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## **SEA for Transport in the United Kingdom**

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**MINISTRY OF TRANSPORT AND MARITIME  
ECONOMY**



**STRATEGIC ENVIRONMENTAL ASSESSMENT GUIDANCE IN THE UNITED KINGDOM****Paul Tomlinson**

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**ABSTRACT**

Historically, the appraisal of different transport modes in the UK has been undertaken on a separate and non-comparative basis. In recent years, Common Appraisal Framework (CAF) methodologies have been developed to assess various transportation measures against a series of objectives set for a clear definition of the problem to be addressed. These objectives comprise environmental, social equity and economic considerations beyond the confines of the traditional cost-benefit approach.

CAF methodology is now evolving into a tool that facilitates not only the comparison of transportation measures on an equal basis across a wide range of topics, but also to assist in the formulation of transportation measures and the manner in which they are packaged into transportation strategies. The appraisals are consequently dealing with a variety of modes of transport and policy/fiscal measures.

The UK approach to the environmental assessment of highways schemes is described in the Highways Agency Design Manual for Roads and Bridges (DMRB), Volume 11 (1993). This Manual specifies the approach to the assessment of highway alignment options (Stage 2 assessments) and the environmental design and assessment of the preferred scheme (Stage 3 assessments). The Manual does not, however address the potential environmental impacts associated with different means (different modes of transport) for addressing a transportation problem. For non-highway projects, an ad hoc approach to assessment based upon DMRB has tended to be adopted due to the lack of comprehensive guidance.

In the Roads Review "A New Deal for Trunk Roads in England" (DETR, 1998a), the Government announced that it would also be taking forward a programme of Multi-Modal Studies (MMS). The aim of these studies is to examine the contribution that each of the transportation modes in major urban areas or inter-urban corridors can make to tackling the most urgent strategic transportation problems. In parallel, a New Approach to Appraisal (DETR, 1998b) was developed to assist in choosing between different options for solving transport problems and for prioritising between proposals.

Partly in response to the above developments, partly in response to the forthcoming Strategic Environmental Assessment Directive, and partly due to recognition that there was lack of guidance on environmental assessment methodologies to address inter-urban Multi-Modal Studies, the Transport Research Laboratory (TRL) was commissioned by the Highways Agency to investigate methodologies. Arising from this first phase, an Interim Guidance Note was prepared. TRL was then appointed to prepare a detailed guidance manual for Multi-Modal Environmental Assessment.

This paper explores some of the emerging issues associated with the development of MMEA methodologies and the Guidance Manual in particular, it then highlights how some were addressed in the pioneering M4 – South Wales Common Appraisal Framework.

## 1. INTRODUCTION

This paper provides a brief review of the evolution of Common Appraisal Frameworks from an urban transportation arena into an inter-urban scale tool. This process has been accompanied by a variety of different studies increasingly with a multi-modal transportation focus. With this diversity of methodologies so Government has responded with a series of new assessment methodologies. This paper provides a review of the new policy environment that is also aiding the development of strategic environmental assessment in national and local transportation planning in the form of Multi-Modal Studies and Local Transport Plans, before considering the New Approach to Appraisal. Following an outline of the key elements of the Guidance on Methodology for Multi-Modal Studies, it considers the approach being taken to the development of the Guidance Manual for Multi-Modal Environmental Assessment (MMEA). The MMEA Guidance Manual is expected to emerge as a new Volume to the Design Manual for Roads and Bridges and focus upon Strategic Environmental Assessment and its role in Multi-Modal Studies.

The paper provides a brief introduction to the issues that are being addressed during the research to develop the Guidance Manual. Some of the methodological issues associated with the strategic environment assessment of transportation policies, plans and programmes that the Guidance Manual will address are outlined. Then the experiences associated with the M4 South Wales Common Appraisal Framework are presented as an illustration of how some were addressed in this pioneering study.

It should be noted, that as the work on the Guidance Manual is at an early stage, some of the information presented in this paper is likely to evolve. Also, the views presented in this paper are those of the author alone and should not be taken to represent those of the Highways Agency or the Department of Transport, Environment and the Regions.

## 2. MULTI-MODAL PLANNING EXPERIENCE IN THE UK

Early attempts to establish common appraisal frameworks for the different transport modes commenced with Cost Benefit Analysis (COBA) studies undertaken in the 1970's. Historically, however, the appraisal of different transport modes has been on a separate and non-comparative basis. In the early 1990's, the City of Birmingham and Centro, a transport provider led the search for a framework to appraise urban transportation proposals on a common basis. The development of the package approach to transportation planning within Transport Policies and Programmes then led the Department of Transport to encourage the use of common appraisal frameworks in 1993. Consequently, appraisal techniques widened from their COBA roots and began to address the environmental and social dimension in a more robust manner.

In recent years, the Common Appraisal Framework (CAF) methodologies have been developed to assess various transportation measures against a series of objectives based on a clear definition of the problem to be addressed. These objectives comprise environmental, social equity and the distribution of costs and benefits, as well as economic considerations beyond the confines of the traditional cost/benefit approach.

CAF methodologies are now evolving into tools that facilitate comparison of transportation measures on an equal basis over a wide range of topics. The methodologies also assist the process by which transportation measures are formulated and packaged to create the transportation options being investigated to address urban, inter-urban and transport interchange transport problems.

It is helpful to develop a typology of different appraisals in order to provide a basis for exploring some of the methodological issues that arise. Table 1 represents a preliminary attempt to classify some of the UK studies.

**Table 1: Preliminary Classification of Multi-Modal Appraisals in the UK**

Scale	Policy/Plan/Programme
<b>National</b>	<ul style="list-style-type: none"> <li>• Roads Review</li> <li>• New Approach to Appraisal</li> </ul>
<b>Regional/County</b>	<ul style="list-style-type: none"> <li>• Strategic Environmental Assessment in the Trans-Pennine Corridor</li> <li>• Dorset County Joint Structure Plan Appraisal</li> <li>• Gloucestershire BPEO Transportation Framework</li> </ul>
<b>Inter-Urban Corridors</b>	<ul style="list-style-type: none"> <li>• Setting Forth</li> <li>• M4 Newport/South Wales – RSPB</li> <li>• M4 Motorway South Wales CAF</li> </ul>
<b>Urban</b>	<ul style="list-style-type: none"> <li>• London Assessment Studies</li> <li>• M2 Motorway/Channel Tunnel Rail Link Cumulative Assessment</li> <li>• East Thames Crossing Appraisal</li> <li>• Leeds Transport Study</li> <li>• West Midlands CAF</li> <li>• Salisbury Transport Study</li> <li>• Warrington Transport Study</li> </ul>

These studies identified above evolved different approaches to reflect the particular circumstances in which they were being applied. For example, the Roads Review uses a multi-criteria appraisal approach to assess the relative performance of schemes within the English Roads Programme. Since the scheme proposals within the Roads Review have typically completed the Stage 2 - corridor studies or Stage 3 - scheme design assessments, there is a considerable amount of information available on which to perform the appraisal. Others have been applied to highway proposals with differing levels of available information. For example, the Dorset County Council study examined some 25 transportation proposals to test their case for continued inclusion in the Structure Plan using an objective-led approach. Some of the schemes had been subject to an environmental assessment, while others were simply indicative alignments on plans dating back over 40 years. The methodology needed to span the different levels of scheme knowledge.

