional documents, it spells out priorities for investment over the next three years. The strategy will however require action over 15-20 years in order to cement real change.

Skills White Paper 2005

This white paper sets out the Government's plans for the next major phase of reform aiming to make the UK a world leader in skills. The Skills Strategy Core comprises the following strands;

- Working in partnership with employers to enhance skills through the National Employer Training Network.
- Giving employers strong voices in shaping the supply of training at every level. The introduction of Sector Skills Agreement and Skills Academies.
- Supporting individuals in achieving their ambitions, through better information and guidance.
- To help adults gain the functional skills of literacy, language and numeracy through 'upskilling'.
- To tackle the obstacles that people face in gaining fair access to training and jobs.
- To encourage the role that trade unions play in addressing skills needs.

Success will be measured through a number of indicators including ensuring that more young people get higher education qualifications, increasing the number of people completing apprenticeships and aiming for 2.25 millions adults to achieve functional literacy, language and numeracy.

Construction Sector Skills Agreement

The Sector Skills Agreement (SSA) has been implemented locally in Scotland, Wales and Northern Ireland, and in each of the eight English Regions and covers 2005-2010. ConstructionSkills is working to fulfil the skills and productivity needs of the UK through the construction industry's Sector Skills Agreement. The construction industry's SAA, negotiated by ConstructionSkills, is a series of agreements between training providers, employers and Government, designed to address the construction industry's current and future skills needs. Within each region a forum operates through five subgroups that are responsible for delivery of the key SSA challenges. These are:

- Improving business performance
- Qualifying the workforce
- Image and recruitment
- Higher education
- Equal opportunities.

Lisbon Strategy for Jobs & Growth : UK National Reform Programme

In March 2005 the European Council agreed to re-launch the Lisbon agenda and focus it more sharply in relation to what they see as the key priorities of jobs and growth. Member States were then invited to identify their own reform priorities and present forward-looking reform plans to the European Commission. The UK's first National Reform was published in 2005. It sets out the challenges currently facing the UK economy, details the Government forward looking agenda and gives the economic reform agenda.

Updates on progress to the Reform Programmes were published in 2006 and 2007 in line with the Lisbon Strategy. These updates focus on progress in relation to principle reform implementation and set out further strategies for delivering long-term sustainable growth, high employment and a fair and inclusive society.

Procurement

'Procuring the Future – The Sustainable Procurement Task Force national Action'

The Task Force drew on the findings of reports by the National Audit Officer, Environmental Audit Committee and others, as well as its own research to analyse the key barriers to sustainable procurement and present a National Action Plan for overcoming them. The plan makes six key recommendations, underpinned by three building blocks for sustainable procurement and details the actions which must be taken with milestones for getting started and clear target dates for the future. The action plan makes a number of key recommendations which include;

- Lead by Example. The Government should lead by example. The lack of consistent leadership on sustainable procurement is often seen as a barrier.

- Set Clear Priorities. Government should rationalise the significant number of policies through procurement into a single integrated sustainable procurement framework.
- Raise the Bar. Existing minimum standards for central government should be properly enforced and extended to the rest of the public sector with the introduction of further standards.
- Build Capacity. The public sector should build capacity by developing its capabilities to deliver sustainable procurement.
- Remove Barriers. The Government should remove barriers to sustainable procurement, whether actual or perceived and put in place the right budgetary mechanisms.
- Capture Opportunities. The public sector needs to capture opportunities for innovation and social benefits and to manage risk better through smarter engagement with the market.

OGC – Office of Government Commerce – Common Minimum Standards For Procurement of Built Environments in the public sector

Government Ministers were conscious that public sector procurers are subjected to a range of policy initiatives of differing levels of importance and considered it was essential to adopt a consistent benchmark for delivering value for money and to provide a coherent approach to the market. As such, OGC established a group of cross-government senior policy officials (SOPG). SOPG's objective was to identify and promulgate a set of key minimum procurement standards which would improve the coherence and integration between the different policy agenda impacting areas.

The standards themselves are not new and some are already mandatory. The standards do not cover legislative requirements which are already considered mandatory. Compliance with these standards is considered to represent cost effectiveness, however their practical application by individual procurers should be considered on a project specific basis within the context of practicality, achievability and value for money, defined as the optimum combination of whole life cost and quality to meet user requirements. Procurers will be expected to comply with these standards unless it can be clearly demonstrated that one or more of them fall outside the relevant criteria.

Best Practice – Environment Agency : Recycled Content Targets

The Environment Agency (EA) has established its National Capital Programme Management Service (NCPMS) to deliver flood defence and other capital projects on a consistent basis across all Agency Regions. The EA's procurement strategy "Constructing a better environment"; is based on the "Achieving Excellence" principles of the Office of Government Commerce. Through this strategy, and the Framework agreements established to deliver this strategy, the EA aims to deliver a 15% cost saving over five years. Within this procurement approach, the EA sets requirements for materials recycling. The EA initially set the requirement at 50% recycled material, which has been increased to 60% because of the success of contractors in meeting the requirement. Experience has led the EA to believe that the use of recycled materials can deliver cost savings in certain instances.

Source : AggRegain

Landscape, Townscape & Heritage

Our Countryside – The Future – A Fair Deal for Rural England

This White Paper is towards the aim of delivering an improved quality of life for everyone in the countryside as well as in cities and towns. The White Paper recognises that town and country are interdependent and the needs of both have to be addressed together. However, there are special problems in rural areas which require a direct response and that is the primary focus of the paper.

The Government's overall aim is to "*sustain and enhance the distinctive environment, economy and social fabric of the England countryside for the benefit of all*".

In order to work towards this overall aim 10 ways in which to make a difference have been identified and given in this white paper, these are shown below;

- Support vital village services
- Modernise rural services
- Provide affordable homes
- Deliver local transport solutions
- Rejuvenate market towns and a thriving local economy
- Set a new direction for farming
- Preserve what makes rural England special
- Ensure everyone can enjoy accessible countryside
- Think rural in relation to all decisions.

The Rural Strategy 2004

The starting point for the Rural Strategy 2004 is the vision of sustainable development for rural areas set out in the 2000 Rural White Paper. This document provides a framework, the tools and the evidence base to help all Government Departments, Regional and Local Partners to work together in a collaborative way over the next three to five years to deliver enhanced and enriched countryside and more sustainable rural communities.

The strategy identifies 3 key priorities for rural policy and the manner in which they will be delivered in a modernised delivery framework. The 3 key priorities for rural policy are;

- Economic and Social Regeneration
- Social justice for all
- Enhancing the value of our Countryside.

The Countryside in and around towns – A vision for connection town and country in the pursuit of sustainable development

Strategy uses the 10 functions given below which when combined produce multifunctional landscapes which form a rich mosaic around our towns and cities. The

strategy also recognise the barriers to change and addresses how change can be made by giving 4 steps for making it happen.

- A bridge to the country – The aim is to allow the countryside closest to urban areas to operate as recreational gateway to the deeper countryside.
- A gateway to the town – The quality of the countryside in and around towns is an often an indicator of the quality of that town or city. Land adjacent to major transport routes is often seen as being especially important in this regard.
- A health centre – Recognition of the fact that accessible and attractive countryside can provide an invaluable respite from the stresses of urban living.
- A class room – Recognition that the countryside in and around town can provide hands-on learning and supports the National Curriculum.
- A recycling and renewable energy centre – Fringe areas of towns and cities are often seen as dumping ground as this tends to be where landfill sites are located. Countryside in and around towns is often recognised as playing an important part in the sustainable management of waste, water and pollution generated by urban areas.
- A productive landscape – Farmers operating close to urban areas should take advantage of their proximity to large urban markets and supply consumers with high quality local produce.
- A cultural legacy – Ensuring that development and expansion of towns and cities is not detrimental to our historic legacy.
- A place for sustainable living – The need for careful decisions in relation to where to accommodate new developments, especially affordable homes.
- An engine for regeneration – Local regeneration strategies can use the countryside on the urban edge to help that community develop confidence, skills and prospects, for instance community gardens and allotments.
- A nature reserve – Countryside in and around town contains historic and newly established woodland, wetlands and a broad array of other natural habitats. Therefore recognition of biodiversity is paramount when considering land use and management.

THE EAST LANCASHIRE CANAL STRATEGY

Prepared by British Waterways in partnership with the North West Development Agency and English Heritage, this strategy shows how the 200 year old Leeds Liverpool Canal can be a catalyst for the regeneration of the urban fringe between Blackburn, Accrington, Burnley, Nelson and Colne. It identifies ways in which the communities alongside the canal can develop a strong identity linked to their local waterway. Strategic plans show the potential of the wider canal corridor, with scope for improved links to both town centres and nearby attractive open countryside. The roles which culture, heritage, landscape, biodiversity and regeneration can play are prioritised within a long-term sustainable action plan.

Local Geodiversity Action Plans

Local Geodiversity Action Plans (LGAPs) set out actions to conserve and enhance the geodiversity of a specific area. Their overall aim is to:

- Help influence local planning policy
- Provide specific geodiversity information to relation to that specific area
- Identify geological sites and promote geoconservation

- Identify and preserve sites which represent geological history for scientific, recreational and cultural purposes.

The Historic Environment: A Force for Our Future

This statement contains the Government's agenda which over time it is hoped can deliver more attractive towns and cities; a prosperous and sustainable countryside; world class tourist attractions; new jobs; and self-confident communities.

Heritage Protection for the 21st Century – White Paper (still under consultation)

This joint England and Wales White Paper is based on three core principles: the need to develop a unified approach to the historic environment; maximising opportunities for inclusion and involvement; and supporting sustainable communities through ensuring the historic environment is at the heart of an effective planning system. The paper sets out a heritage protection system and proposed legislative change and implementation within England. This paper is also inclusive of the both the terrestrial and marine historic environment.

Design & Innovation

CEEQUAL – The Civil Engineering Environmental Quality Assessment and Award Scheme

CEEQUAL is an award scheme assessing the environmental quality of civil engineering projects - a civil engineering equivalent to BREEAM for buildings. It is being promoted by ICE, BRE, CIRIA, BERR and a group of committed industry organisations. 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. More information on CEEQUAL is available from their website.



The N7 Naas Road Widening & Interchange Scheme

The N7 Naas Road Widening & Interchanges Scheme is the first construction project in the Republic of Ireland to gain a CEEQUAL award. The scheme consisted of an upgrade of a 14km stretch of the existing N7. The road was widening from a two-lane dual carriageway with at-grade junctions to a three-lane dual carriageway. The scheme also included the construction of four new grade-separated interchanges, two footbridges and other upgrading works. One of the project's approaches was to sustainable resource management and was to reduce the amount of virgin aggregate and to re-use existing materials on site. This was achieved in part by using a rubblelisation technique to turn the existing old concrete slabs beneath the blacktop into a sub-base for the new road.

Source : CEEQUAL

Aggregate Standards & Quality Protocols

Aggregate standards and quality protocols are fundamental to ensuring the use of secondary and recycled aggregates within new builds while reducing the need for the importation of virgin materials.

Aggregate standards

European standards for aggregates came into force in June 2004. The introduction of these standards has meant that secondary and recycled aggregates can be used in a broad range of applications. The standards cover aggregates from natural sources and manufactured materials (secondary and recycled materials) focusing on whether the materials are fit for purpose and not discriminating between different sources. The European Standards for aggregates are:

- BSEN 12620 – Aggregates for concrete
- BSEN13043 – Aggregates for bituminous mixtures and surface treatments for roads, airfields and other tracked areas
- BSEN13055 – Lightweight aggregates
- BSEN13139 – Aggregates for mortar
- BSEN13242 – Armourstone
- BSEN13450 – Aggregates for railway ballast

Aggregates Quality Protocol

The Quality Protocol for the production of aggregates from inert waste has been produced with the purpose of providing uniform criteria for producers, which can be used to demonstrate that their product has been fully recovered and has therefore ceased to be a waste. As a result, aggregates produced from inert waste to this specification can therefore be used as a product and not as a waste which vastly increases their application and use. The protocol also provides assurances to those buying the quality managed product that it has been produced to the correct standard, is fit for purpose and increases confidence in its performance. The protocol can be found at www.wrap.org.uk.

Alongside a Quality Protocol for aggregates, WRAP have also introduced protocols for plastics, paper, tyres, compost and glass. WRAP are engaged in a two year waste protocol project in which it aims release several quality protocols for a range of waste including PFA (Pulverised Fuel Ash), BFS (Blast Furnance Slag), steel slag and IBA (incinerator Bottom Ash). Many of these wastes have the potential to be used in road construction and maintenance activities. Having such protocols in place will support the Specification of Highways to deliver the inclusion of waste derived products in construction.

Sustainable Products – Improving the efficiency of energy using products – street lighting and traffic signals (under consultation)

This consultation will help to implement the Government's Energy White Paper in that it fulfils a commitment made within it to publish a series of papers analysing how the performance of a range of energy-using products will need to improve over the next 10-20 years. It will also support delivery of the Government's objectives for energy and for sustainable consumption and production. One such paper looks at the evidence, analysis, targets and indicative standards in relation to improving the energy performance of street lighting and traffic signals.

The consultation paper addresses in-use energy consumption and carbon emission associated with public street lighting, including signage and traffic signals, high and low pressure sodium lamps, ceramic metal halide lamps, high-pressure mercury lamps, tungsten filament lamps, fluorescent lighting and light-emitting diodes.

The majority of new installations on major roads utilise high-pressure sodium lamps. Using the best available high-pressure sodium technologies, can have a significant effect on the energy consumption of new road schemes.

Until recently traffic signals had been fitted with fluorescent lamps. Compact fluorescent lamps are now in common use due to their long life and low maintenance requirements. The consultation makes a number of proposals in a wide range of subjects from promoting energy/carbon saving, product innovation through to waste and health impacts.

Code for Sustainable Homes

In December 2006, the code for Sustainable Homes, a new national standard for sustainable design and construction of new homes was launched. Since April 2007, the developer of any new home in England can choose to be assessed against the code. The code measures the sustainability of a new home against categories of sustainable design, rating the whole home on a star rating system of 1 to 6. The code gives minimum standards for energy and water use at each level and within England has replaced the EcoHomes scheme.

Building a Green Future : Towards Zero Carbon Development

This document is seeking views on the Government's proposals to reduce the carbon footprint of new housing developments. It sets out the Government's views on the importance of moving forward towards zero carbon in new housing. This document explores the relationship between the planning system, Code of Sustainable Homes and the Building Regulations in delivering the ambitions for zero carbon.

