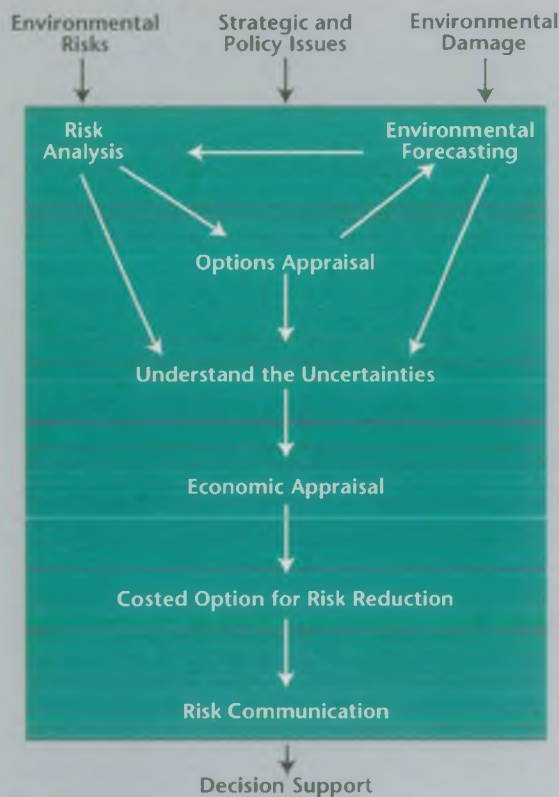


Road Transport and the Environment

Road transport is an integral component of our day-to-day lives, and yet it poses a significant risk to the environment. This Risk Profile is the first to be produced by the Environment Agency's National Centre for Risk Analysis and Options Appraisal, and is the precursor to a more in-depth analysis of the issues surrounding road transport.

RISK ANALYSIS AND OPTIONS APPRAISAL



The Environment Agency has no formal remit in relation to road transport, although many of the associated issues have a bearing on the Agency's ability to regulate and manage the environment effectively. For example, the contribution of pollutants from exhausts to the atmosphere in the UK affects the way in which the Agency is able to regulate certain sectors of industry. Similarly, the building of new roads affects the protection that can be afforded to homes from flooding, may compromise the ability to maintain water quality, and will affect the conservation value of natural resources. It is clear that road transport places a burden on the environment and the Agency has to take account of this in determining the most appropriate way to protect the environment of England and Wales.

The Agency also has an overall aim of contributing to sustainable development, and in doing so is aware of the need to balance the transport requirements of a modern society with the long term health of the environment.

In 1994, the Royal Commission on Environmental Pollution published its report *"Transport and the Environment."* In April 1996, the Government published a green paper on transport, and a further Royal Commission study is underway. The Agency does not seek to duplicate the efforts of others in addressing the issue of road transport, but will impose a logical risk-based framework on the information available. This will ensure that the Agency's response to the risks posed is targeted and proportionate to the issue at hand.

This Risk Profile builds on the work of the Royal Commission, and provides an initial view on how the future state of the environment may be affected by the risks from road transport. It also identifies the type of options that may be available to the Agency and others in preventing environmental damage, as well as the current costs and associated benefits. This forward look is essential if the Agency and others are to ensure that any further development is indeed sustainable.

The National Centre will follow this Risk Profile with a more detailed, and quantitative assessment of the risks facing the environment from road transport, which will be published in due course.

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Sources of risk to the environment

The environment is at risk from a wide variety of activities of which road transport is only one. It is evident that the risks posed by road transport arise from a limited number of discrete sources.

Raw materials

These present a risk to the environment as a result of their extraction, transport and usage. Road construction materials (for example road stone, cement, gravel), car construction materials (such as steel) and petroleum products are all sources of risk to the environment. Road building in the UK accounts for 90 million tonnes per year of the aggregates used (33% of total UK); steel and aluminium used in car manufacturing accounts for 20% and 10% respectively of total world production. Petroleum used in road transport accounts for over 40% of total UK consumption of petroleum products. All of these are set to increase over the next 20 years in proportion to the length of new roads built, and the amount of kilometres travelled. Petroleum consumption will increase at a lower rate due to increases in vehicle efficiency, and may decrease in the long-term as alternative vehicle technology develops.