The M4 Motorway Common Appraisal Framework prepared for the Welsh Office, involved the evaluation of various transportation measures including traffic management, public transport proposals, as well as the proposed M4 Relief Road as a means to address anticipated congestion on the M4 at Newport. It was the first CAF to examine inter-urban issues. Consequently, the large geographic study area raised many methodological issues for the environmental assessment.

Over the years, CAF methodologies have evolved into a tool that facilitates comparison of transportation measures on an equal basis over a wide range of topics for a variety of geographic scales (urban, inter-urban and transport interchange transport problems). They also assist the process by which transportation measures are formulated and packaged to create the transportation options being investigated. Given this evolution there has been a diversity of methodologies, but generally they have adopted an objective-led approach. Given the Multi-Modal characteristics of the potential solutions now being examined, so these investigations are increasingly being termed Multi-Modal Studies.

### **3. EVOLVING ASSESSMENT METHODOLOGIES**

#### **3.1 New Policy Environment**

The 1998 Transport White Paper on the Future of Transport, "A New Deal for Trunk Roads in England" highlighted the necessity of delivering an integrated transport policy. This situation required the development of a new approach designed to draw together the information gathered in the appraisal of

transportation problems and alternative solutions. From then, transportation projects are to be evaluated against the following five criteria:

- Integration;
- Safety;
- Economy;
- Environment, and
- Accessibility.

The White Paper 'A New Deal for Transport' included a commitment to give top priority to maintenance and management of the Highway Network rather than new road construction, with a programme of carefully targeted capacity improvements.

### *National Transportation Networks*

To address criticism of the Roads Programme and to reduce expenditure, a comprehensive review of the Roads Programme identified 17 problems on the trunk road network which were to be subject to Multi-Modal Studies. These studies are to be taken forward by the Government Offices in partnership with the Regional Planning Bodies. Later increased to 18, these studies are due to commence in two tranches, the first 12 commencing during the second half of 1999 (see Table 2).

**Table 2: Programme of English Multi-Modal Studies**

Tranche 1	Tranche 2	Tranche 3
West Midlands to NW Conurbation;	Southampton to Folkestone;	A34 North from Southampton
London Orbital	London to South Midlands;	A47 West of Norwich
Access to Hastings	West Midlands to Nottingham;	A North of Newcastle
Tyneside;	London to Reading;	
West Midlands Area;	Hull;	
South and West Yorkshire Motorway Box;	London-Ipswich	
London to SW and South Wales;		
North South Movements in East Midlands;		
South East Manchester;		
Cambridge to Huntingdon;		
A453 (MI -Nottingham);		

Multi-Modal Studies are intended initially to focus upon the specific problems in the trunk road network identified in the 1998 Roads Review. The studies will consider a variety of civil and non-civil engineering solutions. All modes are to be considered, as well as non-transport policies such as land-use, health and education. The focus is not necessarily upon ways to increase road capacity. Future studies would address other problems and opportunities on the transportation networks.

The Government Offices and Regional Planning Bodies are charged with the responsibility of identifying appropriate multi-modal transport solutions to these defined problems incorporating consideration of social, economic and environmental impacts. Future Multi-Modal Studies would be instigated and led by the Regional Planning Bodies.

The Multi-Modal Studies are expected to generate a set of strategies or plans for their respective study areas. Strategies would consist of a series of policies to influence the use made of the transportation system. Such strategies could involve transportation policies, land use policies, as well as policies for major users of the transportation system e.g. health and education. Plans could comprise a series of specific and individual transportation measures, such as traffic calming, junction improvements, new rail services, and information systems etc.

It is envisaged that the outputs from the Multi-Modal Studies will always include a plan for specific transportation measures, while in the case of some studies, it may also be appropriate to provide over-arching strategies. Whatever policies and transportation measures are proposed from the Multi-Modal Studies, they are to be developed within the framework set by the Regional Planning Guidance and development plans. They are then to be used in developing and reviewing the Regional Transport Strategies.

In developing transportation measures for consideration within the Multi-Modal Studies, some measures will previously have been developed to a point where the statutory procedures may be implemented. Others, however, will be newly formulated and will need to be developed to a level of detail to ensure that robust decisions can be made and that decisions may be defended at a public examination or inquiry. The Multi-Modal Studies are envisaged to require over a year to undertake depending upon their study area.

### ***Local Transportation Networks***

While problems on the national trunk road network are now to be subject to Multi-Modal Studies, local authorities have embarked upon the preparation of a new style of Local Transport Plans, replacing the Transport Policies and Programme system. The Government's White Paper on the Future of Transport, now requires local authorities to deliver integrated transport through these new Local Transport Plans.

The importance of appraisal has been highlighted in guidance issued for the preparation of Local Transport Plans. This states that in seeking specific funding for major public transport and road schemes, the local authority must demonstrate that the scheme is necessary for achieving the objectives of the Local Transport Plan and *than it cannot be done in other ways*. Schemes are also to be properly integrated with measures to promote modal shift. Local authorities are expected to demonstrate that they have explored the scope for alternative solutions that do not involve major new construction, e.g. demand restraint and have taken account of the strong presumption of avoiding environmentally sensitive sites. Central to the new approach is:

- A fundamental review of transport strategy;
- Demonstration of consistency with the Government's transport objectives;
- Establishment of local transport targets;
- Extensive participation by transport operators, business, health and education sectors as well as the public;
- Emphasis upon management rather than construction of major schemes;
- Demonstration that alternatives have been examined.

## **3.2 Evolving Role for SEA**

It is evident from the preceding sections that the traditional approach to transportation, focusing upon the development of highway schemes, is changing with greater flexibility in design standards, and recognition that single solutions may not address current problems. Many of the transportation strategies to be evaluated within a Multi-Modal Study are likely to include non-engineering solutions such as demand/traffic management, or at least incorporate a variety of modes (including walking), in addition to construction projects. This calls for a change in the approach to option assessment exercises to one which is more iterative, with several cycles of assessment separating the technical or practical aspects of

implementation from the political aspects of implementation associated with procedures, levers, and the willingness to use financial instruments.

Clearly, environmental issues are a key component in this new approach. In having a focus upon policies and plans across wide geographic areas, so the current stock of EIA methodologies, as presented in Volume 11 of the Design Manual for Roads and Bridges (DMRB), have been found to be deficient for Multi-Modal Studies.

Additionally, experience with EIA has demonstrated that its use in individual transportation measures can be too late to tackle long-term, cumulative, and global or policy issues, such as the effects of traffic growth and atmospheric emissions or changes in land use. This focus upon individual measures results in a number of limitations, namely:

- Consideration of **alternatives** is limited;
- Consideration of **cumulative effects** of different elements of a transport infrastructure programme is difficult;
- Scope for **mitigation** is limited to the particular project being examined;
- Opportunities for **public involvement** in policy debate may be limited (witness the length of public inquiries in the UK).

Given these developments and the increased emphasis upon sustainable development, increased interest in Strategic Environmental Assessment has been stimulated in the UK.

### 3.3 New Appraisal Methodologies

The 'New Approach to Appraisal' (NATA) was developed to provide a broad based appraisal and to help inform the prioritisation of trunk road investment proposals in the Roads Review, and is considered suitable for use in the planning and development of a wide range of road investment proposals. It has as its core the five Government principles, environment, safety, economy, accessibility and integration.