BREEAM (BRE's Environmental Assessment method)

BREEAM, created by BRE (building Research Establishment) is the world's longest established and most widely used environmental assessment method for buildings. The aims and objectives of BREEAM are given below;

AIMS OF BREEAM:

- To reduce the environmental impacts of developments.

- To enable developments to be recognised according to their environmental benefits.
- To provide a credible, environmental label for buildings.
- To stimulate demand for environmentally sustainable buildings.

OBJECTIVES OF BREEAM:

- To distinguish buildings of reduced environmental impact in the marketplace.
- To ensure best environmental practice is incorporated in building design, operation, management and maintenance.
- To set criteria and standards surpassing those required by regulations.
- To raise the awareness of owners, occupants, designers and operators of the benefits of buildings with a reduced impact on the environment.
- To inform the design process.
- To allow organisations to demonstrate progress towards corporate environmental objectives.

BREEAM sets out standards for best practice in sustainable development and demonstrates a high level of achievement.

Tools for assessing environmental impacts of buildings and construction

This section contains details of tools from an International, European and UK source and summarises more detailed information given elsewhere within the report. These tools are used to assess either short or long term impacts of a construction projects.

International Context

Source of some text:

http://www.canadianarchitect.com/asf/perspectives_sustainability/programs_evaluations/programs_evaluationtools_tools.htm

Today there are a large range of environmental assessment tools and environmental indicators that can assist designers, architects, construction companies, planners and others to make decisions ranging from material and component choices to greener building designs. These decisions can help to reduce the overall environmental impacts of a project throughout its life cycle. The tools used in these decisions can be qualitative and/or quantitative. Practical examples are discussed below.

Athena Institute (Canada)

The Athena Impact Estimator for buildings is a decision support tool that is based on the LCA methodology. The software will compare the environmental implications of industrial, institutional, commercial and residential designs—both for new buildings and major renovations. The software takes into account the environmental impacts of materials manufacture, related transport, on-site construction, building type, lifespan, demolition and repair, and operating energy emissions. The Athena Eco-calculator provides LCA results on over 400 building products.

BEES (USA)

BEES (Building for Environmental and Economic Sustainability) is a decision support software that measures the environmental performance of building products. The tool contains actual environmental and economic performance data on a number of building products. All stages in the life of a product are analysed such as raw material acquisition, manufacture, transportation, installation, use, recycling and waste management. Economic performance is measured using the ASTM standard life-cycle cost method, which covers the costs of initial investment, replacement, operation, maintenance and repair, and disposal. The environmental and economic assessments are combined into an overall performance measure.

European Context

ECOQUANTUM (NL)

Ecoquantum is a tool based on LCA that calculates the environmental impact of a building design. It assesses the environmental impacts of materials, energy and water used during the lifecycle of the building. It can be used by construction companies, architects, or municipalities to optimise design and to set policy. Also the future building owner can use the tool to demonstrate that a certain level of environmental performance has been reached.

GREENCAL (NL)

Greencalc is a computer model used to assess the environmental impacts of a building.

EQUER (France)

Equer is an environmental performance simulation tool for buildings. It assesses the environmental consequences of design choices over the future life of the building. This information is made available to the design team to help in decision making. The tool is LCA based and assesses fabrication of materials, construction, utilisation, renovation and demolition. It assesses a range of environmental indicators such as global warming, acidification and eutrophication potentials, exhaust of natural resources, etc.

The report "Assessment of Sustainability Tools" reviews a number of sustainability tools that are available for the urban environment that are relevant to the UK and EU. A brief summary of each tool is given below.

UK Context

BRE (UK)

BREEAM tools and methods can be used to help reduce the environmental impacts of construction projects. The tools can be used in different stages of construction such as the manufacture of building materials, the design stage, construction and post

construction. The tools can be used on a range of construction activities from housing to large scale developments. Some of the tools include:

- BREEAM- LCA -Certified system for providing information about the environmental impacts of construction materials measured over the whole life cycle of the product
- BREEAM – Invest Tool assesses the life-cycle environmental impacts of a proposed building design and can be used to explore various design options.
- BEAM- Specification- Publication outlining the environmental impacts of over 250 elemental specifications of roofs, walls and floors.
- BREEAM-Smartwaste tools -Used to reduce waste during the construction programme which can lead to cost and resource use savings. Smartwaste tools include, waste audits, SWMP tool and pre-demolition audits. The tools can help to identify waste streams, set KPIs and waste reduction targets, and aid planning day-to-day waste minimisation activities on site.

The report “Assessment of Sustainability Tool” reviews a number of sustainability tools that are available for the urban environment that are relevant to the UK and EU. A brief summary of each tool is given below.

BRE sustainability checklist

This guide enables developers, planning authorities and their advisors to specify and assess the sustainability attributes of their developments. Described as a series of straightforward steps that can be followed to incorporate sustainability into developments, it reflects the latest guidance on sustainability. Wherever possible, the checklist uses existing systems and standards to define performance, such as ‘BREEAM’ (BRE’s environmental assessment method), EcoHomes (the homes version) and ‘Secured by Design’. It considers the environmental, social, and economic aspects of sustainability under the following eight broad headings:

- Land use, urban form and design
- Transport
- Energy
- Impact of individual buildings
- Natural resources
- Ecology
- Community issues
- Business issues.

The guide was developed in partnership with local authorities (including Leicester City Council, Newcastle City Council, Watford Council and Hertfordshire County Council), English Partnerships, Nightingale Associates, West of Stevenage Development Consortium, Surrey University, Living Villages Trust and Llewellyn Davies, and was sponsored by DTI/DETR.

SPARTACUS

SPARTACUS is a method for assessing sustainability implications of urban land use and transport policies. The core of the systems is a computerised land use transport interaction model, MEPLAN. MEPLAN can be used to analyse the impacts of e.g. transport investment, regulatory, pricing or planning policies on e.g. overall mobility, modal split, journey times, movements of households and jobs and production costs of firms. The SPARTACUS method builds on the results of the model to calculate values for sustainability indicators. Sustainability is understood as consisting of environmental and social sustainability and economic efficiency. The environmental and social indicators are aggregated into indices using user-given indicator-specific weights and value functions. The social indicators include a set of justice indicators which assess the justice of the distributions of certain impacts among socio-economic groups. The methodology is being further developed in the PROPOLIS project.

SEEDA sustainability checklist

The Checklist is a tool which allows the sustainability aspects of a development to be addressed and for reviewing organisations such as local authorities, SEEDA and Government Office of the South East (GO-SE) to understand the level of performance that might be achieved. It may also be used by developers to demonstrate the sustainability credentials of their development. The Checklist aims to form a common framework for the South East.

PLACE3S

PLACE3S is an urban planning method designed to help communities establish an effective path towards sustainability. It is unique because it employs a yardstick to measure the sustainability of urban design and growth management plans. Using a Btu-based accounting system, PLACE3S can evaluate how efficiently we use land, provide housing and jobs, move people and materials, operate buildings and public infrastructure, site energy facilities and use other resources. PLACE3S integrates public participation, planning, design and quantitative measurements into a five stop process appropriate for regional and neighbourhood-scale assessments.

SPeAr

The Sustainable Project Appraisal Routine (SPeAr®) is based on a four-quadrant model that structures the issues of sustainability into a robust framework, from which an appraisal of performance can be undertaken. SPeAr® brings sustainability into the decision-making process with its focus on the key elements of environmental protection, social equity, economic viability and efficient use of natural resources. As such the information generated by the appraisal prompts innovative thinking and informs decision-making at all stages of design and development. This allows continual improvement in sustainability performance and assists in delivering sustainable objectives.

EcoCal

EcoCal® is used to find the environmental impact of your household. The results are measured in eco-calories. Dials are used to compare households with similar

households. On the dials Green is good, Amber is average and Red means that there is a lot more environmental action that the householder can take. The EcoCal questions are divided into seven activity areas. 1. Transport, 2. Water, 3. House and Garden, 4. Community Action, 5. Energy, 6. Shopping and 7. Waste.

BREEAM

BREEAM provides a broad ranging assessment of the environmental impact of a building. Issues covered include those relating to the global, local and internal environments. BREEAM relates to design stage assessments (i.e. new build and refurbishment) and relates to the ongoing operation and management of the building. Assessors operating under licence from BRE carry out the assessments.

Assessment Tools: LCA Approach

ENVEST

A lifecycle assessment approach for the construction of new buildings.

BRE environmental Profiles

Environmental Profiles are a method of gathering and presenting environmental data to compare the environmental performance of building materials. They enable architects, specifiers and clients to make informed decisions about construction materials and components, by providing a method for independent, 'level playing field' information about the relative environmental impacts of different design options.

Bousted

The Bousted Model is a self-contained database and software application, which enables the user to construct full life-cycle inventories for virtually any process situated anywhere in the world. The database that accompanies the application is the largest, open, fully editable inventory database that is commercially available.

Infrastructure Tools

CEEQUAL

The Civil Engineering Environmental Quality Award Scheme is an assessment and awards scheme for publicly rewarding high environmental quality of civil engineering project. It builds on current guidance and environmental good practice in construction and supports UK Government strategy by providing the civil engineering industry with an incentive and protocol for assessing, benchmarking and labelling the environmental quality of its projects as part of their contribution to sustainable construction. Four types of award are available. Whole project award – for a joint application by the client, designer and principal contractor, - Design and build award – for partnership contract teams, Design award – for principal designers only, - Construction process award – for principal contractors only.

The assessment tools fall into the five broad categories set out previously. Three of the categories, urban planning, rating systems and LCA approach contained seven

tools each. There were three design tools and one infrastructure tool. The tools range in their type and nature requiring in some cases qualitative and in other cases quantitative measures of sustainability.

It is noticeable that some tools have been in existence for a number of years such as BREEAM and HK-BEAM and there has been a growing acceptance and use of these tools. Other tools have been developed as checklists of sustainability, a checklist approach is simplistic and can assist the user to cover a whole range of sustainability issues.

Each tool has been developed for specific purposes, some considering specific issues such as energy use and others the whole range of sustainability themes. It is noticeable that the recent tools, e.g. the sustainability checklist and SEEDA checklist, have been driven by non government organisations for specific purposes, whereas the earlier tools were developed within research projects and rolled out as outputs from the research.

The development of tools is recognised as an important issue. The assessed tools have generally allowed for development as a result of changes in legislation or technological advances.

Further resource programmes

This section captures other researched information which cannot be expressly categorised as being legislation, a strategic document or an assessment tool. It provides sources of further guidance and information.

EPSRC

Engineering and Physical Sciences Research Council (EPSRC) are the main Government agency for funding research and training in engineering and the physical sciences. Their aim is to meet the needs of both society and industry by working in partnership with universities to invest in people, scientific discovery and innovation.

The Sustainable Urban Environment (SUE) programme, which EPSRC funds, aims to improve the quality of life of UK citizens, to support the sustainable development of the UK economy and to meet the needs of users of EPSRC funded research. For Further Details Please See Appendix C.

Sustainable Construction: Practical Guidance for Planners and Developers

The Sustainable Construction: Practical Guidance for Planners and Developers website was a DTI funded Partners in Innovation project. It aims to bring together the knowledge of those tasked with promoting and controlling development, and those who deliver development in order to produce a practical set of measures that could

be used on different types of construction sites. In addition, it aims to explain the relevance of sustainable construction to planners and developers.

The website covers the drivers for sustainable construction, the development context, sustainable design and construction measures, the background to the project, and provides training materials.

Construction Knowledge Wales

Construction Knowledge Wales is a Technology Transfer Network (TTN) covering Wales. It is designed to enable the construction industry to contribute towards sustainable development in Wales by providing access to expertise, research and development, case studies, and reference material covering all topics related to the construction industry.

4.2 The Road Construction Context

'Towards a Sustainable Transport System – Supporting Economic Growth in a Low Carbon World (DfT Cm7226 October 2007)

Some of the key thinking behind this document comes from the Stern Review and Eddington Study. The Eddington Report argued that a well-functioning transport system is vital to the continued success of the UK economy and to our quality of life. Whereas the Stern report argued that this does not have to be an either/or choice and that a well designed strategy can support economic growth and tackle carbon emissions.

Although this document is not solely limited to vehicular use of the transport system or to the construction of roads, these subjects feature heavily within the document as do aspects of sustainability. This document has three aims:

- It describes how the Government is responding to the recommendation made within the Eddington study to improve transport's contribution to economic growth and productivity and how transport can help deliver reductions in carbon emissions as recommended by the Stern Report;
- It sets out the DfT's (Department of Transport) policy and investment plans until 2013-14, and;
- It proposes a new approach to longer-term transport strategy and highlights the need to engage with the transport industry, passengers and users.

Included in the list of proposals and plans for the period to 2014 are the following;

- A need to improve the reliability and to tackle capacity constraints on the national motorway network and other strategic roads. It is recognised within this document that this poses particular challenges against a background of escalating costs and environmental concerns.
- The document highlights a continuing need to develop ways in which to make the best use of the existing network. Alongside investment in the

infrastructure, the introduction of traffic officers is said to have greatly improved the speed with which incidents are dealt with on strategic roads.

The report recognises an effective strategy needs to start by being clear on the policy goals and the desired outcomes. 5 goals have been identified;

- Maximising the overall competitiveness and productivity of the national economy, so as to achieve a sustained high level of GDP growth.
- Reducing transport's emissions of CO₂ and other greenhouse gases, and therefore helping to mitigate climate change.
- Contributing to better health and longer life-expectancy through reducing the risk of death, injury or illness arising from transport, and promoting travel modes that are beneficial to health such as cycling.
- Improving quality of life for transport users and non-transport users, including through a health natural environment, with the desired outcome of improved well-being for all.
- Promoting greater equality of transport opportunity for all citizens, with the desired outcome of achieving a fairer society.

The report provides an initial assessment of each goal split down into issues affecting the International network, National network, cities and regional network and cross-cutting areas. In its conclusion the report shows how these goals fit together and how they link to the formal objectives set for the Secretary of State for Transport in the recent Comprehensive Spending Review.

Sustainable Highways – A Short Guide (Draft May 2007 – produced by TRL) This document provides relevant and succinct guidance to Local Authority (LAs) highway and material engineers giving a range of techniques and sustainable materials which can be used for footway and highway maintenance and also new construction. Detailing and simplifying what are often thought of as complex sustainability concepts in a simplistic understandable manner, this manual documents how to incorporate sustainability into highway maintenance.