Road construction and maintenance

Such activities will inevitably result in some risk to the environment. Physical activities such as movement of earth, removal of vegetation, the creation of cuttings and embankments, and the construction of bridges all have an impact on the environment. In addition, the maintenance of the road surfaces can pose problems for the quality of water in adjacent watercourses.

Road run-off

As water runs off hard surfaces such as roads, it takes with it many pollutants including oil and tyre residues. The flush of these substances together with their inherent ability to pollute, poses a significant risk to the environment. The impervious surfaces also pose a risk for the stability of the water cycle itself. As water runs off such surfaces far faster than from areas such as grassland, the hydraulic characteristics of the floodplain are altered, thereby posing a greater flood risk to areas both upstream and downstream.

Accidents and spillages

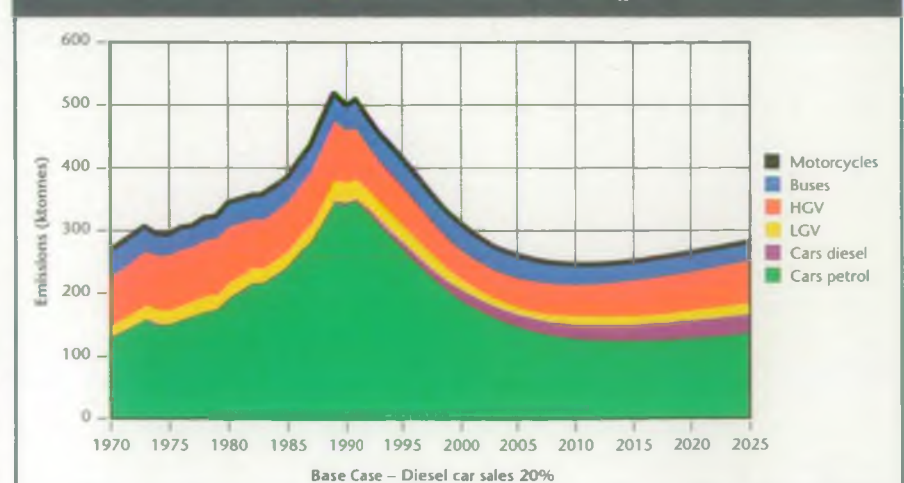
Road accidents are a significant contributor to human fatalities, accounting for around 25% of the total individual risk of death from accidents. The total number of road accident casualties (including less than serious injuries) has however remained stable over the same period, because the increasing volume of traffic has roughly balanced the declining rate of accidents per vehicle-km. Accidents also result in spillages of substances which pollute the environment. Such substances can range from noxious gases and toxic chemicals to ordinary liquids such as milk or beer. All have the potential to cause environmental damage, and the risk is increasing.



Exhaust emissions

Road transport is a significant source of a number of air pollutants including oxides of nitrogen (NO_x), volatile organic compounds, carbon dioxide (CO_2), carbon monoxide and particles with a diameter less than 10 micrometres (PM_{10}). These pollutants impact on environmental quality in a number of ways. To illustrate the problems, we have taken NO_x and CO_2 as examples. Road transport emissions of NO_x account for over 50% of the UK total and, as they occur close to ground, are a major influence on local air quality. Emissions of CO_2 from motor vehicles account for 20% of the national total and, as CO_2 is a greenhouse gas, contribute to climate change.

URBAN ROAD TRANSPORT EMISSIONS OF NO_x IN GREAT BRITAIN



Uncertainties

This Risk Profile provides a brief assessment of the environmental damage that is, and may be, caused by road transport. This is by no means a definitive statement as there is a range of uncertainties which will be addressed over the coming year.

Linking environmental damage back to the original cause is far from straightforward. For example, the links between exhaust emissions and human health are still the subject of investigation, as is the contribution of road construction to ecological and social fragmentation. However, in areas such as the effects of road bridges on floodplain characteristics, the main factors are now well understood. Further research and monitoring will help in linking the pressure to the environmental response.