The new approach as applied to road investment is set out in 'A New Deal for Trunk Roads in England: Guidance on the New Approach to Appraisal' and the companion document 'Understanding the New Approach to Appraisal' (DETR, 1998). The New Approach to Appraisal (NATA) is primarily concerned with the way in which information generated by existing appraisal techniques is used to inform the decision making process. Originally for highways, NATA has now been developed for application to Multi-Modal corridor and other studies. This appraisal technique will also be modified for use with Local Transport Plans.

NATA provides for the identification and assessment of problems, the identification of options and their subsequent assessment. An important element is the inclusion of an Appraisal Summary Table (AST). This is a one page tabular summary of the main economic, environmental and social impacts of a transport option (see Table 3). The AST sets out, on one page, the key consequences of different options for tackling a particular transport problem using the five Government objectives that have been divided into sub-objectives. The AST does not make judgements about the relative value to be put on the criteria, nor does it provide a mechanistic means of delivering a decision. Instead, the AST simply summarises the effects in each area so that decision-makers have a clearer and more transparent basis on which to make such judgements.

The multi-modal version of the AST is designed to present information under the following objectives and sub-objectives:

- **Environment** – to protect the built and natural environment;
  - to reduce **noise**;
  - to improve **local air quality**;
  - to minimise **climate change**;
  - to protect and minimise impacts on the **landscape**;
  - to protect and minimise impacts on the **townscape**;
  - to protect and minimise impacts on **heritage**;
  - to protect and minimise impacts on **biodiversity**;
  - to minimise impacts on **water resources**;
  - to minimise other **health** impacts;
  - to improve the **quality of journey**.
  
- **Safety** – to improve safety;
  - to reduce **accidents**;
  - to improve **security**.
  
- **Economy** – to support sustainable economic activity and get good value for money:
  - to improve **transport economic efficiency**;
  - to provide net benefits to users;
  - to provide net benefits to operators;
  - to provide net benefits to Government.
  
- **Accessibility** – to improve access to facilities for those without a car and to reduce severance:
  - to improve **access** to the transport system;
  - to increase **option values**;
  - to reduce **severance**.
  
- **Integration** – to ensure that all decisions are taken in the context of the Government’s integrated transport policy:
  - to improve **transport interchange**;
  - to integrate transport policy with **land use policy**;
  - to integrate transport policy with **other Government policies**.

**Table 3: Appraisal Summary Table**

Proposal name		Option description		
<b>PROBLEMS</b>		<b>Statement of problems</b>		
<b>OTHER OPTIONS</b>		<b>List of other options that have been, or could be, tested</b>		
<b>OBJECTIVES</b>		<b>QUALITATIVE IMPACTS</b>	<b>QUANTITATIVE MEASURES</b>	<b>ASSESSMENT</b>
<b>ENVIRONMENT</b>  CO <sub>2</sub> : <i>xxx tonnes added or removed</i>	<b>Noise</b>		No properties experiencing: - Increase in noise    xxx - Decrease in noise    xxx	Net xxx properties Experience <i>higher</i> Noise levels
	<b>Local air quality</b>		No properties experiencing: - better air quality    xxx - worse air quality    xxx	+/-xxx PM10 +/-xxx NO <sub>2</sub>
	<b>Landscape</b>		Not applicable	<b>Moderate adverse</b>
	<b>Biodiversity</b>		Not applicable	<b>Neutral</b>
	<b>Heritage</b>		Not applicable	<b>Moderate beneficial</b>
	<b>Water</b>		Not applicable	<b>Large adverse</b>
<b>SAFETY</b>			Accidents Deaths Serious Slight xxx    xxx    xxx    xxx	PVB £xxm xx% of PVC
<b>ECONOMY</b>	<b>Journey times &amp; Vehicle operating costs</b>		Trunk road journey time savings: Peak xxx mins; inter-peak xxx mins	PVB £xxm xxx% of PVC
	<b>Cost</b>		Not applicable	PVC £xxm
	<b>Journey time reliability</b>		Stress on key trunk road link: Before xxx%; After xx%	<b>Moderate beneficial</b> <i>Small rel to PVC</i>
	<b>Regeneration</b>		Serves regeneration priority area? Development depends on scheme?	<b>Yes</b> <b>No</b>
<b>ACCESSIBILITY</b>	<b>Pedestrians &amp; Others</b>		Not applicable	<b>Slight beneficial</b>
	<b>Access to public transport</b>		Not applicable	<b>Moderate beneficial</b>
	<b>Community severance</b>		Not applicable	<b>Large adverse</b>
<b>INTEGRATION</b>			Not applicable	<b>Positive</b>
<b>Version of date</b>	Cost benefit analysis:		<b>PVB £xxxm    PVC £xxxm    NPV £xxxm    BCR x x</b>	

The New Approach to Appraisal adopts a series of appraisal thresholds, indicators and predictive techniques for each subsidiary environmental objective. These are summarised below and are drawn from the road-based NATA documentation.

- **Noise:** Only situations where a change in traffic volume of more than 10% are reported, except where proposals would either introduce or eliminate significant queuing. Residential properties experiencing changes greater than 3 dB(A) are to be counted, separately identifying increases and decreases. The net number of residential properties with a greater than 3 dB(A) change in noise levels between the do minimum and the proposal is to be recorded.
- **Air Quality:** Using the same screening threshold of 10% as with noise, the assessment is to be carried out for the year 2005, so that compliance with the National Air Quality Strategy can be qualitatively assessed. Emissions of PM<sub>10</sub> and NO<sub>2</sub> are to be calculated using the DMRB air quality assessment methodology and the number of properties within 50m bands extending from the road up to 200m are to be calculated using a weighting factor. Proposals resulting in a change greater than 2 ug/m<sup>3</sup> of PM<sub>10</sub> and an increase in NO<sub>2</sub> of at least 2 ppb where the road is above the NAQA NO<sub>2</sub> objective of 21 ppb are to be accompanied by a qualitative comment. The total emissions of CO<sub>2</sub> are also to be recorded.
- **Landscape:** Landscape issues are generally relevant where proposals involve new land-take, although measures affecting highway planting or significantly affecting external appearance of the road, such as gantries and masts are to be examined. The approach establishes the landscape character and its environmental capital through a series of descriptors. Each feature or attribute is then assessed using a series of landscape criteria.
- **Biodiversity:** Biodiversity is generally relevant where proposals involve new land-take, although measures affecting protected species or habitat within the highway estate may also be important. The Appraisal Framework specifies several items of information that are required. The New Approach to Appraisal notes that it is not realistic to assess the ecological impact based on set rules in terms of the percentage of a feature's area affected. Instead, the impact of a proposal on a site should be considered using the concepts of significance and integrity.
- **Heritage:** Generally heritage issues are considered to be relevant where proposals involve new land-take, although some measures may affect the setting of sites of heritage value. A similar approach is taken as with landscape in that a series of attributes are to be detailed.
- **Water:** A risk-based approach to assess potential negative impacts of proposals on the water environment is used alongside consideration of the scope for design and mitigation measures and the likelihood that the proposal will reduce existing risks to the water environment. To facilitate the assessment, water criteria have been further divided into:
  - Water quality; and
  - Land drainage/flood defence.