The document divides construction and highway maintenance of highways works into six applications; surfacing, pavement reconstruction, edging, footways and cycle tracks, capping and sub-base and earthworks. For each of these applications a number of actions have been identified which are grouped under milestones. These actions include the use of different materials and associated maintenance techniques and also the reuse of waste. The actions found under each milestone vary between the 6 different applications, reflecting the ease which they can be accomplished.

Recognition is given to the importance of Highways departments having in place achievable KPIs to show continuous improvement in relation to sustainability performance and suggests that KPIs and targets should be kept to a minimum so as not to add to existing KPIs. Suggestions and guiding principles are given for developing KPIs in relation to highways activities.

The importance of quality controls is highlighted while also recognising that highway specifications have been significantly updated over the last 10 years therefore actively allowing and promoting the use of recycled and secondary materials within new builds and maintenance. This is further complemented by the production of waste protocols which encourage the use of range of wastes such as PFA, BFS and IBA within construction as alternatives to virgin materials to the same consistently high standard as traditional virgin materials.

Also addressed in this document are the positive and potentially negative environmental impacts of using recycled and secondary materials along with tools which assess and quantify environmental benefits resulting from their use. Chapter 9 of the document provides clear, practical and relevant advice in relation to a range of waste management topics.

Case Studies – Aggregate Replacement

Case Study 1 : Glasphalt

RMC has been investigating the possibility of producing asphalt with crushed glass whereby replacing some of the aggregate in conventional mixtures. This product is marketed under the name of Glasphalt and it is intended for use only in the structural layers of pavement because glass will polish quickly under traffic and will not provide the skid-resistance required for a surface course. 30% of the limestone content was replaced with crushed and screened glass. Several full-scale trials have taken place since the successful completion of the pilot trail and a road construction at Mansfield. The trials have shown that the inclusion of glass did not adversely affect the properties of the mixture and generally complies with the current set of performance requirements in SHW for materials used in the structural layers of pavements.

Case Study 2 : IBA Incinerator Bottom Ash

This case study features a 4km by-pass to Waltham Abbey which was originally designed in accordance with Volume 7 of the DMRB. The design was modified to obtain environmental benefits, in particular the clay sub-grade was stabilised to construct the sub-base. IBA was produced by Ballast Phoenix at Edmonton to meet requirements of BS882. This totally replaced primary aggregate in the production of the CBM3. A medium strength lower base (using CBM) satisfied the design criteria doe CBM3R. The CBM aggregate comprised 100% IBA to the given grading, used pith Portland cement. The 7 day compressive strength of the CBM was 12 MPa.

Case Study 3 : Slag bound materials

The A485 Carmarthen site was constructed in 1999 and comprised two sections of SBM, one with SBM base and the other with SBM base and sub-base. The SBM design consisted of 16% granulated blast furnance slag, 1.5% lime, 77.5 air-cooled slag aggregate, 5% limesone filler and 7.5% water. The use of SBM allows much more handling time, between batching and laying, then the 2 hours permitted for the control cement bound material, CMB3. The early strength development of the SBM is lower than CBM3, therefore reducing the risk of reflection cracks, whereas the 360-days strength properties, which are used in pavement design are comparable to CBM3.

Source – TRL Report 598.

4.3 Implementation and best practice

The Quality Protocol for the production of aggregates from inert waste (Prepared by WRAP/Highway Agency/Quarry Products Association – September 2005)

The purpose of this Quality Protocol is to provide a uniform control framework for producers from which they can reasonably state and demonstrate that their product has been fully recovered and is no longer a waste. It also provides purchasers with a quality managed product to common aggregate standards therefore increasing confidence in its performance. The framework created by the Protocol also provides a clear audit trail which helps to ensure compliance with waste management legislation.

This protocol supersedes the Quality Control Protocol, called 'Quality Control – the production of recycled aggregates', reference BR392. The Protocol itself contains 3 appendices, these appendices provide an example of a flowchart for acceptance and processing of inert waste, a list of testing methods which may be used as a means of either decided or illustrating suitability for a particular end use and finally a list wastes by EWC codes which are considered inert for use with this protocol.

A model set of asphalt sustainability indicators (Prepared for the Highways Agency, Quarry Product Association and Refined Bitumen Association by TRL, Report TRL638, 2005)

This report recommends a 'model' set of indicators that could be adopted and developed by the asphalt industry, should they wish to progress towards greater sustainability. The report itself provides an overview of sustainability and the potential role of sustainability indicators and sustainability reporting in the industry's response to Government Sustainable Construction Policy. A further purpose of the paper is to consult and prompt discussion within the asphalt industry on the acceptability of the 'model' indicator set and to determine the level of commitment expected to using such indicators.

The report highlights that recycling is an area where the asphalt industry has the greatest potential to make a difference in terms of sustainability, previous progress has also been made. No figures were available from the UK at the time this report was written however, the European Asphalt Pavement Association (EAPA 2004) has firmly asserted that:

'If reclaimed asphalt is recovered and free of contamination, it can be guaranteed that the total amount of this reclaimed asphalt can be reused as construction material.'

Having a set of indicators to provide evidence of performance has a number of uses including:

- Performance planning
- Providing evidence for quality submission in tendering

- Reporting to shareholders and other investors
- Reporting to planning authorities, regulatory bodies and the public.

A number of asphalt producers are already producing sustainability reports and examples of these and the indicators they use.

Tarmac 2002:

- Health and Safety Targets; Target for 2005: zero lost time injury accident rate
- Energy Consumption; 92.0 kWh (specific energy consumption) per unit production with a target to reduce this to 88.4 within eight years.

Aggregate Industries 2000:

- Water consumption; 112 thousand m³ compared with 215 in 1999.

RMC 2001 (including aggregate, asphalt, cement and concrete production):

- Emissions of CO₂ ; 47kg per tonne of product produced and transported with a target reduction of 1% per year.
- Generation of waste; 14kg per tonnes of product produced and transported with a target to reduce by 1% per annum

Source : TRL Report 638.

Prior to deciding which indicators of sustainability should be chosen, a review of the major impacts on the asphalt industry in terms of sustainability themes was undertaken. The results of this review were used to inform and draw up a list of potential indicators. The report recommends the use of two sets of indicators; key performance indicators (KPIs) and; Possible Impact Area internal Diagnostic Indicators. KPIs would be used to benchmark the industry as a whole and Impact Area Diagnostic Indicators would form part of best practice management and potentially, specific reports for clients.

Development of new materials for secondary and recycled aggregates in highway infrastructure (Prepared by TRL for the DTI and WRAP, TRL Report 598, 2004)

This report reviews the use of secondary and recycled aggregates in highway infrastructure, with an emphasis on high-value applications in road infrastructure. This report has been produced in the context of the SHW (Specifications for Highways Works) which is the basis for road specification in the UK. The document highlights potential new applications, not included in the SHW at the time, to support the optimised use of alternative materials.

Discussed in this report is the assessment of the technical, environmental and regulatory barriers to the use of new materials and applications. This assessment addresses the relevant technical issues and highlights any lack of knowledge in relation to performance characteristics that may have an impact on the use of new materials. Environmental and regulatory risks are discussed in the context of leaching and contamination, potential to generate dust, health and safety, and the current waste management licensing regime.

The report concludes with a comprehensive set of recommendations highlighting the need for future work to overcome the barriers identified and to support the

development of new material applications. The main materials discussed within the report as having a potential for increased use or higher value use in highway infrastructure are:

- Construction and demolition waste.
- IBA.
- Glass.
- Plastic.
- Tyre rubber.
- Power station fly ash.
- Slags.

A Guide to the use and specification of cold recycled materials for the maintenance of road pavements (TRL report TRL611 2004)

This report is based on a three year programme of work and provides an end-performance based design guide and specification for cold recycled materials, regardless of how they are produced. The report also covers a wide range of cold-mix recycled materials involving a range of binders and binder blends. The materials are all divided into 'families' which enables materials produced with new binders or combinations of binders to be introduced with relative ease.

Advice is given within the document for a wide range of traffic conditions ranging from the lightly trafficked roads to heavily trafficked trunk roads. The intention is that the specifications and advice given within the report should facilitate a more prudent use of natural resources and assist in the protection of the environment in line with Government Policy.

Planning Policy Statement 25 – Development and Flood Risk

Drainage in the England and Wales involves a number of different bodies, including private landowners, the Local Authorities (LAs), Sewerage Undertakers and the Environment Agency. Most environmental duties are set out in legislation. There is however, no specific legislation to ensure that issues of sustainability are considered with regard to drainage. Current drainage law was drawn up before the widespread use of SUDS.

PPS25 aims to ensure that flood risk is considered on a catchment scale. It directly identifies the potential for SUDS (sustainable urban drainage systems) to reduce flooding downstream of developments and promotes the development of teamwork to encourage the incorporation of sustainable drainage within developments. Drainage responsibilities are divided between four main bodies:

- LAs
- Highway authorities
- Sewerage undertakers
- Environment Agency.

LAs act as planning authorities and also have responsibilities for local roads, public landscaping and local land drainage. The Highways Agency controls trunk road

drainage, while the sewerage undertakers are responsible for sewers carrying surface water from private impermeable areas.

Where a development includes road drainage, consent is obtained from the highways authority (LA department). With trunk roads this responsibility is that of the Highway Agency. Each LA will set out standards which prospective developers must follow throughout the construction process to ensure that adoptable roads are of satisfactory construction, can be easily maintained and are safe for public use. When LAs consider construction consent applications, they will normally want to be satisfied that SUDS at particular locations meet their road drainage requirements and will not require onerous maintenance.

4.3.1 HA Own initiatives (policies and strategies)

Building Better Roads: Towards Sustainable Construction (December 2003)

This document has been produced to highlight and explain what the Highways Agency is doing in-order to promote sustainability through the construction and maintenance of the strategic road network in England. This document also sets out sustainability information for stakeholders and for its suppliers.

The Agency identifies the following drivers for progress towards more sustainable construction:

- Building a Better Quality of Life – the UK Government’s strategy and commitment to sustainable construction
- The Customer Charter – this sets out the minimum standards the client community expect in construction procurement
- Rethinking Construction – this aims to improve the performance of the construction industry through guidance and partnerships
- The Office of Government Commerce Sustainability Action Plan – which sets out recommended action and a timescale for the implementation for improved supplier performance.

The drivers above led to the Agency to develop a more sustainable approach to its construction and maintenance operations.

The document demonstrates why the Agency is looking to improve its performance, what it wants to achieve, and how it is improving in the following key areas; management of natural resources, reducing energy consumption, reducing emissions, landscape, townscape and heritage, biodiversity, respect for people and partnerships to better business.

Each of these topic areas is discussed in depth along with details of the Agency’s goal in relation to that subject area and how the Agency is achieving this goal. The text is complemented by illustrative case studies of specific schemes and projects showing Agency achievements in this subject area. Although the document clearly shows the Agency has and is making progress towards its goals, there is also a recognition that

progress must be continuously monitored and that there is need for future development.

Helping you with your journey – Highways Agency (HA) Business Plan 07-08

The plan sets out how the HA intend to help its customers with their journeys on the Strategic Network in 2007-2008 and gives an indication of the HA's longer term intentions. Within the introduction to this plan is a section which discusses sustainable development and details how through the SDAP (Sustainable Development Action Plan) the HA will develop and implement sustainable ways of working across all of its business activities.

Within the plan the HA give its main impacts on sustainability as being;

- The materials and energy used
- Waste, including emissions which are produced
- Impact on the landscape, local environment, biodiversity and habitats
- Congestion, accessibility and community severance
- Safety and quality of life for its staff, contractors and customers
- The way in which the HA work with its contractors and suppliers.

The plan itself is divided into 5 outcome based targets which are;

- Making customers' journeys more reliable
- Improving safety
- Respecting the environment
- Engaging with customers
- Improving efficiency.

Within each of these areas, the plan highlights improvements which are being undertaken in these subject areas.

It is recognised within the plan that developing strong working relationships with partners is crucial to success, the HA works with many organisations. The HA have recently entered into formal working partnership with the Environment Agency and English Heritage and they are continuing to work towards similar partnerships with Network Rail and Freight Transport Association.

From 2008-09 it is the HA's intention to continue to work towards five outcome based targets which are given above. However, the HA programme beyond 2007-8 is dependant on the outcome of the current spending review, the context of the Eddington report and also outcomes from the Nicholas review.

Highways Agency Key Performance Indicators 2007-8

Annex C of the HA business plan for 07-08 contains the HA's Key Performance Indicators (KPIs) for 2007-8. Each year the HA has its challenging performance measures agreed by the Ministers. The KPIs for 2007-8 are displayed under the following headings which mirror the target based outcome detailed within the business plan;

- Reducing congestion and improving reliability

- Improving road safety
- Respecting the environment
- Seeking and responding to feedback from customers, and;
- Improving efficiency.

The table summarises the 2007-2008 Key Performance Measures and targets taken from the 07-08 business plan.