Placing a value on those parts of the environment affected by road transport is an emerging field, and often depends on how the public perceive the environment. The National Centre will compile a register of environmental costs which will help overcome uncertainties in this area.

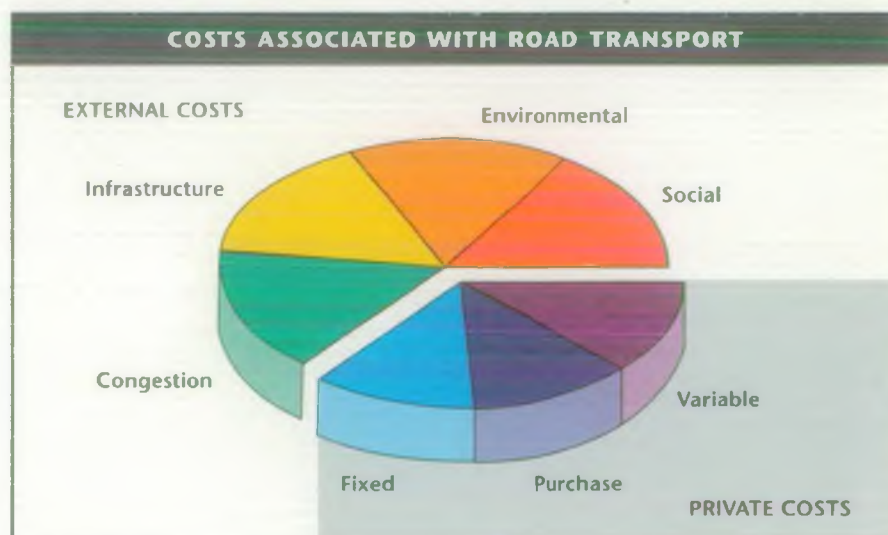
Understanding how uncertainties in information affect the final outcome is a key step in a credible assessment of risk. The National Centre is working with Glasgow University to see how new statistical techniques can help reduce the level of uncertainty.



Costs and benefits of road transport

Individual decisions about transport are made by balancing the benefits to the individual of a journey against the perceived private costs, both financial and in terms of time and convenience. When we decide to use road transport however, we rarely consider the costs to the environment and to society.

Decisions to use private cars are based on costs such as the price of a car, fuel and parking expenses. Commercial road transport decisions are likely to be based on a more complete assessment of private costs. However, private costs and benefits tend not to reflect the full economic implications of using road transport and therefore we tend to ignore external issues such as the costs of environmental damage.



Options for preventing environmental damage

The Environment Agency is one of a number of organisations that has an interest in the impacts of road transport on the environment. Many of the options outlined below will be evaluated in the next phase of the work, although some will clearly be for bodies other than the Agency to pursue. Rather than tolerate risks, there are a series of actions which can be taken to reduce levels, ranging from new, or changes to existing, policies to improvements in technology, education and economic instruments.

The Agency's experience of the impacts of road transport should be considered at the policy level as Government takes steps to influence the growth in demand for transport by attempting to ensure that people pay the full social and environmental costs of their transport decisions. The Eighteenth Report of the Royal Commission on Environmental Pollution recommended the development of sustainable transport policies with an integration of transport (in all its modes) and land use policies at the national, regional and local levels. As the Agency is a statutory consultee in the planning process, its experience in this area could be valuable in developing such policies.

There are also a number of actions which can be taken at project-level for mitigating the impacts of roads including the use of oil interceptors close to river crossings, enforced speed limits and traffic calming measures. Advances in technology could lead to the manufacture and sale of more fuel efficient vehicles leading to reduced emissions.

Options requiring further investigation	SOURCE OF RISK TO THE ENVIRONMENT				
	Raw materials	Exhaust emissions	Roads	Accidents	Waste disposal
Transport policy	✓✓	✓✓	✓		✓
Roads programme			✓		
Regional plans			✓	✓	
Specific roads			✓	✓✓	
Technology	✓	✓✓		✓	✓
Education	✓	✓	✓	✓	✓
Economic	✓✓	✓✓	✓		

The Agency is already pursuing a number of options in this area. These include a national policy for flood risk management, which seeks to limit development in areas that flood more frequently than 1 in 100 years; surveys to define the nature and extent of flood risk; improved liaison with the fire services to help minimise the effect of road transport related incidents on water quality; and the use of wetland basins for root zone treatment and attenuation of run-off.