The potential to cause harm is judged to be high where AADT flows in excess of 30,000 occur or where land-take is in excess of 40 ha. Where a proposal involves any of the following elements then an additional risk is considered to occur:

- Route crosses, or is in the close proximity (250m) of a landfill site or contaminated land;
- Involves realignment of a watercourse;
- Requires major cuttings or embankments;
- Needs significant infrastructure during construction (haul roads and so on);
- Incorporates a tunnel.

- **Safety:** The New Approach to Appraisal requires the numbers of accidents and casualties, as well as the monetised present value of accident reduction benefits.
- **Economy:** The ability of the proposal to contribute to economic efficiency and to support sustainable economic growth in appropriate locations is considered through four criteria:
  - Journey times and vehicle operating costs;
  - Scheme construction and maintenance costs;
  - Journey time reliability; and
  - Regeneration.
- **Accessibility:** Within accessibility three aspects are to be considered:
  - Pedestrians and others;
  - Access to public transport;
  - Community severance.
- **Integration:** This criterion covers transport policies and proposals (all motorised and non-motorised modes, not just road-based); proposals by transport providers; as well as development proposed under the land use planning system. Policies and proposals that are facilitated or hindered by a scheme are to be identified and should be divided into transport and land use, and into local, regional and national contexts. An overall assessment of the transportation measure's performance on policy grounds is to be made.

## 4. DEVELOPMENT OF MULTI-MODAL GUIDANCE MANUALS

### 4.1 Guidance on Methodology for Multi-Modal Studies (GOMMMS)

The DETR is currently in the final stages of publishing Guidance on the Methodology for Multi-Modal Studies. This guidance provides an overview on the entire process and some detailed guidance upon specific aspects, particularly transportation and land use modelling, as well as appraisal techniques for each of the Government's objectives for transport. The Guidance document comes in two volumes, Volume 1 being intended for all parties involved in Multi-Modal Studies, whereas Volume 2 provides technical guidance primarily for the consultants commissioned to undertake the studies.

The methodology detailed within the Guidance presents advice on a series of steps to be taken. These steps are presented in Table 4. The environmental assessment guidance is strongly based upon the environmental capital approach with worktables in which to transfer the results eventually into the Appraisal Summary Tables.

**Table 4: Steps in the Multi-Modal Study Process**

Step	Activity
1.	Establish local regional or study-specific objectives
2.	Develop an understanding of the current situation in terms of: <ul style="list-style-type: none"> <li>• Current transport and other policies impacting transport;</li> <li>• Opportunities and constraints;</li> <li>• Current travel demands and levels of service;</li> <li>• Current transport-related problems.</li> </ul>
3.	Understanding the future situation in terms of: <ul style="list-style-type: none"> <li>• Future committed land uses and policies;</li> <li>• Future committed transport system changes;</li> <li>• Future travel demands and levels of service;</li> <li>• Future transport-related problems.</li> </ul>
4.	Undertake consultations, participation and information assembly
5.	Identification of potential solutions
6.	Defining the information needed to apply the appraisal framework
7.	Establishing the methods by which the information is to be provided through: <ul style="list-style-type: none"> <li>• Transport model or land-use/transport interaction model;</li> <li>• Environmental impact assessment procedure;</li> <li>• Cost/benefit analysis procedure;</li> <li>• Geographic information system</li> </ul>
8.	Costs of implementation, operation maintenance and enforcement are to be defined
9.	Option testing and appraisal
10.	Distillation and comparison of options
11.	Consultations on options
12.	Study outputs
13.	Review funding sources to confirm option feasibility
14.	Formulation of implementation programme

## 4.2 Guidance Manual for Multi-Modal Environmental Assessment (MMEA)

As there was little detailed guidance available on how to address environmental assessment within the Common Appraisal Frameworks or the evolving Multi-Modal Studies, TRL were requested by the Highways Agency in 1998 to undertake research into this aspect and to provide interim guidance for the environmental aspects of such studies. As a further dimension, the research was also to investigate how the emerging EC Directive on Strategic Environmental Assessment could be addressed within the new framework of transportation planning by the regional planning bodies. The purpose of this research was to:

- Identify the most appropriate methodology for the SEA of transportation proposals;
- Identify what further work is required to produce a guidance manual for MMEA, taking into account DMRB Volume 11, EC Directive 97/11 and the work undertaken on the Appraisal Summary Table.

TRL completed this research in April 1999 and published the results in a report titled “The Environmental Assessment of Multi-Modal Transport Schemes – Phase 1”. TRL also produced an Interim Guidance Note on the Strategic Environmental Assessment of Multi-Modal Transport Studies that is currently with the Highways Agency. The Interim Guidance Note addresses key stages in the assessment process from problem identification, objectives setting, scoping, baseline data needs and assessment of transportation options. Finally, advice is provided on reporting the results as part of the Multi-Modal Study, while meeting the potential requirements of the proposed SEA Directive.

The term Multi-Modal Environmental Assessment evolved during this work and is taken to encompass both the investigations into the environmental effects of various strategies, plans and programmes needed to address transport problems on the trunk road network and also the traditional project design process where they have multi-modal characteristics. The traditional 3 stages presented in DMRB were found to be restrictive, particularly as a new series of activities were effectively to proceed DMRB Stage 1 activities.

Following from the initial research, TRL are now working with the Highways Agency to develop detailed environmental assessment methodologies to address Multi-Modal Studies at the SEA level. A new guidance manual is expected to emerge in the second half of next year, to be published as a Volume of DMRB. While a seven Part process was proposed during the initial research, this has now been revised to be a 10 level process. These Levels comprise:

- **Level 1:** Commence Regional Transportation Strategy/Regional Planning Guidance Cycle;
- **Level 2:** Undertake Multi-Modal Studies;
- **Level 3:** Finalise Regional Transportation Strategy/Regional Planning Guidance;
- **Level 4:** Evaluation of design and implementation alternatives of transportation measures;
- **Level 5:** Selection of preferred transportation measures/implementation programme;
- **Level 6:** Undertake transportation design, environmental assessment and consent processes;
- **Level 7:** Public Inquiry and announcement;
- **Level 8:** Transportation measure design and tender/implementation process;
- **Level 9:** Construction/implementation;
- **Level 10:** Post-project evaluation.

The key research activities to be undertaken during the current Phase 2 of the commission are as follows:

- Review relevant guidance documentation and experience on individual topic areas;
- Identify relevant case studies and illustrative materials for inclusion within the Guidance Manual;
- Consult with relevant experts, user groups, transport authorities, statutory consultees, government offices and NGOs on environmental assessment methodologies and to take account of relevant work undertaken in Europe and North America; and
- Development of a cumulative assessment methodology for transportation studies;
- Integration with NATA and the Appraisal Summary Table;
- Report in October 1999 the results of these investigations.