Business Plan (BP) Agency Customer Service Objective	Business Plan KPI	2007-2008 Target	
Reducing congestion and improving reliability	Deliver the PSA target to make journeys more reliable on the strategic road network by 07/08.	Make journeys more reliable on the strategic road network by ensuring that the average vehicle delay on the 10% slowest journeys is less in 2007-2008 than the baseline period.	
	Deliver the programme of improvements to the strategic road network.	Open at least 23 major national road and region road schemes between 01/04/05 – 31/03/08 Develop a target by 30/09/07 to measure progress in developing major scheme. In meantime continue to work towards achieving by 31/03/08, at least 2666 of 2806 progress points for delivery of the strategic roads programme	
	Deliver improvements to journeys by making information available with a view to influencing travel behaviour and informing decisions.	Complete a cumulative total of at least 85 priority action sites at junctions. Implement the new driver information services in line with the timetable agreed in the business cases approved by Ministers in 2006-07, and develop further services for Ministerial consideration during 2007-08. Consider the benefits of voluntary travel plans introduced in 2006-07 and introduce at least 18 Implement high occupancy vehicle (HOV) lane at the junction of the M606 and M62.	
	Improving Road Safety	Deliver HAs contribution to proportion of national road casualty reduction target.	By 2010 reduce by a third (to 2244) the number of people killed or seriously injured on the core network compared with the 1994-98 average of 3366.
		Maintain network in a safe and serviceable condition.	Maintain road surface condition index of 100 ±1 within the renewal of roads budget. Development a value for money indicator by September 2007.
	Respecting the environment	Mitigate the potentially adverse impact of strategic roads and take opportunities to enhance the environment taking into account value for money.	Achieve an average score of no less than 95% across the 5 sub-targets. Air Quality: implement measures to improve the air quality in at least 2 prioritised Air Quality Management Areas - AQMAs (making a cumulative total of 6 completed improvements in the 32 priority areas.
		Deliver HAs contribution to the DfT's joint PSA target	Biodiversity: achieve at least 7% of the published HA Biodiversity Action Plan, which extends across 15 targets (making a cumulative total of 48% of the HA BAP completed)

	for air quality.	Landscape: introduce at least 9 planting schemes to enhance the landscape Noise: treat at least 900 lane km of road surface with lower noise surfacing of which 20 lane km are on concrete roads Water Quality: treat at least 4 of the high priority pollution risk water outfall sites Improve the environmental performance of major schemes by improving the average score for the environmental subcriteria in the Appraisal Summary Table, in at least 5 out of the 10 sub-criteria
Seeking and responding to feedback from HA customers	Deliver a high level of road user satisfaction.	Improve road user satisfaction by reducing the gap between the 2006-07 targets and total road user satisfaction by 5% across core objectives: <ul style="list-style-type: none"> • Journey reliability and congestion • Safety • Environment
Improving efficiency	Deliver the HAs contribution to the DfTs efficiency target	Deliver efficiency improvements in roads procurement through adding value to service delivery of £200m in 2007-08. Deliver the programme within the allocated administration budget, which requires an efficiency improvement of at least £1m.

Achieving Sustainability – The Highways Agency’s Sustainable Development Action Plan 2007-08

This is the HA’s first Sustainable Development Action Plan. It aims to show how the Government’s principles and policies in relation to sustainability are embedded within HA activities and operations and how the HA intend to deliver a more sustainable approach to the delivery of its business during 2007-2008. The plan is said to be a ‘living document’ and that the timescales within it against specific action areas for very much a journey to become more sustainable.

The table below summarises where the HA consider its business impacts against the UK sustainability priorities;

UK sustainability Priority	HA recognised sustainability impact against the UK Priority
Sustainable Consumption and production	<ul style="list-style-type: none"> • Consideration of product lifecycles on the network and in HA offices • Procurement processes • Processes and materials used for construction and also maintenance on the network
Climate Change & Energy	<ul style="list-style-type: none"> • Customers using the network • Electricity and gas used on the network and in HA offices • HA staff and contractors commuting too and for work.
Creating sustainable communities & fairer world	<ul style="list-style-type: none"> • HA employees, contractors, suppliers and their employees. • Safety on the network for HA staff and contractors • Regeneration, local economies, cultural heritage. • Congestion, severance and accessibility
Protecting our natural resources and enhancing our environment	<ul style="list-style-type: none"> • Pollution from noise and light • Biodiversity and habitats • Use of natural resources i.e. water and aggregates • Emissions of air and water from the HAs offices.

HA priorities lie within the Business Plan targets and these targets are set to support sustainability principles. This plan provides focus to work towards reaching these targets in a sustainable manner. Internal targets have been set in-order to deliver the action plan, these targets are given in tabular format within the plan along with timescales for each action. Implementation of the plan within the HA will be bought about through a communications strategy which will include dedicated workshops and intranet sites.

Towards a balance with nature – Highways Agency Environment Strategic Plan

This builds upon the achievements of the HA's first Environmental Strategic Plan 'Living with Roads' from 1996 and has taken on board the content of the Government's Integrated Transport Policy as set out in the White Paper 'A New Deal for Trunk Roads in England'.

The HAs overall strategic aim is given as, *"to contribute to sustainable development by maintaining, operating and improving the truck road network in support of the Government's integrated transport and land use planning policies"* with a specific environmental key objective *"to minimise the impact of the trunk road network on both the natural and built environment"*.

The strategy areas covered are Maintenance, Operation and Improvement within the delivery areas of the Governments 5 criteria of safety, environment, economy,

accessibility and integration. These criteria are taken from a 'New Approach to Appraisal' (NATA) as set out in 'A New Deal for Trunk Roads in England. Detailed action programmes supporting this plan will be assessed against the NATA principles.

The plan identifies 10 areas for action, these are;

- Monitoring HA performance
- Procurement
- Working with people
- Biodiversity
- Air emissions monitoring
- Noise management
- Water management
- Waste management
- Landscape and townscape
- Heritage.

Within each of the identified areas for action is an objective along with actions to achieve this objective and a relevant case study showing achievements and progress to date. For instance within waste management the objective is to 'develop techniques which will ensure that trunk roads are managed in the most sustainable manner, by conserving existing resource and by generating less waste and by removing to barriers which exist surrounding the use of secondary and waste materials'. Conserving existing resources and reducing quantities of waste, amending technical specifications to allow the use of lower spec materials are two of the actions given within the plan to achieve objective.

Highways Agency Biodiversity Action Plan

This document is the HA's own Biodiversity Action Plan, the HABAP, and forms part of a long-term strategy to conserve habitats and species on the motorway and trunk road verges of the road Network for which the HA is responsible. This so called 'soft estate' is approximately 30,000 hectares of land and from a 1999/2000 study this land supports about 40% of priority habitats and 53% of priority species identified in the UK BAP.

The overall aim of the HABAP is to assist the HA to meet its objectives in relation to conserving and where possible enhancing biodiversity. The plan details that this will be achieved by fulfilling the following objectives;

- Providing habitat and species action plans which are relevant and appropriate to HA business. This is to include some of those requested by consultees.
- The setting of practical and realistic action so that the HA's contribution to biodiversity is maximised.
- Raising awareness internally and with contractors, environmental partners and the general public as to the importance of the HA's biodiversity work.

The HABAP covers the period 2002-2012, defines actions and sets targets for the management of soft estate for diversity and recognises the partnership (internal and

external) approach to the BAP process is desirable due the multidisciplinary nature of biodiversity.

The plan details some of the initiatives adopted by the HA at the inception of this document. Much of the work carried out by the HA is site-based conservation work which aims develop diverse habitats or the continuation of a specific species.

Implementation of the HABAP will be through three routes;

- Local verge management practices (TRMM (Trunk Road Maintenance Manual – now replaced by the NMM), Route Management Strategies and Environmental Management Plans);
- Any environmental works associated with road construction, maintenance and improvement schemes; and
- Specific biodiversity conservation projects at selected locations.

5-yearly reviews of the HABAP will be published to show monitored progress towards the Government's aims and objectives for biodiversity.

Volume 7 DMRB (Design Manual for Roads and Bridges) Sections 1 & 2

The intention of Volume 7 of the DMRB is to provide an instruction manual with regard to pavement assessment and maintenance. Volume 7 should be read in conjunction with the Overseeing Organisation's maintenance instructions. Volume 7 can be used on all schemes including construction, improvement and maintenance. A further provision to Volume 7 is to highlight existing provisions made by the specification (MCHW1) for the use of reclaimed materials and applicable techniques for using such materials.

Volume 7, part 2 provides advice concerning the conservation and the use of secondary and recycled materials. It gives specific guidance to design organisations on conservation techniques and secondary and recycled materials which are currently permitted for use in the Specification (MCHW – The Manual of Contract Documents for Highway Works) and also earthworks, drainage and pavement construction parts of DMRB (DMRB 4.1, .2 and 7).

Volume 7 recognises that secondary and recycled materials from roads during reconstruction, industrial process residues and suitable construction and demolition materials provide good value for money alternatives to virgin materials not withstanding the environmental benefits. This document highlights some barriers to using reclaimed materials such as the possibilities for leachability and variability of such materials and hence the need for more comprehensive testing regimes to ensure the materials are fit for purpose. As such it is often more cost effective to use reclaimed and recycled materials lower down in the pavement structure or foundations.

Volume 10 & 11 DMRB (Design Manual for Roads & Bridges)

The HA gives advice on Environmental Design and Management and Environmental Assessment in Volumes 10 and 11 of the DMRB. The methodology is intended to provide a consistent system for defining and achieving the environmental objectives, which may be policy, or route-specific objectives. The level of detail and the coverage of the assessment should be appropriate to the type of decision that can reasonably be taken at each stage.

The close link between environmental issues and sustainability is recognised and the HA identify core functions of visual screening, landscape integration, enhancing the built environment, nature conservation and biodiversity, visual amenity, heritage, auditory amenity and water quality. Within this framework, particular examples are the focus on sustainable construction using noise reducing barriers and earthworks where possible. Also the importance of water pollution control measures in protecting receiving watercourses and groundwaters is emphasised and this is of particular importance in view of the increasing frequency of heavy rainfall incidents due to the effect of climate change and recent flooding incidents. Watercourse quality is recorded by its River Ecosystem classification so that the impact of highway construction and subsequent pollution from runoff can be minimised.

The HA's Environmental Database system comprising an electronically linked map-based inventory and a text-based database is populated and used by Designers and Managing Agents. In scheme development the identification of opportunities for environmental improvements vary enormously, from minor planting schemes, biodiversity enhancement measures, noise mitigation, water quality protection measures, to major townscape improvements in urban areas.

Sections 1, 2 and 3 of Volume 10 of the DMRB give requirements for new roads, improving existing roads, and landscape management respectively. This series of documents is often known as the Good Roads Guide. The objective of route selection is generally to minimise the effect on landform by requiring the fewest significant earthworks. Within the concept of sustainable construction this achieves the best possible use of excavated materials within the scheme or the re-use of nearby waste materials. Avoiding sites of heritage, nature conservation, or archaeological interest are clearly stated objectives. Examples of good practice are promoted by the HA in the Good Roads Guide.

The Guide recommends that retaining walls and overbridges which may be necessary on constrained sites are constructed from local materials and integrated with planting regimes where possible. Unnecessary and dominant fencing should be avoided where possible. Detailed advice on a range of environmental issues related to protection of flora and fauna are given in Volume 10 of the DMRB.

Of particular relevance to sustainable construction is the function of environmental barriers in combining the function of a visual screen and a noise barrier to protect residential, recreational and other vulnerable areas alongside a road. Advice is given on how the impact of the barrier itself on its surroundings can be minimised by the appropriate choice of the form and materials used, at the same time taking advantage of developments in noise attenuation techniques. Barrier fences or walls can be made from any construction material but must be sufficiently durable to have

a low maintenance requirement. Vegetation can be used to advantage in urban areas to enhance earth retaining forms of barrier; “green” barriers often soften the appearance. In rural settings the soft “natural” outline of an earth mound in conjunction with planting is likely to be more visually attractive. HA65 (DMRB 10.4.2) considers the sustainability and design life of the various types of and materials used in environmental barrier. Barriers should be designed so that they require minimal maintenance other than cleaning or repair of damage for at least 20 years. Maintenance cost indicators have been developed for the different forms of construction.

A new appraisal system has been set in place in HA99 (DMRB 10.7.1) with one of its prime objectives to protect and enhance the built environment. This clarifies the various organisations in the UK with responsibility for the environment, countryside, heritage and agriculture to ensure that highway construction is designed and carried out in a sustainable manner.

Volume 11 of the DMRB provides advice on the environmental assessment of trunk road schemes setting out the general principles and guidance on the assessment techniques. Assessment techniques discussed include those for air quality, cultural heritage, disruption due to construction, ecology and nature conservancy, landscape effects, land use, traffic noise and vibration, road drainage and the water environment, etc. All of these issues have relevance to sustainable construction, maintenance and operations. Volume 11 also includes advice on how to report on the Environmental Assessment.

The Specification for Highway Works (MCHW1)

The Specification for Highway Works is published as Volume 1 of the Manual of Contract Documents for Highway Works (MCHW). The Specification for Highway Works (MCHW1) permits the use of a wide range of reclaimed materials, many of which would otherwise be deemed waste, including road planings, crushed concrete and mineral by-products such as blast furnace slags, incinerator bottom ash (IBA) to be used as an alternative to virgin primary aggregates.

Below is a table taken from DBRM Volume 7 showing which recycled and secondary materials can be used in one form or another in which application and series. Further details of the applications and series are contained within individual sections of MCHW1.

Application & Series > Material	Pipe Bedding	Embankment & Fill	Capping	Unbound Mixtures for Sub-base	Hydraulically Bound Mixtures for Sub-base and Base	Bitumen Bound Layers	PQ Concrete
	500	600	600	800	800	900	100
Blast Furnace slag	i1	i1	i1	i1	i1	i1	i1
Burnt Colliery Spoil	x	i1	i1	i1	i1	X	x
China Clay Sand/Stent	i1	i1	i1	i1	i1	i1	i1
Coal Fly	i1	i1	i1	x	i1	i1	i1

Ash/Pulverised Fuel Ash (CFA/PFA)							
Foundry Sand	ij						
Furnace Bottom Ash (FBA)	ij	ij	ij	x	ij	X	x
Incinerator Bottom As Aggregate (IBAA)	ij						
Phosphoric Slag	ij						
Recycled Aggregate	ij						
Recycled Asphalt	ij						
Recycled Concrete	ij						
Recycled Glass	ij	ij	ij	ij	ij	ij	x
Slate Aggregate	ij						
Spent Oil Shale/Blaise	ij	ij	ij	ij	ij	X	X
Steel Slag	ij	ij	ij	ij	ij	ij	X
Unburnt Colliery Spoil	x	ij	x	x	ij	X	x

ij- Shows that the material is permitted as a constituent if the material complies with the Specification (MCHW1)

X – Shows that the particular reclaimed material is not permitted for that application.

For instance, Series 600 Earthworks Specification as detailed in MCHW1 permits the use of a very wide range of bulk fill materials within the definition of 'general granular fill' and 'general cohesive fill'. The Specification requires that leachability is addressed and provides a list of unacceptable materials, such as those which have hazardous properties.

Highways Agency Greening operations report 1999

This document contains the "Highways Agency's Policy Statement for Greening Operations (Working Environment) and Action Plan", which sets out how the HA can contribute to greening its activities which are not network based such as facilities management, office services, printing, publishing and procurement. This document is one of a series of documents which the HA intends to issue which details the HA's role in contributing to the Government policy on "greening" its activities. Individual aims and objectives have been identified within the document which also contains more specific and detailed information in relation to procurement and estates management.