Account should be taken of the role of education in securing better environmental management and reducing environmental risk. The introduction of economic measures would present road users with the true costs of their decision to drive. This could involve increasing the costs of road tax or fuel, or introducing an emissions tax.

Ecological quality

Close to roads, there can be significant impacts on ecology both during the construction and subsequent use of roads. These can arise from the loss of natural features such as habitats, changes in the quality of air, soil and water, as well as a barrier to species movement presented by the road itself. The recovery of restored ecosystems may also be adversely affected by road run-off.

Landscape

Highway development often results in the loss of natural undeveloped land. This may include the direct loss of ecological habitats, geological exposures or geophysical features. There may also be a significant impact on the landscape value of an area. Important landscape features may be lost and desirable views may become obscured or replaced by less pleasing outlooks.



Property

The physical effects of road traffic, including vibration and air pollution can have an adverse effect on property. The impacts are low relative to other contributors to property damage but are expected to grow with increasing traffic.

Human health

Nitric oxide (NO) and nitrogen dioxide (NO₂), collectively known as NO_x, are formed during combustion; further reaction in the atmosphere converts NO to NO₂. While NO has no harmful effects when inhaled at ambient concentrations, NO₂ is

believed to have effects on health at lower concentrations than those found in the ambient atmosphere and is included in the Government's "National Air Quality Strategy". NO_x is just one of a cocktail of pollutants emitted by vehicles.

Quality of life

Society can also be affected by road transport through issues such as noise, stress, property values and social fragmentation. It is expected that the number of people affected by noise black spots will fall but the incidence of intermediate grey area noise will increase. Whilst the effects of high noise levels are generally localised, noise from traffic is widespread throughout the country. Property values, and the feeling of security which goes with them, can be affected by changes in access and traffic flows, planning blight and even demolition. Whilst new roads may relieve congestion, their impact on the social well-being of communities are less understood. Road transport can improve access to the countryside, increasing the recreational opportunities open to all of us.

Environmental impact	Size	Spatial scale	Trend
Climate change	Low	Global	↗
Air quality	High	Local	↗
Soil quality	Low	National	↘
Water quality	High	Local	↗
Flooding & water resources	Low	Local	↗
Ecological quality	High	Local/National	↗
Landscape	High	Local/National	↗
Property	Low	Local	↗
Human health	High	Local/National	↗
Quality of life – noise	High	Local	↗
– property values	Low	Local	→

Environmental impact	£ per 1000 passenger/kilometres	Approximate annual total cost, UK £ billion
Air pollution	4.3 (urban) 1.7 (other)	1.12 ¹ 0.52 ¹
Air pollution (health effects)	14.0 (urban) 2.5 (all)	1.5 ²
Air pollution and climate change	10.7	6.0 ²
Noise	1.8	1.0 ²
Air pollution, climate change and noise	8.1 to 22.8	4.6 to 12.9 ²
Water pollution	2.2	1.2 ²
Ecological, land loss, visual, severance, sustainability impacts	Considerable effort is being put into the valuation of these environmental impacts but as yet there are no satisfactory valuation techniques	

¹ Based on 190 billion kilometres driven on non-built up roads and 163 billion kilometres driven on built-up roads 1995 and 1.6 passenger/car

² Assuming 353 billion kilometres driven 1995 and 1.6 passenger/car

Costs are taken from diverse sources and should not be summed, care should be taken in comparing between costs

Future road transport options will need to ensure, as far as possible, that transport decisions reflect the true costs, by reducing the social and environmental impacts.

From previous studies of the costs of environmental damage, such costs appear to be substantial. The figures above illustrate the cost of some environmental impacts of private passenger road transport. The figures are not directly comparable as the information comes from a variety of sources.