The third Phase involves development of methodologies to a point that they can be included within the Guidance Manual. It is suggested that the methodologies proposed should pass several tests, namely:

- Be transparent without undue assumptions that could put the overall outcome of the appraisal at risk;
- Avoid undue data collection bearing in mind the prospect that further studies and environmental investigations are likely to be necessary at the project level;
- Recognise that variations may be necessary to accommodate the different geographic scales to which the Multi-Modal Studies are being applied;
- Avoid bias in favour one mode over another;
- Interface with transport modelling data; and
- Are easily understandable by both the decision-makers and the public

**Table 5: Outline Multi-Modal Environmental Assessment Procedures**

Regional Planning Guidance Process	Transportation Planning Process	Level	MMEA Activities	Reporting	SEA/EIA	
<b>Commence Regional Transportation Strategy/Regional Planning Guidance Cycle</b>						
Issues Identification	<ul style="list-style-type: none"> <li>Establish stakeholder groups</li> <li>Issue identification</li> <li>Define Multi-Modal Study areas</li> </ul>	<b>Level 1</b>			<b>STRATEGIC ENVIRONMENTAL ASSESSMENT</b>	
Set Objectives	<ul style="list-style-type: none"> <li>Set environmental, transportation, economic, land use and social objectives</li> </ul>					
Preliminary Strategy/ Guidance	<ul style="list-style-type: none"> <li>Establish preliminary regional transport strategy</li> <li>Undertake sustainability appraisal</li> </ul>			<ul style="list-style-type: none"> <li>Sustainability Report</li> <li>Preliminary RTS/RPG</li> </ul>		
<b>Undertake Multi-Modal Studies</b>						
	<ul style="list-style-type: none"> <li>Identify potentially viable transportation measures</li> <li>Package transportation measures into options/ strategies for evaluation</li> <li>Define the do minimum scenario</li> </ul>	<b>Level 2</b>	<ul style="list-style-type: none"> <li>Scoping of potential impacts</li> <li>Contribute to specification of transportation measures</li> <li>Formulate environmental do minimum</li> <li>Liaise with Consultative Environmental Forum</li> <li>Establish framework for cumulative effects</li> </ul>	<ul style="list-style-type: none"> <li>Liaise with Consultative Environmental Forum</li> <li>Multi-Modal Study Scoping Report</li> </ul>		
	<ul style="list-style-type: none"> <li>Conduct surveys to assemble modelling data</li> <li>Assess effects of transportation measures</li> <li>Review viability of transportation measures</li> <li>Re-package viable transportation strategies and conduct sensitivity testing</li> </ul>		<ul style="list-style-type: none"> <li>Environmental surveys and data assembly</li> <li>Forecast environmental effects</li> <li>Conduct cumulative effects assessment</li> <li>Identify scope for mitigation/enhancement of transportation measures</li> <li>Evaluate against objectives</li> </ul>	<ul style="list-style-type: none"> <li>Liaise with Consultative Environmental Forum</li> </ul>		
	<ul style="list-style-type: none"> <li>Appraise performance of transportation strategies/ measures and identify preferred strategy</li> </ul>		<ul style="list-style-type: none"> <li>Identify best practical environmental strategy</li> <li>Assist in identification of preferred strategy</li> <li>Outline performance indicators and monitoring need</li> <li>Contribute to MMS report and Appraisal Summary Table</li> </ul>	<ul style="list-style-type: none"> <li>Liaise with Consultative Environmental Forum</li> <li>Publish draft and final SEA/NTS</li> <li>Publish MMS report and Appraisal Summary Table</li> </ul>		

Regional Planning Guidance Process	Transportation Planning Process	Level	MMEA Activities	Reporting	SEA/EIA
<b>Finalise Regional Transportation Strategy/Regional Planning Guidance</b>					
Draft RTS/RPG	<ul style="list-style-type: none"> <li>Sustainability appraisal</li> </ul>	Level 3	<ul style="list-style-type: none"> <li>Test strategy against sustainability objectives</li> </ul>	<ul style="list-style-type: none"> <li>Public draft RTS/RPG</li> <li>Publish sustainability appraisal</li> </ul>	DECISION MAKING PROCESSES
Public examination	<ul style="list-style-type: none"> <li>Public review</li> </ul>		<ul style="list-style-type: none"> <li>Possible expert witness role</li> </ul>		
Final RTS/RPG	<ul style="list-style-type: none"> <li>Secretary of State decision on preferred transportation strategy</li> </ul>			<ul style="list-style-type: none"> <li>Publish final RTS/RPG</li> </ul>	
<b>Evaluation of Design and Implementation Alternatives of Transportation Measures</b>					
Specify transportation strategy objectives	<ul style="list-style-type: none"> <li>Identify design and implementation alternatives</li> <li>Initial engineering designs of alternatives</li> <li>Engineering and transportation data assembly</li> </ul>	Level 4	<ul style="list-style-type: none"> <li>Confirm environmental objectives and study boundaries</li> <li>Input into design and implementation alternatives</li> <li>Identify environmental design issues and assemble baseline information</li> </ul>	<ul style="list-style-type: none"> <li>Liaise with Consultative Environmental Forum</li> <li>Publish Alternatives Scoping Report</li> </ul>	ENVIRONMENTAL ASSESSMENT
	<ul style="list-style-type: none"> <li>Forecast transportation and economic effects for design and implementation alternatives</li> <li>Identify engineering/institutional constraints to design/implementation of measures</li> <li>Appraise implementation of transportation strategy</li> </ul>		<ul style="list-style-type: none"> <li>Forecast environmental effects of design/implementation alternatives</li> <li>Identify mitigation/enhancement measures</li> <li>Outline performance indicators and monitoring needs</li> </ul>		
	<ul style="list-style-type: none"> <li>Appraise design/implementation alternatives against objectives</li> <li>Specify sequencing of multi-modal measures</li> </ul>		<ul style="list-style-type: none"> <li>Appraise design/implementation alternatives against environmental objectives</li> <li>Identify Best Practical Environmental Option</li> </ul>	<ul style="list-style-type: none"> <li>Contribute to design alternatives report and Appraisal Summary Table</li> </ul>	

Regional Planning Guidance Process	Transportation Planning Process	Level	MMEA Activities	Reporting		
<b>Selection of Preferred Transportation Measures Design/Implementation Programme</b>						
	<ul style="list-style-type: none"> <li>Public consultation/exhibitions</li> <li>Report on outcome of public consultation</li> <li>Investigate any new alternatives</li> <li>Report to Minister/RPS on preferred design/implementation alternatives</li> </ul>	Level 5	<ul style="list-style-type: none"> <li>Contribution to publicity materials</li> <li>Representation at exhibitions</li> <li>Investigate any new alternatives</li> <li>Contribution to public consultation report</li> </ul>	<ul style="list-style-type: none"> <li>Publish public consultation report</li> </ul>	ENVIRONMENTAL ASSESSMENT AND CONSENT PROCESSES	
Decision on preferred design/implementation sequence	<ul style="list-style-type: none"> <li>Ministerial decision and announcement</li> </ul>					
<b>Transportation Measures Design, Environmental Assessment and Consent Processes</b>						
	<ul style="list-style-type: none"> <li>Undertake geophysical, topographical and hydrological surveys as appropriate</li> <li>Engineering design and transportation modelling</li> <li>Update traffic forecasts and economic appraisal</li> </ul>	Level 6	<ul style="list-style-type: none"> <li>Up-date baseline survey with detailed surveys as necessary</li> <li>Refine environmental impact predictions</li> <li>Develop of mitigation/enhancement measures in parallel with engineering design activities</li> </ul>			
Prepare for consents process	<ul style="list-style-type: none"> <li>Prepare for consent procedures</li> </ul>		<ul style="list-style-type: none"> <li>Prepare Environmental Statement and Non-Technical Summary</li> <li>Obtain clearances for publication of Environmental Statement and Non-Technical Summary</li> </ul>	<ul style="list-style-type: none"> <li>Publish Environmental Statement and Non-Technical Summary</li> </ul>		
	<ul style="list-style-type: none"> <li>Organise publicity campaign</li> <li>Hold public exhibition as appropriate</li> <li>Support public consultation/objection process</li> </ul>		<ul style="list-style-type: none"> <li>Contribute to publicity materials</li> <li>Representation at exhibitions</li> <li>Contribute to public consultation report</li> <li>Contribute to resolution of objections</li> </ul>	<ul style="list-style-type: none"> <li>Publish public consultation report</li> </ul>		