Also contained in this document is the action which is divided into two sections, 'Conserving Resources' and 'Reducing pollution'. Within these two sections the following subject areas are addressed;

Conserving resources

- Energy
- Water
- Wood
- Paper
- Horticulture

Reducing pollution

- Climate change
- Ozone depleting substances
- Vehicle emission
- Pesticides and artificial fertilisers
- Asbestos
- Hazardous substances
- Batteries
- Solvents and paints
- Biodegradables, litter and noise

Procurement

Waste

Estate management

Monitoring and auditing

Contracts

The action plans contain specified targets for each of the above subject areas which are often all considered within the context of sustainability, one such example is shown below, however many of the targets throughout the plan are a little outdated and potentially ambiguous with no fixed date given for demonstrating improvement or achieving the requirements of the plan.

Waste (taken from the Greening Operation report for illustrative purposes)

		Target Date
1	To contribute to meeting the cross - Government target of recovering a minimum of 40% of total office waste, with at least 25% of that recovery coming from recycling or composting in 2000-01; and to increase the amount recovered and recycled by 10% each year to achieve 70% recovery or recycling in 2003-04.	On-going The number of new recycling schemes operating in year.
2	Survey premises to check they are operating schemes for recycling paper, cans, bottles, printer cartridges, used vegetable oil and vending cups etc where it is practicable to do so. Seek opportunities to maximise recycling opportunities.	On-going Ensure that disposal arrangements conform to the UK waste hierarchy of reduce, reuse, recycle and dispose.
3	C4S at TRL Limited and Halcrow Participate in call-off contracts for recycling spent fluorescent tubes on the Government estate - if feasible. If not, ensure that sites/ buildings have an appropriate waste management strategy for their safe disposal.	133 On-going UPR The number of buildings recycling fluorescent tubes where the Agency is the major occupier.

IANs (interim Advice Notes)

The HA periodically issue IANs which provide specific guidance in relation to a whole range of subjects. IANs are read in conjunction with relevant sections of the DMRB and MCHW and incorporate amendments or give additions to these manuals without forming part of the actual manual itself. The table below details IANs which have relevance to sustainable construction, maintenance and operations. However, the IANs which have not been issued, superseded, or replaced are not included although they have been reviewed.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
106/08. Guidance Note for Traffic Consultants Employed on Highways Agency Schemes. (DMRB 12)	Traffic modelling and economic appraisal are used to inform the environmental assessment, particularly in terms of air, noise and water quality. Guidance is provided on the various issues to ensure efficient design within the Programme of Major Schemes.
105/08. Implementation of Construction (Design and Management) 2007 and the withdrawal of SD 10 and SD 11. (SD 10 and SD 11)	Guidance is provided on ensuring that thorough records are kept of construction works including earthworks, drainage, pavement, highway structures, fencing, road restraint systems, road markings and traffic signs, traffic signals, lighting, statutory undertaker equipment, control and communications equipment, and legislative requirements. In this way efficient maintenance procedures can be employed to ensure sustainable construction.
104/07. The Anchorage of Reinforcement & Fixings in Hardened Concrete	Anchorages in drilled holes using resin or cement based grout can offer a cost effective method of fixing to existing structures. This technique can have a benefit to road users in reducing disruption to the highway.
103/xx. Ramp metering	Pending.
102/07. The introduction of BS EN standards for bituminous mixtures – Site supervision aspects. (MCHW 900, read in conjunction with IAN 101)	Guidance is provided on the new BS EN Standards for bituminous mixtures and their associated test methods. Conformity in the transport, laying and compaction of bituminous mixtures will ensure high quality products are used to produce durable pavements.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
101/07. Revised MCHW Specification 900 Series – Amendment No. 1. (MCHW 900, read in conjunction with IAN 102))	This revised specification of the 900 series for bituminous bound materials includes the new names and designations of mixes. The revision also includes a revised clause for sealing at cold joints and a new clause for asphalt concrete. This IAN impacts on the sustainability of road pavements.
100/07. Cultural Heritage Asset Management Plans. (DMRB 10, read in conjunction with IAN 84/07)	The advice is intended to help to identify the scope of cultural heritage asset management plans (CHAMPS), and to assess priorities, advise on the preparation of management proposals and monitor the effectiveness of the process, in order to fulfil HA's obligations towards the historic environment. The objective of CHAMPS is to ensure that valuable historic assets within and adjacent to the highway are protected from roads maintenance and management activities.
99/07. Implementation of Local Grid Referencing System for England. (SD 12/96)	The interoperability and compatibility of survey data obtained from many different contractors and other users is ensured by implementing a new local grid referencing system. This IAN has no direct impact on sustainability issues.
98/07. HD 28 - Guidance for HA Service Providers on Implementing the Skid Resistance Policy. (HD 28)	Maintenance treatments carried out to improve the skid resistance also have implications for traffic disruption, monetary cost and environmental impact. The skid resistance Standard provides a way of assessing the requirement and priority for remedial works.
97/07. Assessment and upgrading of existing parapets. (Supersedes TD 19/06 (in part), BA 37/92, IAN 72/06)	A consistent risk based approach, using incursion and ALARP based risk ranking tools, and the TD 19/06 Road Restraint Risk Assessment Process, to enable realistic risk levels to be ascertained together with associated upgrading advice. This IAN has no direct impact on sustainability issues other than assessing upgrading and maintenance needs.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
96/07r1. Guidance On Implementing Results Of Research On Bridge Deck Waterproofing. (Read in conjunction with BD 47/99)	The waterproofing and surfacing of concrete bridge decks is important in producing durable structures. Although a total thickness of surfacing of at least 120mm is advisable, guidance is provided on the risk of failure where this thickness cannot be achieved for practical or other reasons. Advice on the application of bridge deck waterproofing systems to concrete aged less than 28 days is also provided.
95/07. Revised guidance regarding the use of BS8500(2006) for the design and construction of structures using concrete. (Supersedes IAN 74/06)	Improved sustainability of structures is anticipated from the use of the recently published BS8500 so that fewer maintenance operations are required. For example revised guidance is given on resisting chloride induced corrosion, the chloride class for post-tensioned structures, and concrete in aggressive ground. Guidance on concrete quality for 100 year working life structures.
93/07. Driver location signs – Interim Performance Specification.	This IAN has no direct impact on sustainability issues.
91/07, Interim Advice on the identification of 'Particularly at Risk' Supports	The strengthening or protection of bridge supports is important both in terms of making the roads safer, but also in terms of reducing structural damage and hence decreasing the frequency and duration of maintenance interventions to repair damage from vehicle impact. Guidance is provided to ensure consistency in the identification of such "particularly at risk" supports and to give guidance on the action required.
90/07 Amendment No.1. Guidance For The Use Of Rapid Setting Emergency Repair Materials. (MCHW 900, replaces IAN 90/07)	Guidance is provided on emergency patching materials and approaches to be used for emergency repairs of bituminous surfacing after fire damage and spillages. The options for treatment are aimed at minimising loss of service to the road user in terms of carriageway availability and journey time reliability.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
87/07. The Provision Of Signal Gantries For Motorways With Four Or More Running Lanes.	This provides guidance on the provision of gantries for implementing Variable Mandatory Speed Limit (VMSL) operation for motorways according to the number of running lanes and for Active Traffic Management motorways. More efficient use of the existing highway corridor will improve journey time reliability for the road user.
86/07. Amendments To Design Requirements For Portal And Cantilever Sign/Signal Gantries. (BD 51)	Advances in the reliability and ease of replacement of signal equipment calls into question the need for access walkways for new gantries and recognises that, because of developments in technology, gantries are likely to become functionally obsolete before a 60 year design life is reached.
85/07. Design Of Passively Safe Portal Signal Gantries.	Passively safe structures are those that are designed to yield or detach under vehicle impact in order to limit injury to the vehicle occupants. They can be cheaper in whole-life cost terms and are viable in certain conditions. The IAN is related to the need to increase driver information to improve journey time reliability.
84/07. Environmental Information System (EnvIS). (Vol. 10)	The key objective in the HA Environment Strategic Plan is to “minimise the impact of the trunk road network on both the natural and built environment”. For this purpose the HA has developed the Environmental Information System (EnvIS). EnvIS replaces the Environmental Database (EDB). EnvIS data is collected by both the HA and Service Providers in a standard format. EnvIS will be used by all parties to progress the HA’s overall business and environmental management processes and provides an integrated framework for the management of environmental impacts, compliance with environmental legislation, and continual improvement of the HA’s environmental performance.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
83/06. Principal and General Inspection of Sign/Signal Gantries, and Gantries with low handrails or open mesh flooring. (Read in conjunction with BD 63 & BA 63)	This provides further advice for gantries regarding the inspection requirements given in BD63/94 and BA63/94. This IAN has no direct impact on sustainability issues other than the improved identification of maintenance actions.
82/06. Reporting. (HA 206, read in conjunction with IANs 76 – 82)	The IAN gives comprehensive guidance on the reporting of the environmental assessment process which can generate many working documents covering different issues. The aim is to provide decision-makers and the public with an accessible document which reflects the assessment activities, provides clear information on the proposed environmental measures and gives due weight to significant impacts.
81/06. Management of Environmental Effects. (HA 205, read in conjunction with IANs 76 – 82)	Guidance is presented on the identification and assessment of environmental effects, significance criteria, and environmental management.
80/06. Scoping. (HA 204, read in conjunction with IANs 76 – 82)	This gives information on how to scope the environmental assessment for a project.
79/06. Screening. (HA 203, read in conjunction with IANs 76 – 82)	Screening should be used to decide whether a project would have an Environmental Impact Assessment (EIA) requirement. Screening establishes if the project represents a “relevant project”, the determination for the purposes of the EIA regulations, and whether EIA is to be completed or not.
78/06. Environmental Assessments. (HA 202, read in conjunction with IANs 76 – 82)	This IAN gives guidance on the Strategic Environmental Assessment (SEA), SEA implications for project environmental assessment, impact assessment regulations, appropriate assessment, relationship to transport appraisal, and the required expertise.
77/06. Introduction. (HA 201, read in conjunction with IANs 76 – 82)	This provides the overarching assessment principles and methods to be applied when conducting an environmental assessment across the range of the HA's projects.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
76/06. Aims & Objectives of Environmental Assessment. (HA 200, read in conjunction with IANs 76 – 82)	This IAN provides the aims and objectives of environmental assessment, the appropriate level of assessment according to the trunk road type, integrating with project approvals and delivery.
75/06. Code of Practice for Emergency Access to and Egress from the Trunk Road Network in England. (Read in conjunction with IAN 68)	This Code of Practice has been developed as part of the overall strategy for traffic incident management. The objective is to develop route specific, emergency access and egress procedures. This has no relevance to sustainability issues other than safety and journey time implications.
73/06. Design of Pavement Foundations. (Draft HD 25/xx)	Road pavement upper layers are now subject to new design methods and criteria that have been published in HD26/06. The new classification into four classes is described and methods to be used in their design and the testing regime specified. The IAN is relevant to improved sustainability and durability of the pavement structure.
71/06. Marker Posts On Lay-By Segregation Islands. (TA 69/96)	This ensures that segregation islands are sufficiently conspicuous. There are no sustainability issues in this IAN.
70/06. Implementation Of New Reinforcement Standards (BS 4449:2005, BS 4482:2005, BS 4483:2005 and BS 8666:2005). (BS 5400 Pt 4 SHW 1700 NG 1700)	This IAN provides guidance on the implementation of revised British Standards for steel reinforcement in concrete. The continuing refinement of Standards should produce more durable reinforced concrete.
69/05. Designing for Maintenance.	A key objective is to reduce the casualties and risks faced by those that work on our roads. The CDM Regulations require the identification of hazards and, where reasonably practicable, their elimination. Maintenance work, especially alongside traffic, presents significant hazards to operatives and road users. Appropriate design of maintenance and operations is discussed.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
68/05. Infrastructure changes to improve emergency access to and egress from the trunk road network in England. (Read in conjunction with IAN 75)	The HA is concerned about the plight of road users whose vehicles become trapped on the network when one, or both, carriageways become totally blocked. This may be as a result of a major incident or adverse weather conditions. This has no relevance to sustainability issues other than safety and journey time implications.
66/05. Advice Regarding The Assessment Of Sites For Ramp Metering.	Advice is provided upon the circumstances where ramp metering may be of benefit in improving the flow of traffic on the main line carriageway of a motorway, in the vicinity of an entry merge from a slip road or interchange link at grade separated junctions. There are no sustainability issues and the main benefit is journey time reliability.
64/05. Driver Information At Road Works.	The prime objective is to provide road users with information that is relevant to their journeys – to have “informed travellers”. Policy relating to driver information signs at roadworks that require closure of a lane or hard shoulder is discussed.
63/05r1. Asbestos Management Applicable To The Strategic Road Network. (Supersedes IAN 63/05)	Asbestos containing materials are known to exist in roads and drainage, highway structures and associated buildings and other assets outside the highway boundary. This IAN sets out the legal duty to manage this risk and the various roles and responsibilities. Road tunnels are considered to pose the highest risk for highway works and are addressed accordingly in the management system.
56/04. Maintenance Of Traffic Signs With Dew Resistant Coatings. (TD 25 / 01 DMRB 8.2.2)	This warns against the use of inappropriate cleaning methods by using abrasive materials and advises of the need to follow manufacturer's recommendations.
53/04. Concrete Half-Joint Deck Structures.	Advice is presented on the performance and management of bridges with half-joints. A risk based strategy ensures that all structures of this type, which are particularly vulnerable to deterioration and difficult to inspect, are recorded, specially inspected, and remedial works planned, and to allow future maintenance funding requirements to be identified.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
51/03. Hinge Deck Structures. (DMRB 3.1, supersedes IAN 40)	Hinged joints suffer from the disadvantages that they are not easily accessible for inspection and maintenance. They are vulnerable to deterioration in the event of bridge deck waterproofing failure, where chloride rich seepage through the joint can cause corrosion. This IAN sets out an Interim Management Strategy for all structures of this type. Inspection, monitoring, appraisal, risk management and maintenance are considered.
49/03. Use of Warning Signs For New Asphalt Road Surfaces. (DMRB 7.5).	Newly laid asphalt surfacings can exhibit lower skid resistance than the same surfacings after a period of trafficking. The IAN gives advice on where and when warning signs should be used. The aim is to ensure that road users have a safe and reliable journey.
48/03. Measures To Minimise The Risk of Sulfate Attack (Including Thaumasite) – New Construction and Structures Under Construction. (DMRB 2.1, supersedes IAN 25)	Sulphate attack can occur in buried concrete structures, sub-surface structural elements and foundations. This has a deleterious effect on sustainability of substructures and requires intervention for maintenance. The IAN implements revised precautionary measures for new construction and advises on additional protective measures.
47/02. Post Tensioned Grouted Duct Concrete Bridges. (DMRB 2.2, supersedes IAN 16)	This IAN provides information for the design, construction and repair of post-tensioned concrete structures. Design advice includes guidance on quality assurance, technical approval, specification and grouting trials.
42/05. Traffic-Speed Condition Surveys (TRACS): Revised Assessment Criteria. (DMRB 7.3.4, supersedes IAN 42/02)	Assessment of road condition is carried out using TRACS and advice is provided on assessment criteria. Condition criteria for texture depth, rut depth, ride quality, cracking, fretting, and noise are presented. TRACS are important in establishing a quality audit procedure so that maintenance requirements can be established.
41/02. European Cement Standards. (DMRB 1.3)	Information is provided detailing the changes in current cement standard requirements following the publication of a new harmonised European Standard BS EN 197-1:2000.