Risk communication

As road transport is such a central component of our lives, we are often oblivious to the full range of impacts, costs and benefits that come with this lifestyle.

Although road transport has significant benefits for society as a whole, it also has significant disadvantages. Environmental quality problems, increased risk of flooding, ecosystem damage, and risks to water abstractions have to be balanced with the benefits. The National Centre will now take an impartial and objective view of this area and will publish its findings in due course. The study will not seek to evaluate past policy or strategic options, but look to the future for a more sustainable environment.



Environmental impacts

Source of the risk	Size	Trend
Raw materials	Med	↗
Road construction	High	↗
Road maintenance	Med	→
Road run-off	Low	↗
Accidents & spillages	Med	→
Exhaust emissions	High	↗
Waste disposal eg tyre disposal	Low	↘

The introduction of catalysts on new cars, and stricter regulations on trucks, has resulted in a downwards trend in NO_x emissions since 1990. This is expected to continue until about 2010; thereafter, in the absence of additional controls, current projections suggest that NO_x emissions will start to rise again. In contrast, emissions of CO₂ from motor vehicles are projected to rise steadily.

Waste disposal

These arise from the disposal of tyres, scrap cars, old road surfaces, and spent oils and petroleum. Taking tyre disposal as an example, approximately 30 to 35 million tyres (0.3m to 0.4m tonnes) are disposed of each year of which around 35% are retreaded and around 45% are recovered for other uses including incineration for energy recovery. The remainder amounts to less than 115,000 tonnes of tyres compared with 250m tonnes of controlled waste in total disposed of annually (less than 0.05%). The special difficulties of tyre disposal suggest that the environmental impact of their disposal may be disproportionate to their weight but nevertheless, in relative terms, the environmental risk associated with the end of life of tyres is rated low. The trend appears to be decreasing as more recycling and reuse schemes are implemented.

Poor air quality in our towns and cities is the most common view of the environmental impact of road transport. Whilst poor air quality is a key impact, it is only one in a number that the Agency will have to address.

Climate change

Carbon dioxide is one of the principal greenhouse gases contributing to global warming. Road transport comprises around 20% of national CO₂ emissions resulting in 16% of the total global warming potential of UK emissions. There is an increasing trend with emissions in 1993 over 60% larger than those in 1970.

Air quality

Road transport is a major contributor to poor urban air quality. Vehicles account for over 50% of NO_x emissions and, as these are released close to ground, they have a disproportionate effect on urban air quality, particularly close to busy roads. The pattern of estimated NO_x concentrations in 1994 is shown opposite.

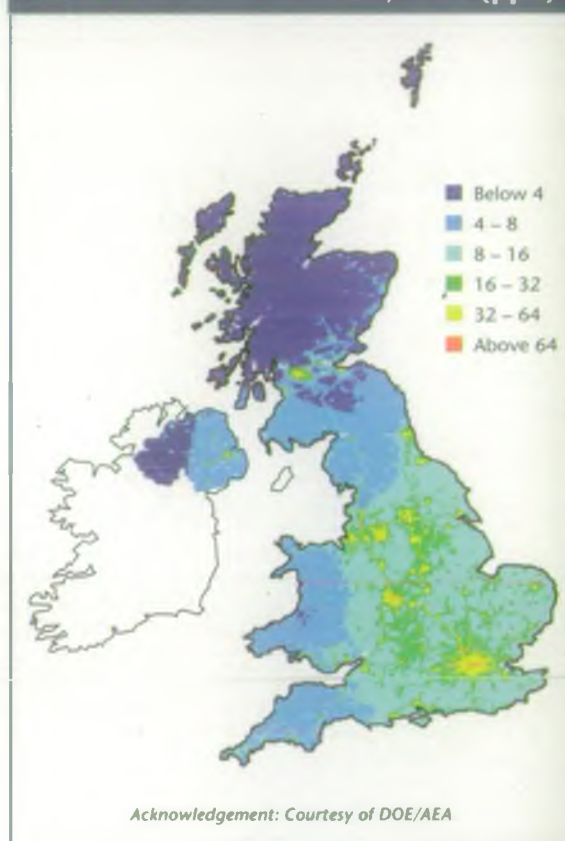
Soil quality

Oxides of nitrogen contribute to acidification and also affect biodiversity. Increasing N input can result in a shift in vegetation towards more nitrogen demanding species. This is typified by a shift from heath to grassland for example. At present critical loads for soil acidification are exceeded in many sensitive ecosystems, particularly in upland areas of northern and western parts of the UK. The contribution from road transport is significant but likely to decrease in the immediate future.