Regional Planning Guidance Process	Transportation Planning Process	Level	MMEA Activities	Reporting	SEA/EIA
<b>Public Inquiry and Announcement</b>					
	<ul style="list-style-type: none"> <li>Develop objector's alternatives and advertise for counter-objections</li> <li>Prepare evidence</li> <li>Issue Public Notice of Inquiry and Rule 5 Statement</li> <li>Hold Public Inquiry</li> </ul>	Level 7	<ul style="list-style-type: none"> <li>Assist in development of objector's alternative</li> <li>Prepare evidence</li> </ul>	<ul style="list-style-type: none"> <li>Public inquiry evidence</li> </ul>	DECISION MAKING PROCESS
Announcement of decision	<ul style="list-style-type: none"> <li>Ministerial review of Inspectors Report</li> <li>Ministerial decision letter published</li> <li>Orders made as necessary</li> </ul>				
<b>Transportation Measure Design and Tender/Implementation Processes</b>					
	<ul style="list-style-type: none"> <li>Complete design and cost estimates to level necessary for tendering process</li> <li>Agree advance works</li> <li>Develop tender/implementation documentation</li> </ul>	Level 8	<ul style="list-style-type: none"> <li>Specify advance works for environmental mitigation/enhancement</li> <li>Review advance works tender for environmental management clauses</li> </ul>		ENVIRONMENTAL MANAGEMENT
	<ul style="list-style-type: none"> <li>Review tenders</li> </ul>		<ul style="list-style-type: none"> <li>Review environmental management procedures of tenders</li> </ul>		
<b>Construction/Implementation</b>					
	<ul style="list-style-type: none"> <li>Supervision of works</li> <li>Hand-over to maintaining/operating authority</li> </ul>	Level 9	<ul style="list-style-type: none"> <li>Review performance of environmental management system</li> </ul>	<ul style="list-style-type: none"> <li>Publish environmental monitoring reports</li> </ul>	ENVIRONMENTAL MANAGEMENT
<b>Post-Project Evaluation</b>					
	<ul style="list-style-type: none"> <li>Monitoring performance indicators</li> <li>Identification of additional measures</li> </ul>	Level 10	<ul style="list-style-type: none"> <li>Evaluate against sustainability indicators</li> <li>Post-project audits of predictions</li> <li>Review of predictive techniques</li> </ul>	<ul style="list-style-type: none"> <li>Sustainability monitoring reports</li> <li>Post-project audit reports</li> </ul>	ENVIRONMENTAL MANAGEMENT

The Guidance Manual is intended to:

- Provide guidance on how to address uncertainty, cumulative and synergistic effects both for and between individual topics for Levels 1 to 3 of the MMEA process;
- Advise on the extent to which significance criteria can be developed to ensure consistency in the assessment process;
- Advise on the manner in which mitigation strategies may be addressed at a strategic level bearing in mind the concept of tiering and the potential for individual projects to require an EIA;
- Produce a cost-effective and pragmatic framework for the environmental appraisal of multi-modal transportation options at a strategic level appropriate to different geographic and decision-making exercises applicable to Levels 1 to 3 of the MMEA process.

The final phase is that of reporting, with a draft Guidance Manual to be available by June 2000. It is envisaged that this document would be sent out to a wide range of interested parties and organisations for their comments. Comments raised would be discussed at the final NGO Environment Committee Meeting and Steering Group Meeting in August before a final approved Guidance Manual is produced in September 2000.

The Guidance Manual is envisaged to comprise three Sections, A) presenting an overview; B) providing procedural details, while C) details the predictive techniques and assessment methodologies for a series of topic areas. Each of the topic areas has been grouped into the following three Topic Guidance areas:

- **Topic Guidance 1:** Air Quality, Water, Noise and Health;
- **Topic Guidance 2:** Soils, Natural Resources, Waste, Agriculture, Landscape/Townscape, Cultural Heritage, Ecology and Biodiversity;
- **Topic Guidance 3:** Community Effects, Accessibility, Severance, Effects on Travellers and Non-Motorised Users, Land Use and Integration

The scope of each of these Topic Guidance Areas is outlined in the following sections.

### *Topic Guidance 1: Air Quality, Water, Noise and Health*

- **Air Quality:** In the case of air quality, the selection of appropriate indicators of global, regional and local air quality will be undertaken with advice generated on they should be calculated. This will require consideration of emission factors for the different modes. It has been determined only to consider emissions at the point of use rather than including emissions from power stations. There is also a need to promote predictive techniques that reflect the quality of input data and avoid spurious numerical differentiation of transportation options. A key issue is likely to be the selection of the assessment year(s) and the mechanisms for comparison with National Air Quality Standard (NAQS) especially given differing averaging periods for different pollutants. Linkages with health impact assessment are to be developed.
- **Water:** A risk-based approach is being investigated that recognises that many of the issues are resolved at the project design stage. This does not mean that they are ignored at a policy, plan or programme levels, especially as the extent to which mitigation measures are available can have an important bearing upon the acceptability of a particular transportation measure. The extent to which the water quality predictive techniques presented in DMRB Volume 11 can be customised for use in MMEA is also to be investigated.
- **Noise and Vibration:** Many of the same issues arising with air quality are associated with the examination of the acoustic implications of transportation measures. In addition, there is the added complication of different types of noise whether from air, rail or road and also their different means of calculation. The methodologies are also to consider effects upon tranquil areas that may be sparsely populated, but have a recreational or amenity value. A coherent methodology is required that will enable changes in noise levels to be examined as a part of the Multi-Modal Studies. This

may imply that the length of sensitive frontage along the transportation network experiencing various changes in noise levels should be recorded. This however, generates issues concerning the relationship with the transportation models and the extent to which it is necessary to establish the actual relationship between the noise source and the receiver. Linkages of noise and vibration effects to health impact assessment are also to be explored.

- **Health Impact:** Health benefits and dis-benefits accrue from different transport modes with cycling and walking being promoted as part of the national health initiatives. While accident statistics are estimated within the economic modelling that accompanies transportation projects, these do not provide for any spatial or temporal analysis of the situation, nor do they present a classification by community area or grouping. Equally, changes in air quality associated with transportation measures are not currently translated into health statistics, which may be possible at a regional level. The recent WHO methodology for linking vehicle emissions to health will be explored and utilised as appropriate. Other accident risks may be associated with use of different modes of transport and the fear of crime on public transport networks.