IAN Number, Title and Manual Reference	Relevance to Sustainable Construction, Maintenance and Operations
39/01. Post Opening Project Appraisal (POPE). (DMRB 12.1.1)	This Procedure Note deals with the monitoring of the predicted and actual effects of new road schemes. It covers two aspects of before and after monitoring, i.e. POPE and Traffic Impact Studies (TIS).
36/01. The Use and Application of Micro-Simulation Traffic Models. (DMRB 12)	Advice is provided on choosing a traffic micro-simulation approach and developing the model. There are no relevant sustainability issues included.
05/96. BD 24/92 The Design of Concrete Highway Bridges and Structures. Use of BS 5400: Part 4:1990. (DMRB 1.3.1)	This implements BS5400 Part 4 for concrete bridge design purposes.
04/96. BD 44/95 The Assessment of Concrete Highway Bridges and Structures. (DMRB 3.4.14)	Since the issue of BD 44/95, a few technical amendments were necessary to rectify typographical errors and omissions.
03/96. BA 50/93 Post Tensioned Concrete Bridges. (DMRB 3.1.3)	This document emphasises some aspects of BA 50/93 and modifies the guidance in the light of inspections. A primary aim of the inspection programme is to identify areas where deterioration may occur and establish the basis for future management decisions.
01/95. TD 37/93 Scheme Assessment Reporting. (DMRB 5.1.2)	The requirements for assessment reporting are to permit consideration of the likely environmental, economic and traffic effects of alternative proposals and to allow public and statutory bodies to comment on their implications.

The Highways Agency Disability Equality and Duty Action Plan 2006-2009
This plan has been developed by means of an internal HA Diversity Group and shows the HA's commitment to its customers in terms of putting them first and also ensuring that its own workforce is representative of its customer base. This plan has also been generated in response to the Disability Discrimination Act 2005 which requires public bodies to produce Disability Equality Schemes (DES).

The plan itself contains a table which is populated with required actions and the target date by which these actions shall be completed, reviewed or progressed. Within this table the HA have prioritised each action in terms of the level of impact (high, medium or low) which that area of work has on either the HA's disabled

customers or staff in term of accessing the HA's services. Each of these areas requiring action have been giving as a responsibility to various sections of the HA.

The Role of the Highways Agency in Local Air Quality Management 2003

Air quality knows no boundaries and therefore requires a holistic and partnership approach from all those with a statutory or voluntary interest. Nevertheless, the HA recognise they have a part to play in the overall improvement of air quality and as such have produced this document. The network only represents a small part (8255 km) of the overall road estate however, the network is heavily used and has a high proportion of HGV use. The HA as a consultee through the Environment Act 1995 is therefore committed to working in partnership with Local Authorities in delivering the Air Quality Strategy (AQS).

This document has three main purposes;

- It introduces the HA and sets out the processes and contracts through which it can be engaged in LAQM.
- It describes how the HA can work in partnership with Local Authorities with an aim of delivering the AQS.
- It introduces how emissions or concentrations can be affected by proposals.

Routine and Winter Service Code ("the code")

The requirements and relevant advice in relation to the management of maintenance of the motorway and trunk road network is contained within this document and also the Network Management Manual (NMM). This code covers the performance requirement for highways and structures and also includes winter service operations for both cyclic and unplanned activities. Such activities include reactive repairs and winter, flood and emergency responses but exclude preventative and programmed works. The code rather than providing prescriptive methods for activities on the network, defines the level of performance required from a Service Provider whilst maintaining a minimum standard for the identification and verification of repair defects. Defects within the code are defined as being either Category 1 or Category 2, the code gives timescales with dealing which such defects depending on the categorisation.

Routine and winter service activities required for the operation of the network are considered in 17 technical Areas which are divided into 4 technical groups, infrastructure, incident management, environment and winter service.

Many aspects of sustainable construction and overall sustainability are dealt with in a cursory manner within this document such as drainage within the context of biodiversity and flooding (important links with climate change and SUDS), the use of environmental barriers (for noise reduction and visual effect), the maintenance of soft estate for aesthetic and biodiversity purposes, and street cleaning (sweeping, litter, refuse etc) within the context of the Environment Protection Act (EPA) and pollution prevention. The document is however focused on providing timescales and performance requirements for relevant activities as opposed to bringing sustainability into routine and winter activities.

Highways Agency Network Management Manual (NMM)

The NMM replaces volumes 1 and 2 of the Trunk Road Maintenance Manual (TRMM). The NMM brings together extant policy from the two volumes of the TRMM, current Area Management Memos, Network Security Notes and provides advice, some mandatory instruction and also good practice guidance for management and provision of routine and winter service on the motorway and trunk road network. The NMM is commended to users for consideration, however mandatory requirements arising from legislative or contractual obligations are contained within boxes in the document. As with the Routine and Winter Service Code many potential sustainability issues are given a cursory mention within the context of highway activities, however, some very specific issues are addressed. For instance Section 5.5.1 relates to Winter Service and alternatives to anti-icing and de-icing materials. The direct potential environmental effects of highways salting operations are discussed and substances which are more 'environmentally friendly' are identified as alternatives to traditional rock salt.

Table 5.5.1 Alternative Anti-icing/De-icing Materials taken from the NMM

Anti-icing/De-icing Material	Approx. cost (see note 1)	Treatment Spread rate	Action/Effectiveness	Environmental Effects	Health & Safety
Potassium Acetate (Solution)	X12	10-40g/m ²	Immediate action Effective for up to 48 hours to -15°C in suitable weather conditions	Effectively non-corrosive compared to salt Safe to aquatic life	Gloves and eye Protection Solutions are safe To handle
Urea	X100	20-50g/m ²	Requires agitation By traffic Effectiveness: 10% solution to -3°C 25% solution to approx -7°C Little worthwhile effect below -7°C and ineffective below -11.5°C Remains effective for up to 12 hours in fair weather but repeat applications need to be more frequent in rain or strong winds	Non-aggressive, but very soluble in water, and may produce ammonia and carbon dioxide. Ammonia is toxic to aquatic life. Ammonia further decomposes to nitrate which, promotes growth of vegetation, and creates an oxygen demand that may cause further harm to life. Urea solutions may be detrimental to steel, plastics and concrete in some circumstances. Vehicles should not be left full of urea for any length of time, and thoroughly washed down after use.	Ventilation, due to ammonia required Safe to handle but the pellets break into powder easily which becomes very slippery due to its high hygroscopic nature. Face masks and eye protection are recommended When heated to melting (i.e. fires) Urea decomposes to form toxic substances. Only trained fire fighters, properly equipped with breathing apparatus should attempt to deal with fires in Urea stores. Local Fire Fighting Services should be informed of Urea stock sites.

4.3.2 HA Service providers initiatives (policies and strategies)

The State of Art Review undertaken by C4S and Halcrow indicated that a number of service providers are already advance in introducing sustainability agenda in their practice. For this study a number of service providers and their policies and operations were reviewed:

Tarmac (<http://www.tarmac.co.uk>)

Tarmac give their environmental policy as;

“We take pride in being responsible for the environment. By working hard to minimise any negative impact we may have, we're able to prevent pollution, improve our environmental performance and aim for a sustainable future”.

As holders of ISO14001, Tarmac employees are encouraged to be environmentally aware through regular training programmes while looking for new and innovative ways in which to protect the environment further. Tarmac state that they are committed to encouraging the adoption of sound environmental principles amongst its contractors, suppliers and customers.

Tarmac's latest achievements in relation to the sustainability and the environment are contained within 'Constructive Thinking, Report to Society 2006'. This report not only details Tarmac's performance in four key areas; safety, health, environment and the community, it also sets the scene for further works. The details how in 2006 Tarmac set itself challenging environmental targets and through increased efficiency has made importance reductions in specific energy consumption in the production of crushed rock, asphalt, concrete, concrete products, cement and lime in comparison with their 2004 baseline. These reductions in turn have delivered a significant reduction in Tarmac CO₂ intensity.

Tarmac performance targets include the following;

- Climate Change – To reduce specific energy consumption by 15% (based on 2004 usage) by 2014.
- Waste Management – To reduce waste sent for licensed disposal by 5% by 2010 based on 2004 totals.
- To introduce site-specific BAPs at all active mineral extraction site by 2008.
- To reduce portable water consumption(per unit of production) by 4.3% for concrete and mortar and concrete products by 2010 (based on 2002 usage).
- Tarmac also has clearly defined policies in relation to investing in its work force and diversity in the workplace.

A-one Integrated Highway Services (www.aone.uk.com)

A-one Integrated Highway Services is a joint venture partnership formed by [Halcrow Group Limited](#) and [Colas Limited](#) appointed by the Highways Agency as Managing Agent Contractor (MAC) for the Area 14 network. A-one+ Integrated Highway Services is a joint venture partnership formed by [Halcrow Group Limited](#), [Colas Limited](#) and [Costain Group Plc](#), appointed by the Highways Agency as Managing Agent Contractor (MAC) for the Area 10 network.

The overall vision of A-one is:

"To deliver Areas 10 and 14 as 'Beacon of Excellence', achieving a long term sustainable business"

Area 14 has a series of annual and monthly APIs (Area Performance Indicators) which are broken down into the following 15 performance areas. Each performance area is further divided and has within it between 1 and 4 performance specific targets. The January 2007 to December 2007 targets have been reviewed as this is the latest available information.

Response to emergency incidents	Response to Category 1 Defects
Customer Satisfaction	Environmental Amenity Index
Site Workplace Safety	Predictability of Discrete Schemes – times
Predictability of Discrete Schemes - Cost	Accruals Expenditure Forecasting
Winter Maintenance	Defect Free Work
Road Traffic Accidents	Street Lighting Outages
Network Availability	Third Party Claims
Recycling & Re-use	

Below is an example of one such API;

RR01(M) : To promote the recycling and re-use of materials used in or arising from all network activities. Total of scores recorded across the 19 identified materials categories. (Tyres, glass, paper, office consumables/equipments, planings, unbound, materials/aggregates, wood, ferrous metals, safety fencing, non-ferrous metals, batteries, oil, plastics, water, green waste, lantern unit and gully arisings).

The proposed monthly and annual target for RR01 is 50%. The actual percentage achieved during 2007 levelled out at 76% therefore exceeding the 50% API which is thought to have been bought about by improved segregation of both concrete and ferrous metals.

Carillion (<http://www.carillionplc.com/sustainability/sustainability.asp>)
Carillion consider themselves a market leader in Corporate Social Responsibility, and that sustainability is built into their business goals and policies across the group from Health and Safety to environment protection.

The Carillion sustainability report 2006 described the progress made by the company on a range of sustainability issues over the past year and plans and targets for 2007. Implementation of sustainability issues is via means of a dedicated sustainability committee. Two of Carillion's sustainability initiatives are given in the box below.

Carillion's Initiatives

Communities & CSR

Carillion continue to be members of the BITC PerCent club, contributing over 1% of our profit in cash or in kind to supporting charity and community activities. We are now working with BITC and Business Action on Homelessness a scheme that aims to break the vicious cycle of 'no job, no home', through helping homeless people to find employment and achieve independent living. We have successfully placed our first employee through the scheme with schedules in place to work with more individuals in 2007.

Biodiversity

Carillion Natural Habitats is in its sixth year. Carillion has now contributed over £150,000 to the Wildlife Trusts. An additional £2,330 was donated to the Wildlife Trusts charity from the share save scheme surplus in 2006 on top of the annual £25,000 donated as part of the Carillion Natural Habitats fund. The fund has now supported 23 projects across the country all of which have personal support from Carillion representatives.

Carillion's sustainability strategy is divided into four priority areas;

- Sustainable communities;
- Natural resource protection and environmental enhancement;
- Climate change and energy; and
- Sustainable consumption and production.

Within these four core priority areas are a total of 12 impact areas for which individual policies have been developed with measurement methodologies/criterion and targets for 2010.

Carillion's considers that its KPIs are at the core of its sustainability policy and strategy. In 2000 Carillion launched their 'Sun Diagram' which was developed to align their sustainability strategy with the 1999 UK government strategy for sustainable development. The diagram visually represents how the four core priority areas and 12 impact areas are integrated into Carillion's operations. The Sun Diagram "has become a benchmark in our industry and beyond, as it demonstrates how sustainability can be embedded into strategy, business processes, decision-making and key performance indicators.

The Sun Diagram is fundamental to our sustainability strategy to explain:

- Our integrated and holistic approach to corporate social responsibility
- The latest thinking on sustainable development by government and other authorities
- How sustainability benefits our business
- How sustainability benefits our customers, employees and the community"

The Sun Diagram can be seen at:

http://www.carillionplc.com/sustainability_reports/2006/assets/documents/multimedia/sun_diagram.jpg

Atkins (<http://www.atkinsglobal.com/aboutus/environment/>)

Atkins do not appear to have 'KPIs' as part of a CSR (Corporate Social Responsibility) strategy, however, in their 2006 CSR report they list 'key CR objectives for the coming year'. These objectives are divided into five groups (p.28);

- Safety and health;
- Environment;
- Community;
- People; and
- Quality.

http://www.investis.com/reports/atkins_csr_2006_en/report.php?type=1&zoom=1&page=30

There are a total of 26 objectives within the five groups. Atkins uses their annual objectives in these five core groups to report on in their annual CSR report.