Water quality

In 1996, there were 1915 water pollution incidents in surface waters arising from transport. Of these, 73% were due to road transport, and road traffic accidents in particular. This is an increasing trend, with incidents in 1996 representing a 28% increase on those for 1993. This places road transport on a par with agriculture as one of the principal sources of diffuse pollution.

ESTIMATED MEAN NO_x CONCENTRATIONS FROM LOW LEVEL SOURCES, 1994 (ppb)



The extraction of gravel for road aggregates and the construction of roads also poses a significant threat to the quality of groundwater.

Flooding and water resources

Without adequate mitigation measures, the building of roads in the floodplain can alter flooding regimes, potentially increasing the flood risk to land and property, resulting in financial loss and trauma. The potential for greater flood risk will increase as the number of roads increase. Road run-off can also affect the quality, and hence the quantity, of water available for abstraction downstream for purposes as diverse as drinking water, and irrigation of agricultural land.

MANAGEMENT AND CONTACTS:

The Environment Agency delivers a service to its customers, with the emphasis on authority and accountability at the most local level possible. It aims to be cost-effective and efficient and to offer the best service and value for money.

Head Office is responsible for overall policy and relationships with national bodies including Government.

Rio House, Waterside Drive, Aztec West, Almondsbury, Bristol BS12 4UD
Tel: 01454 624 400 Fax: 01454 624 409

NATIONAL CENTRE FOR RISK ANALYSIS AND OPTIONS APPRAISAL

Steel House, 11 Tothill Street, London SW1H 9NF
Tel: 0171 664 6811 GTN: 7 10 6811 Fax: 0171 664 6911

Head of National Centre

Gareth Llewellyn
Tel: 0171 664 6825 Email: gareth.llewellyn@environment-agency.gov.uk

Help Desk

Tel: 0171 664 6896 GTN: 7 10 6896 Fax: 0171 664 6911

ENVIRONMENT AGENCY REGIONAL OFFICES

ANGLIAN

Kingfisher House
Goldhay Way
Orton Goldhay
Peterborough PE2 5ZR
Tel: 01733 371 811
Fax: 01733 231 840

SOUTHERN

Guildbourne House
Chatsworth Road
Worthing
West Sussex BN11 1LD
Tel: 01903 832 000
Fax: 01903 821 832

MIDLANDS

Sapphire East
550 Streetsbrook Road
Solihull B91 1QT
Tel: 0121 711 2324
Fax: 0121 711 5824

SOUTH WEST

Manley House
Kestrel Way
Exeter EX2 7LQ
Tel: 01392 444 000
Fax: 01392 444 238

NORTH EAST

Rivers House
21 Park Square South
Leeds LS1 2QG
Tel: 0113 244 0191
Fax: 0113 246 1889

THAMES

Kings Meadow House
Kings Meadow Road
Reading RG1 8DQ
Tel: 0118 953 5000
Fax: 0118 950 0388

NORTH WEST

Richard Fairclough House
Knutsford Road
Warrington WA4 1HG
Tel: 01925 653 999
Fax: 01925 415 961

WELSH

Rivers House/Plas-yr-Afon
St Mellons Business Park
St Mellons
Cardiff CF3 0LT
Tel: 01222 770 088
Fax: 01222 798 555



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WELSH REGION CATALOGUE
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For general enquiries please call your local Environment Agency office. If you are unsure who to contact, or which is your local office, please call our general enquiry line.

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GENERAL ENQUIRY LINE
0645 333 111

The 24-hour emergency hotline number for reporting all environmental incidents relating to air, land and water.

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EMERGENCY HOTLINE
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