### *Topic Guidance 2: Soils, Natural Resources, Waste, Agriculture, Landscape/Townscape, Cultural Heritage, Ecology and Biodiversity*

- **Natural Resources and Soils:** The consumption of natural resources in various transportation measures would be investigated, as would extent to which different soils can be taken to be indicative of difficult engineering situations with associated environmental risks.
- **Waste:** The topic of waste has several facets, one is the generation of wastes associated with the provision of new infrastructure, while the other is the wastes associated with use of the transportation networks. Here issues may relate to the quantities of waste generated and particular disposal issues. It is by no means clear whether consideration of waste is an appropriate issue for the Multi-Modal Studies.
- **Agriculture:** The assessment of the effects upon the agricultural resource is likely to be based upon an appreciation of likely land take from different grades of agricultural land, although the changing policy context will need to be recognised.
- **Landscape/Townscape:** In this area the Guidance Manual must examine not only the implications of civil engineering measures, but also the effects from changes in traffic within the transportation network. For example, transportation measures may lead to more traffic passing through a Conservation Area or through other areas of high landscape value.
- **Cultural Heritage:** Given the issue of unknown archaeological features, there is a need to investigate how far the traditional approach to archaeological investigations can be sustained in the Multi-Modal Studies. The development of a risk-based approach to archaeology will be explored.
- **Ecology and Biodiversity:** The current methodological focus upon designated sites will be challenged with the potential to make greater use of Biodiversity Action Plans, Local Environment Agency Plans, as well as the Environmental Capital approach. The manner in which ecological risks are framed is to be considered. A simple presentation of land take may not encompass temporary disturbance during construction, or more likely the indirect effects that arise from severance or damage to the ecological interest.

### ***Topic Guidance 3: Community Effects, Accessibility, Severance and Effects on Travellers and Non-Motorised Users, Land Use and Integration***

The community effects of the transportation measures being examined within a Multi-Modal Study comprise a series of traditional consequences explored below. They may also include a new range of issues associated with the imperative to promote social inclusion. Transportation projects can have a particularly important role in the evolution of a community. Changes in transportation systems may give rise to the potential for greater commuting distances and pressures upon the housing markets. Such effects may, however, be difficult to capture. The topics addressed comprise:

- **Accessibility:** Under the topic of accessibility the focus is upon the 'ease of reaching' various facilities or contacts by all modes of transport. While there are clearly boundary issues to be addressed between the MMEA and the transportation studies, the extent to which aspects not addressed within the transportation modelling need to be captured or re-interpreted to provide added value will be explored.
- **Community Severance:** Community severance is traditionally based upon a qualitative assessment of the impact of new roads upon the numbers of pedestrians affected and changes in severance levels. While some infrastructure represent relatively impermeable barriers to non-motorised movement, e.g. rail, others cause delay and increased risk. Both aspects will be explored.
- **Non-Motorised Users:** The issue with this topic is at what scale and in what manner is it possible to capture issues associated with the length and quality of non-motorised journeys. Also, the extent to which these issues should be addressed within MMEA at the different geographic scales will be addressed.
- **Land Use:** Two aspects are to be considered. The first relates to the physical aspects arising from alterations in land use associated with transportation. The second dimension is to develop methodologies to capture the effects of transportation patterns and induced traffic upon future development patterns and to examine such effects in terms of Regional Planning Strategies and development plans. The extent to which models may be available to examine land use change is to be investigated.

**Integration:** Focussing upon development plans and array of other policy guidance that is available, guidance would be provided on how to assemble the policies into a limited set that can be used to assess the relationship the transportation options and their individual measures have with such policies.

The integration objective relates to a spectrum of issues associated with the potential for all modes, either in isolation or in combination with one another, to contribute to the achievement of objectives. It is also concerned with the interaction between transport and the wider issues of Government policy such as environmental sustainability and health, as well as the interaction with land use policies and proposals and with proposals concerning other transport modes. It has a wider coverage than formally adopted plans and includes Local Transport Plans and proposals by operators and developers, as well as those proposed by land use planners. One clear linkage to be investigated is how to address the perceived benefits of improved transportation systems upon regeneration initiatives.

## **5. METHODOLOGICAL ISSUES**

In developing the MMEA Guidance Manual there are a series of generic methodological issues that need to be addressed. These are as follows:

- Geographic scale;
- Selection of objectives and indicators;
- Thresholds and significance criteria;
- Assessment year;
- Do minimum;
- Cumulative effects;

- Mitigation measures;
- Methodological transparency;
- Public consultation and reporting.

## 5.1 Geographic Scale

Multi-Modal Studies may be applied to transportation issues at a variety of scales from a trans-regional scale - such as the Trans-Pennine Study; sub-regional scales such as the M4 Newport CAF and urban scale studies. In the case of the M4 Motorway CAF for Newport, the area of environmental interest extended from Cardiff to the Severn Estuary and northwards to Abergavenny, Ebbw Vale and Merthyr Tydfil. Public transportation measures extended the area of environmental interest to include rail improvements beyond South Wales. The geographic area(s) established for the environmental assessment must be defined with care as:

- It bounds the areas in which effects are identified;
- It influences the complexity of the appraisal;
- It dictates the data assembly tasks;
- It has an influence upon the indicators selected;
- It has relevance to the assignment of significance.

As some transportation measures addressing a local problem may only be viable as part of a wider transportation strategy, such as electrification of an entire rail line, so the study area may extend beyond its original geographic focus. The issue is then how the costs and benefits, both financial and environmental arising from such up-grading should be allocated within the study even though they would be delivered to all users of the rail line and adjacent environmental features, not just those within the study area. Essentially, at what point should the assessment cease to consider geographically remote second order consequences? Also, effective solutions may be available beyond the administrative domain of the organisation investigating the transportation problem.

Difficulties in selecting an appropriate geographic scale for the appraisal are magnified where several alternative corridors affecting urban areas are being examined, such as towns on inter-urban routes. The desire may be to focus the transportation model upon the inter-urban movement patterns, and hence devote limited coverage to the interactions with the urban movement patterns. Also, transportation modelling resources may be saved by superficial modelling of peripheral routes. As a consequence any traffic reassignments to these routes cannot be fully appraised from an environmental perspective.

Linked with the geographic scale is the extent to which transportation modelling considers the different transportation networks. Often the modelling techniques are based upon highway modelling techniques with the focus being upon the principal transportation corridors, ignoring the effects upon the local road hierarchy and other more diffuse movement patterns taken by cyclists or pedestrians. This then makes consideration of the cumulative environmental consequences of the transportation options under consideration upon the different transportation networks difficult.

## 5.2 Selection of Objectives and Indicators

Many of the Common Appraisal Frameworks adopt an objective-led approach where the transportation measures are evaluated against a series of environmental, transportation and economic objectives.

The selection of objectives and indicators can be a process open or closed to the public. Currently, however, the public has little involvement in the definition or validation of such objectives, with each study formulating its own objectives and indicators in a vacuum, drawing upon a variety of policy documents as considered appropriate. There is a need to isolate a set of core objectives, indicators and targets that are set nationally. These may then be apportioned to reflect the scale or characteristics of the study area. A further set of regional or sub-regional indicators are also required to properly consider the environmental issues associated with the study area and the transportation measures being evaluated.

While technical decisions on the selected environmental indicators abound, the following principles should be accommodated wherever possible:

- Be quantified so that the performance of transportation options can be measured;
- Assist in the discrimination between transportation options;
- Be accepted as a fair representation of the likely environmental performance;
- Be understandable, realistic and at a level of detail relevant to the decisions being made;
- Have identifiable thresholds or guidance characteristics to enable performance to be assessed consistently;
- Rely upon information that is easily available;
- Be intelligible to the lay person so that robustness of the conclusions can be transparent.