Costain Group PLC (<http://www.costain.com/>)

Costain's business plan and objectives for 2006, future plans and progress to date are set out in document 'Being Number One'. Also set out in this document are the companies 7 overall key objectives.

Costain addresses aspects of its sustainability within their Corporate Responsibility Policy Statement. High level aims are defined within 6 key areas:

- Our People
- Social and community engagement
- Health & Safety
- Climate Change
- Biodiversity
- Supply Chain Management.

The Costain Group Environmental Policy Statement details the company responsibility towards the environment and details such polices as;

- Contain will identify and evaluate the environmental aspects of all projects which the company undertakes which may include aspects such as:
 - Waste management and minimisation
 - Air quality
 - Noise
 - Ground condition/land
 - Water resources
 - Wildlife habitat
 - Archaeology and heritage.

The Environment Statement also states that Costain will source environmentally sustainable materials, reduce their waste and consumption of energy and raw materials and maximise opportunities to re-use and recycle where possible.

Alfred McAlpine

McAlpine have an environmental policy statement which was developed in 2006 which includes environmental objectives for the whole group relating to the following:

- Environmental incident reporting
- Waste management and waste management plans
- CO₂ emissions.

The policy also details key environmental activities and key responsibilities for environmental management.

<http://www.alfredmcalpineplc.com/cr06/downloads/Environmental%20Policy%202006.pdf>

Data relating to the group environmental objectives can be located within the McAlpine 2006 CSR Report.

http://www.alfredmcalpineplc.com/cr06/cr_e1.asp#5

Balfour Beatty

All aspects of sustainability appear to be incorporated into Balfour Beatty's business aims and objects. The way in which Balfour Beatty presents its sustainability objects and aims is clear, concise and it is readily apparent how the performance targets are formulated and achieved. In 2002 the company investigated the role of the construction industry in relation to sustainable construction and in 2003 the company aimed to spread this understanding to its operating companies. A vast number of sustainability issues are dealt with by Balfour Beatty within the context of corporate responsibility.

Balfour Beatty has split its Corporate Responsibility into 5 areas;

- Safety
- Health
- Environment
- People
- Communities

Further details in relation to all these areas including individual strategies, highlights, case studies and key issues can be found at;

<http://www.balfourbeatty.com/bby/csr/>

The company have set performance targets in each of these corporate responsibility areas.

<http://www.balfourbeatty.co.uk/bbeattycr06/cr06/performance/performance.html>

The Balfour Beatty Corporate Responsibility Report 2006 details the following highlights;

Safety

- 24% Group-wide reduction in Accident Frequency Rate during 2006
- 58% Group-wide reduction in Accident Frequency Rate since 2002

Health

- 96% of operating companies undertake occupational health screening
- 28% reduction in the number of hand arm vibration cases during the year

Environment

- 27% reduction in our relative UK contribution to global warming over the last four years
- 78% of UK timber spend procured from certified sources
- 76% less hazardous waste generated than in 2005

People

- 30,467 full-time employees at the end of 2006
- £15 million invested in training in 2006
- 11% reduction in voluntary turnover

Communities

- £220,000 raised for Marie Curie Cancer Care over two years
- 25,000 + schoolchildren compete in Balfour Beatty sponsored London Youth Games

In 2006 Balfour Beatty revealed the following figures in relation to sustainable consumption;

Energy

- Relative UK contribution to global warming is down 27% over four years, to 41 tonnes CO₂ equivalent per £m NSV (Net Sales Value)
- Improvements in energy efficiency of UK vehicle fleet continues
- Zero purchases of CFCs. Down 100% since 2002
- SF6 purchased for clients has more than doubled since 2002

Waste and Recycling

- Total UK waste generated per £m NSV similar to 2005
- 76% less hazardous waste compared to 2005
- More than doubled the amount of inert materials sent directly to recycling stations compared to 2005
- 58% more metals recycled compared to 2005
- 13% more packaging and 10% more plastics recycled compared to 2005

Resources

- 78% of timber spend from certified sources; 66% was purchased from an FSC certified source
- 11% less water consumed during 2006 compared to 2005

The 2006 CR report highlighted the following priorities for 2007;

- To continue to quantify and understand our environmental impacts globally
- To encourage environmental engagement among our supply chain
- To investigate the causes of incidents and ensure that lessons are learnt and shared
- To develop further our approach to sustainable construction

Implementation and best practice case studies

Below is a collection of best practice case studies which demonstrate how the given companies have implemented aspects of sustainability within their businesses and applied their sustainability principles to individual projects.

Biodiversity tool box tools (Source Carillion)

Carillion have developed for a whole range of species from adders to bats and Japanese Knotweed, tool box information tools which are two sided A4 and use pictures and diagrams for illustrative purposes. These informative documents are audience targeted, succinct and comprehensive and provide key facts such as what it is, what it looks like, what its typical habitat is, what the law says and how to deal with it. They also provide do's and don'ts and where to go for further information. Although Carillion have targeted their tool box information tools at biodiversity, the concept of such information sources is readily adaptable to many aspects of sustainability.

Turning old roads into new roads – FoamMaster (Source: Tarmac)

FoamMaster is a 95% sustainable system. As a sustainable, cost effective and environmentally friendly alternative to hot asphalt materials FoamMaster is suitable for a wide range of applications and combines proven foamed bitumen technology with cold mix production and paving. FoamMaster uses 88% highways arisings, 7% PFA, 2% cement and 3% bitumen mixed with water.

The FoamMaster system offers the following advantages over conventional surfacing techniques;

- It is an energy efficient manufacturing process
- Reduces transport movements (on-site reuse of materials)
- Reduces the need for off site waste disposal
- Produced a stockpile material with an extended life and produces a re-workable material in its early life.
-

FoamMaster was used to reconstruct a 3.5km stretch of the A1094 Aldeburgh Road, in Firston, Suffolk. FoamMaster recycled base materials were used in lieu of virgin aggregates. The re-use of the carriage way planings saved approximately 300 lorry movements as there was no need to remove all waste off site or to bring in virgin materials from local quarries. By recycling the carriageway planings, only a very small quantity of new aggregate was used to complete the upper layers; 2700 tonnes of DBM Binber Course (70mm deep, and 1800 tonnes of Masterpave surface course (30mm deep).

Repave – Hot in situ recycling of carriageways to 50mm (Source: Colas)
Repave is said to provide a faster, more cost effective alternative to traditional forms of surfacing. The benefits of Repave are that the materials are recycled in-situ therefore minimising lorry movements, lessening the need for the use of new primary aggregate and minimising the need for off-site materials. The process is suitable for any class of road.

Heat from Repave penetrates deep into the road material allowing work to take place at virtually any time of year. The existing road surface is heated to 150° C and scarified to a depth of 30mm using a two-stage scarifier with spring loaded tyres to avoid damage to street furniture. Next an oscillating, floating screed reprofiles and corrects levels for the required crown or crossfall. The process is completed by the immediate application of either a 25mm bituminous wearing course, hot rolled asphalt with 20mm pre-coated chippings, high stone content asphalt or a proprietary thin surfacing.

This process was used in HA Area 8 on the A421 near Bedford in early 2006. Snow, rain and temperatures down to -5°C only extended the 15 night programme by one night. Repave complies with Department of Transport Specification for Highway Works Clause 926.

The Porth Relief Road (Source: Costain)

This project involved the construction of a 90m span bowstring Rheola Bridge in Porth town centre, 8 kms of new and improved carriageway, 10 other bridges, 15 retaining walls and 16 culverted watercourses. The aims of the project were to improve the lives the residents of 2500 homes through increased accessibility, contribute towards economic regeneration and to improve routes for pedestrians and cyclists.

Highlights of this scheme:

- Around 96% of waste by volume was reused or recycled, overall the project avoided the disposal of 100,000m³ off site and the associated 10,000 truck movements which would have been required to remove the material.
- 46 local 'economically inactive' people were recruited and trained for long term employment. The target for this was originally only 30 people.
- The project was delivered with a 33% cost saving on the target price
- Early Contractor Involvement (ECI) and the use of the New Engineering Contract was central to procurement and to the success of the project
- The scheme highlighted the need and importance for early consultation with stakeholders and community engagement.

Cement Manufacture – Fossil Fuel Replacement (Source: Tarmac)

In accordance with the Environment Agency's Substitute Fuels Protocol, Tarmac has been trialing the use of waste tyres as an alternative kiln feed to traditional fossil fuels at its Tunstead Cement Plant. With the possibility of replacing 25% of its normal fossil fuel feed with waste tyres this type of operation has the potential to offer many benefits from providing a recovery route for the problematic tyre waste stream and job creation.

Waste and Resources Action Programme (WRAP) – Construction

WRAP have developed a number of best practice guidance documents with regards to the construction and maintenance of roads using recycled/secondary materials. These documents include site waste management guidance documents for site/environmental managers, site foremen, and site labourers (WRAP, 2008a). Additionally, guidance documents relating to achieving good practice in waste management and minimisation have been developed (WRAP, 2008b).

In addition to the documents mentioned above, WRAP has developed an Opportunities Module on their dedicated Aggregates website, AggRegain. This Module aims to indicate where recycled and secondary aggregates can be used in construction applications (WRAP, 2007) including:

- Concrete Roads;
- Bituminous Road Construction;
- Hydraulically bound road construction;
- Ground Improvements;
- Earthworks - embankments;
- Earthworks - cuttings;
- Shallow Foundations;
- Deep foundations;
- Utilities - new trenches;
- Utilities reinstatement;
- Sub-structures; and,
- Concrete structures.

The Case Study section within the AggRegain website displays a number of best practice studies in relation to road infrastructure (WRAP, 2007b). These include the following:

- A38: Ex-situ recycling of a trunk road in South Devon;
- Recycled Asphalt in Footway Works on B3047 at Martyr Worthy;
- Recycling in highway construction and maintenance enabled by partnering in Staffordshire;
- Ferrosilicate slag from zinc production as aggregates bound in bituminous mixes; and,
- Use of recycled aggregates and in-situ stabilisation on the A120 Stansted to Braintree Bypass.

WRAP (2008a) Site how to Guides

http://www.wrap.org.uk/construction/construction_waste_minimisation_and_management/onsite/site_how_to.html

(accessed 12/02/08)

WRAP (2008b) Good Practice Waste Minimisation and Management

http://www.wrap.org.uk/construction/construction_waste_minimisation_and_management/good_practice_wmm.html

(accessed 12/02/08)

WRAP (2007a) Opportunities to Use Recycled and Secondary Aggregates (RSA)

<http://www.aggregain.org.uk/opportunities/index.html>

(accessed 12/02/08)

WRAP (2007b) End Use Case Studies

<http://www.aggregain.org.uk/applications/aggregain/casestudysearch/index.rm>

Sustainable Development Research Network

<http://www.sd-research.org.uk/>

The Sustainable Development Research Network (SDRN) aims to contribute to sustainable development in the UK by encouraging the better use of evidence and

5 Best Practice within the Highways Agency's own practices and initiatives

Below are examples of Best Practice which the Highways Agency has developed in partnership.

Promoting the benefits of recycled and secondary aggregates in the reduction of CO₂ emissions (Source: Developed for the HA by C4S)

This project by C4S aimed to promote the use of recycled and secondary aggregates through raising awareness of the potential *reductions in CO₂ emissions*. This included the production of a *bespoke tool* to estimate the CO₂ impact of construction aggregate sourcing decisions. This was a MS Excel model to measure progress towards waste minimisation targets set in WRAP (Waste Resources Action Programme) annual report. The tool measures and records cost and CO₂ savings based on project specific inputs from the user. C4S carried out the model development using VBA, data processing and writing of the User Guide.

Reducing the Impact of Transporting Aggregates (Source: Developed for the HA by C4S)

This project involved the development of an Aggregates Delivery Optimisation Protocol and encouragements, of the use of Articulated Vehicles to assist end clients, the construction industry and aggregates industry, optimise and minimise the social, environmental and economic impacts of aggregate deliveries. The out put of this project was production of a tool which estimates the CO₂ and economic and social impacts of transporting construction material from quarry to construction site. This protocol was piloted on A34.

6 Future Research and Development Needs

The HA was established in 1994 and is an Executive Agency of the Department of Transport. The Secretary of State is responsible for overall Government Policy on motorways and trunk roads in England and determining the strategic framework and financial resources within which it operates. The HA in many subject areas is therefore responsible for the delivery of many government policies and strategies and therefore many of the HA's own policies and strategies are enhancing and contributing to overall government aims and objectives.

The HA are clearly making progress towards the integration of sustainability throughout its operations. The introduction of the Sustainable Development Action Plan (SDAP) in June 2007 was released in response to "Securing the Future" and mirrors the Government's sustainable development priorities and guiding principles. It is the SDAP which sets out the actions for how the HA Business Plan targets can be delivered in a more sustainable manner. This first SDAP is also a tool which is aimed at engaging and involving HA staff and partners throughout the supply chain.

The table below summarises the HA objectives and details where the objectives have originated. The source of these objectives is convoluted although the SDAP helps to bring these objectives together but not the related performance targets which are found elsewhere, for instance within the business plan. For traceability and ease of use, the SDAP should also contain a spider diagram which shows how the SDAP is cascaded through all HA operations and what policies and strategies are available for delivering the actions and sustainability as a whole. Including this enhancement to the proposed revised SDAP will help to engage HA staff and service providers by ensuring that they are aware of the HA's priorities, what the HA want to achieve and what is expected from them.

It can be seen from the table that the HA have a number of objectives and indeed many of these objectives have targets attached to them. However, as this is the HA's first SDAP although not the first time the HA has looked to address some of the issues such as biodiversity, many of the objectives and accompanying targets are therefore in the conceptual stage and are without a delivery vehicle, whether a subject specific plan or guidance to deliver these targets.

Environmental Subject Area	HA Objective	Source of objective
Procurement	To integrate environmental considerations into procurement decisions	HA Environment Strategic Plan
Landscape	Reduce the adverse effects of trunk road traffic on the countryside	HA Business Plan 07/08
Landscape	Protect and enhance the landscape character and quality of an area when designing new roads and improving existing roads	HA Business Plan 07/08 HA Environment Strategic Plan
Nature, Conservation & Ecology	Safeguard and enhance known populations and potentially suitable habitats for HA BAP protected species/habitats	HA Biodiversity Action Plan

Nature, Conservation & Ecology	Safeguard and enhance known populations and potentially suitable habitats other species/habitats of conservation interest	HA Business Plan 07/08
Nature, Conservation & Ecology	Develop a greater knowledge of the location, distribution and involvement of protected species/habitats	HA Biodiversity Action Plan
Water	Manage drainage on the network	HA Environment Strategic Plan
Water	Reduce impact of network on watercourses, groundwaters and flooding	HA Environment Strategic Plan
Cultural Heritage	Protect and enhance the historic environment	HA Business Plan 07/08 HA Environment Strategic Plan Protocol for the Care of the Government Historic Estate 2003
Townscape	Use of townscape plans for urban roads to enhance townscape	HA Environment Strategic Plan
Air Quality	Reduce emissions cause by road construction/maintenance activities	HA Business Plan 07/08 HA Environment Strategic Plan
Air Quality	Reduce emissions cause by road operation (vehicle movements)	HA Business Plan 07/08 HA Environment Strategic Plan
Noise	Reduce noise nuisance caused by road operation (vehicle movements)	HA Business Plan 07/08 Strategic Roads 2010-The HAs 10 year road strategy
Noise	Reduce noise nuisance caused by road construction/maintenance activities	HA Business Plan 07/08 Strategic Roads 2010-The HAs 10 year road strategy
Materials Resource & Waste	Reduce the use of primary materials	HA Waste and Materials Resources Policy (draft 2006)
Materials Resource & Waste	Increase the re-use of materials	HA Waste and Materials Resources Policy (draft 2006)
Materials Resource & Waste	Increase the use of recycled and secondary materials	HA Waste and Materials Resources Policy (draft 2006)
Materials Resource & Waste	Reduction the production of waste, especially hazardous wastes	HA Waste and Materials Resources Policy (draft 2006)

In the SDAP the HA lists what it considers are its main sustainability impacts of its business against UK priorities, however it does not prioritise these impacts in terms of what that HA considers most applicable and/or achievable in terms of its operations. More importantly the HA does not appear to embrace the current government priorities of waste and resource use, soil, climate change (including for instance

flooding of the network) and the people agenda (except user acceptance and health and safety) in relation to sustainability, although parts of DMRB (volumes 10 and 11) go some way to recognise these issues and integrate them within HA business. However, the way in which the HA address biodiversity may be considered best practice in terms of their BAP and the way in which it is implemented.

Fundamentally the state of art review of the HA's current strategies and policies has revealed gaps which are discussed below and shows that the HA has set its objectives and what it wants to achieve, it has adequate high level direction such as that through the SDAP and has targets such as those within their business plan, but there is little guidance or policy in relation to how these targets will be achieved and what's expected of the business to deliver these targets.

The following gaps have been identified within current HA strategies, reasons why the HA should find these gaps of importance are also detailed;

- Resource Use & Natural Resource Protection – Constructing, maintaining and operating roads requires lots of resources for instance energy, water, aggregate, and asphalt. There are also issues directly relevant to resource use such as transport movement, ever depleting supplies aggregate, CO₂ emissions. The HA needs to look at resource use across its business in line with sustainable consumption and more importantly take direction from current and future strategic drivers such as, but not limited to, the Strategy for Sustainable Construction, Waste Management Strategy for England 2007, Aggregates Levy changes, the Energy White Paper (the need to cut CO₂ emissions by some 60% by 2050), and the Water Strategy. Resource use should be considered in direct partnership with waste management.
- Waste Management - Construction activities produce a lot of waste in comparison to other sectors, for instance 10-15% of materials going onto construction sites become waste before they are even used. Waste and resource management go hand in hand, however in terms of strategy they should be considered separately because any waste management strategy should include a large element of regulatory and legislative compliance integration within business activities. Both the Strategy for Sustainable Construction and also the Waste Strategy 2007 are placing enormous emphasis on the construction industry to manage its waste in a more sustainable way, such proposed targets include by 2012 a 50% reduction of construction, demolition and excavation waste to landfill compared to 2005, by 2015 zero net waste from at construction site level and by 2020 zero waste to landfill. The Specification for Highways Works permits the use of various waste in place of virgin materials, introducing a strategic waste driver within the HA will help to encourage and ensure the use of waste becomes the norm and best practice. This strategy should be based on the gathering of 'true' baseline waste arising cradle to grave figures across all HA operations it would be advantage to couple waste and resource use as mass balance exercises to help demonstrate actual resource use.

- Procurement – In many cases procurement especially the contractual aspects of procurement can ensure sustainability is integral to a business. Procuring items and services which are sustainable sources or service providers along with introducing clauses into contracts would significantly contribute to the HA's sustainability objectives. For instance introducing a contractual clause which ensures aggregates are not imported from abroad.
- Soil – Soils are fundamental to many aspects of society for instance supporting agriculture and forestry, protecting cultural heritage, supporting biodiversity and as a platform for construction. Soils are very much a hot topic and in Spring 2008 Defra are expected to release the Soil Strategy 2008 which will complement the 2005 strategy for soils in the built environment. Soil is likely in the near future to pose a challenge to the HA and to the construction industry as a whole and the Government pushes to protect soils through legislative and regulatory frameworks as an irreplaceable resource.
- Climate Change & Adapting the network to Climate Change – Climate change is all around us and its longevity is unsure, however, it's on the political agenda around world and the Government is currently consulting on the Climate Change Bill. This Bill will commit the UK to increasingly stringent carbon budgets. Specific targets are already suggested within the draft Sustainable Construction Strategy of 2007 and relate directly in some instances to Government Department operations. Government departments are therefore likely to have to lead from front and set the example in relation to climate change and other aspects of sustainability.
- Sustainable Communities – In terms of the people agenda, there is little HA policy or strategy with the exception of the Highways Agency Disability Equality and Duty Action Plan 2006-2009. However this document is very much focused towards ensuring the requirements for public body in relation to the Disability Discrimination Act 2005 are met and in itself is very much focussed on the issues surrounding mobility and disability. Securing the future has brought together policy makers and stakeholders to explore the concept of 'wellbeing' in relation to sustainability. Strategies and policies in relation to sustainable communities should take account of a range of subject areas such as meeting the diverse needs of people and future communities, promoting self well-being, social cohesion and inclusion and creating equality opportunities for all.
- Although gaps have been identified in relation to the delivery of specific subjects across the HAs business it should be remembered that these subjects cannot be delivered in isolation to each other and that a wide reaching holistic view of areas of sustainability should be embedded within all strategies and policies.

The first and foremost are the gaps identified above in terms of having in place suitable guidance which provides direction and the practical detail of how the HA intends to implement sustainability within its business. Without this direction it is difficult to obtain the support needed to deliver the aims, objectives and targets which are already in place.

Although targets exist within specific subject areas at a strategic or legislative level such as those in relation to biodiversity, until July 2007 and the publishing of the draft strategy for Sustainable Construction, no targets existed for sustainability issues within construction. Without having such targets and hence certainty in terms of what is expected of the construction industry, only the most corporately responsible companies have made significant headway in terms of integrating sustainability within their business. Now the Government is looking to put in place sustainability targets in the context of construction significant progress is likely to be achieved.

This report has highlighted the increasing number of strategic drivers and legislative drivers which are intended to address every aspect of sustainability, the intention being for sustainability to be fully included within all aspects of construction. Of course, these drivers identify statutory and non-statutory targets which must or should be reached in-order to achieve the Governments overall aims on sustainability development, the Highways Agency has its role to play within this which it recognises. It has been identified that a gap exists within the Highways Agency in terms of ensuring environmental compliance whether it be at a strategic or legislative level. Since the publication of 'Building Better Roads: Towards Sustainable Construction' the Highways Agency has produced no such further publications highlighting any continued progression in relation to their operations and sustainable development. In-order to assess the implications of this gap, the requirements placed on the Highways Agency from all strategic and legislative should be established and then assessed against all Highways Agency activities, this will show whether the Agency are non-compliant, on course and progressing towards or far exceeding what is required of them in terms of sustainability. Such a study would need to include the identification and likely impact of future legislative and strategic drivers on the Highways Agency and its activities.

In terms of waste management there are a number of historic issues which make waste management a challenging subject area for the HA to tackle and hence the need for an internal strategy. Historically waste data pertaining to construction and demolition waste (including excavated waste) has been a closely guarded secret. This is for a number of reasons, commercial businesses use commercial waste companies and hence there are no central points (other than the Environment Agency) to gather data unlike municipal waste and local authorities. Furthermore there have been no predetermined recycling or re-use targets unlike those for municipal waste and a proportion of construction and demolition waste goes to waste management exempt sites who on the whole have no statutory duty to report waste in-take to the Environment Agency. These issues along with a common perception amongst the construction industry that aggregate is cheap and hence historically resource use hasn't been measured, make establishing a baseline on which to devise meaningful and achievable waste management targets a challenge.

The Specification for Highways makes using waste materials as aggregate replacements a reality subject to suitability, however, not all roads are constructed using waste materials. Pursuing a cost benefit analysis to show the financial savings and environment benefits of using waste materials as opposed to virgin materials may be a way of 'selling' this concept to the HA service providers. A step further from this is to impose a mandatory percentage use of recycled materials within contracts for all construction and maintenance carried out on behalf of the HA. The Governments target of waste neutrality is entirely dependant on the re-use and recycling of waste and the use of more recovered materials.

In terms of resource management, contractual clauses should be added which require the measurement and involvement of materials and resource efficiency for projects. This is especially important for public organisations and this may encourage the private sector to sign up to such commitments.

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Appendix

Legislations and Policy Drivers – Current and Future

New Zealand:

The Environment Act (1986)

Under this Act, the functions of the Ministry for the Environment are:

- To advise the Minister on all aspects of environmental administration, including:
 - management policies for natural and physical resources and ecosystems to meet the objectives of the Environment Act 1986
 - significant environmental impacts of public or private sector proposals, particularly those that are inadequately covered by existing legislative or other environmental assessment requirements

- ensuring effective provision is made for public participation in environmental planning and policy formulation, particularly at the regional and local level.
- To obtain information, and to conduct and supervise research, so it may advise the Government on environmental policies.
- To provide the Government, its agencies, and other public authorities with advice on:
 1. the application, operation, and effectiveness of the Acts specified in the Schedule to the Environment Act 1986 in relation to the achievement of the objectives of the Act
 2. procedures for the assessment and monitoring of environmental impacts
 3. pollution control and the co-ordination of the management of pollutants in the environment
 4. the identification and likelihood of natural hazards and the reduction of the effects of natural hazards
 5. the control of hazardous substances, including the management of the manufacture, storage, transport, and disposal of hazardous substances.
- To facilitate and encourage the resolution of conflict in relation to policies and proposals which may affect the environment.
- To provide and disseminate information and services to promote environmental policies, including environmental education and effective public participation in environmental planning.
- Generally to provide advice on matters relating to the environment.
- To carry out functions specified under any other enactment (this includes for example the Ministry's functions under the Resource Management Act which follows below).

Land Transport Management Act (LTMA)

The Act:

- provides an integrated approach to land transport funding and management; and
- improves social and environmental responsibility in land transport funding, planning, and management; and
- changes the statutory objectives of Transfund and Transit to broaden the focus of each entity; and
- improves long-term planning and investment in land transport; and
- ensures that land transport funding is allocated in an efficient and effective manner; and

- improves the flexibility of land transport funding, including provisions enabling new roads to be built on a tolled or concession agreement basis or on a basis involving a combination of those methods; and
- amends the [Local Government Act 1974](#), the [Transit New Zealand Act 1989](#), and the [Land Transport Act 1998](#), and repeals the Auckland Transport Board Act 1928.

Australia:

National Strategy for Ecologically Sustainable Development (NSES D)

The key initiatives of the Plan include:

- the establishment of the National Environmental Education Council (NEEC), an expert advisory body comprising people from a variety of sectors;
- the establishment of the National Environmental Education Network (NEEN) comprising representatives from Commonwealth, State and Territory environment and education agencies to promote better coordination of activities;
- the implementation of a research program to improve the quality of environmental education and achieve better outcomes; and
- better resourcing of environmental education by including provision for funding of such activities in all departmental funding programs.

The National Greenhouse and Energy Reporting Act 2007

The key features of this Act are:

- Cutting red tape for businesses by reducing the number of reports to government
- Providing robust data as a foundation for an Australian Emissions Trading Scheme
- Facilitating reporting of abatement and offsets prior to commencement of emissions trading
- Providing company level information to the public on greenhouse and energy performance for the first time
- Creating a single online entry point for reporting based on the Australian Government Reporting System for Comprehensive Activity Reporting.

The National Packaging Covenant

The Australian Government has undertaken to:

- produce an action plan for evaluating and improving environmental outcomes in the use and recovery of packaging materials;
- apply the principles of the Covenant in Australian Government operations;
- identify and seek to remove barriers to the purchase of recycled goods; and
- facilitate the implementation of purchasing policies for recycled goods.

USA

The Resource Conservation and Recovery Act RCRA set national goals for:

- Protecting human health and the environment from the potential hazards of waste disposal.
- Conserving energy and natural resources.
- Reducing the amount of waste generated.
- Ensuring that wastes are managed in an environmentally-sound manner.

Appendix B

New Zealand

The New Zealand Transport Strategy (NZTS)

The objectives of the NZTS are:

- assisting economic development
- assisting safety and personal security
- improving access and mobility
- protecting and promoting public health
- ensuring environmental sustainability.

The Australian Local Government Association (ALGA)

Its' core priority areas for action are:

- local government finances
- roads and transport
- sustainability and the environment
- regional equity and regional development
- social policy and human services
- information and communications technology
- whole of government collaboration
- strengthening democratic processes.

USA

The Maryland State Highway Administration's (SHA)

The key elements of MDSHA's environmental policy are to:

- Meet or exceed all environmental laws and regulations applicable to MDSHA activities.
- Incorporate and integrate environmental protection and enhancement measures in planning, design, construction and operations.
- Protect and enhance all aspects of the natural and human environment whenever possible, using available state-of-the-art practices.

- Support advancement in environmental protection technology through innovation and technology transfer.

Appendix C

EPSRC

The objectives of this programme are to:

- Strengthen the capability of the UK research base in sustainability issues within the urban environment in both breadth and depth;
- Provide an identifiable source of multidisciplinary academic excellence able to respond to the needs of the end users of research in industry, commerce, the service and public sectors through a programme of collaborative research and technology transfer; and,
- Develop and promote a strategic research agenda to address sustainability in the urban environment for the 21st century and beyond.