Clearly, there is a need to be pragmatic in setting the objectives and indicators if for no other reason than the cost and effort needed to generate appropriate modelled outputs. As a result, the relationship between transportation modelling and the MMEA should be recognised early in the studies. Indeed, data needed to address the key objectives and indicators should drive the transportation model rather than the other way around. Nevertheless, the indicators must be realistic and be capable of being assessed using the data and models that are available within the timescales and resources of the study. Hence less than ideal environmental indicators may be an inevitable outcome of resource and scheduling constraints.

It should also be recognised that indicators may change as a transportation measure passes through the different levels in the MMEA process, as the understanding of the environmental conditions or transportation measures and their effects evolve. This should be allowed for in the methodology.

There is a risk that indicators for transportation, economic and environmental effects may experience some degree of double counting. For example, financial benefits from accident reductions are included within the economic appraisal of the transportation measures, while the environmental and social indicators may also consider accident black spots and community safety issues. While it is good practice to avoid double counting in different parts of the evaluation process, a pragmatic approach is needed which allows Multi-Modal Studies and environmental assessments to present effects in ways that are a meaningful exploration of the issues, even where this results some degree of double counting.

During the development of the Guidance Manual, the following aspects will be explored in relation to the setting of Environmental Objectives and Indicators:

- Identify mechanisms by which strategic objectives set by the Regional Planning Body can be translated into testable objectives for use in the Multi-Modal Studies.
- Advise on the practicalities of subjecting the environmental objectives to public review;
- Explore the extent to which local objectives ought to be incorporated into the appraisal methodologies and the mechanisms by which they should be assembled.
- Advise on appropriate specifications for environmental performance indicators used to test the performance of the transportation options against the achievement of the environmental objectives.
- Explore whether the extent to which a prescriptive list of objectives and indicators is appropriate to ensure consistency and transparency across Multi-Modal Studies.
- Explore whether there should be a limit on the number of objectives and indicators employed in order to focus upon outputs for NATA and the AST.

### **5.3 Thresholds and Significance Criteria**

In order not to overload the appraisal, as well as to prevent timescales and resource inputs being extended, thresholds are needed beneath which investigation is not required. For example by focussing only upon highway corridors with movements in excess of 1000 vph. The main difficulty here, is the

need to recognise the potential for synergistic and cumulative effects that may arise from effects beneath the selected threshold.

One of the hardest tasks is to establish significance criteria for the effects of the transportation strategies being assessed. As with project level EIAs, environmental effects may vary in geographic scale, time period, duration and their reversibility. Also, not all objectives and indicators will be of equal importance to the decision making process. Consequently, the following issues arise:

- How should significance take account of effects that arise at different points in time?
- How should “red flag” or “show stopper” effects be addressed?
- What sort of significance scale is appropriate?
- How should the significance of cumulative and synergistic effects be addressed?

#### **5.4 Assessment Year**

Project level environmental assessments are based upon an appreciation of the existing environmental conditions and the opening year and design year of a scheme (typically 15 years) with and without the proposal. This strategy is not easily adopted in the strategic environmental assessment of transportation measures as the assessments may be faced with different transportation measures that may be capable of implementation at different time periods. This raises the question of not only the timing of transportation benefits, but also the timing of any environmental effects.

The issue is made more complex, since the characteristics of the environmental effects are dependent upon the conditions in place at that time and there may be some interdependency between the transportation measures. For example, the introduction of a bus lane may increase congestion for a local community remote from the bus lane itself unless a further scheme with a longer implementation period, say a junction improvement, was in place.

The question is whether the assessment should focus upon a single assessment year in which all of the transportation proposals are assumed to deliver their full benefits, or whether a series of 5 yearly forecasts should be used to allow consideration of the timing of transportation and environmental effects. Then there is the need to relate the performance of the transportation measure to Government targets that are set for specific years. Each additional assessment year multiplies the amount of modelling needed, since a forecast is needed for each transportation measure being assessed and the Do Minimum scenario at each assessment year.

#### **5.5 Do Minimum**

A Do Minimum strategy is needed for appraisals and simply can be defined as the existing situation, plus those changes to the transport system which are currently committed. Typically, investigations of the following five main elements are needed to constitute to the transportation Do Minimum:

- Highways;
- Public transport;
- Freight;
- Non-motorised modes;
- Fiscal policy and cost trends.

The Do minimum must also be defined in terms of significant land use developments generating new origin-destinations and new elements in the transportation networks. Potentially, it should also address traffic management measures being considered to fulfil air quality management plans and any road traffic targets.

Unfortunately, the situation is more complex given the different ways in which highway and non-highway schemes are programmed. Considerable judgement is needed in defining the public transport

elements of the Do Minimum as bus and rail planning, which largely falls to the private sector, is typified by generally short time horizons with little forward planning. Consideration also needs to be given to those current transportation measures that may be at different stages of promotion and the prospects for their eventual adoption. The current perspective is only to include consented transportation projects.

In addition to the transportation Do Minimum, it is necessary to define an environmental Do Minimum. This can become a complex task depending upon the geographic extent over which transportation and environmental effects may be anticipated, and the design year(s) on which the appraisal is to be based. An understanding of environmental trends will need to be established within the SEA to cover potentially wide geographic areas.

## **5.6 Cumulative Effects**

Within the context of Multi-Modal Studies, multiple transportation measures are to be investigated as solutions to transportation opportunities or problems. Measures somewhat remote from the target transportation issue may be candidates for consideration. Some of these actions may be outside the study area if their influence extends for considerable distances and length of time. It is also possible that the transportation solutions being investigated will comprise a variety of measures taking on a variety of forms including civil and non-civil engineering solutions that are implemented within differing timescales and different areas. In a transportation planning sense, it is the cumulative effects of these measures that are being sought as solutions to the transportation problem(s).

The cumulative consequences of transportation measures upon the different levels of transportation networks are rarely explicitly considered. Instead, the focus is upon principal transport corridors to the detriment of effects upon the local road hierarchy and other more diffuse movement patterns taken by public transport, cyclists or pedestrians. This situation arises due to the difficulties associated with data availability and suitability, as well as the models used. As indicated earlier, the use of thresholds to restrict the analysis may also result in difficulties in examining cumulative consequences.

Given this context, it is appropriate that attention is given to incorporating cumulative environmental effects into environmental planning and management in order to move towards sustainable development. The only difference is that the effect of other actions on valued resources, as well as those forecast from the transportation strategy/measures are compared to thresholds or policies in order that the implications may be assessed. Although the cumulative effect on a valued resource due to many actions must be identified, the assessment must also make clear to what degree the transportation strategy/measure under review is alone contributing to that total effect.

It is impractical to consider all potential cumulative effects, consequently, scoping is required to limit the studies to that which can be meaningfully evaluated. Such scoping must also recognise that the resources being considered transcend administrative boundaries and operate at their own peculiar geographic scales. The analysis must respect such considerations and focus upon what is needed to ensure long-term productivity or sustainability of the resource. The role of environmental capital comes to the fore in this regard.

## **5.7 Mitigation Measures**

Where significant cumulative effects are anticipated, the assessment should seek to avoid, minimise, or mitigate adverse effects by modifying the transportation measures or by adding additional alternative measures to the analysis. In seeking to mitigate cumulative effects, often the same type of mitigation/enhancement and monitoring that would be recommended in an EIS would be appropriate. However, mitigation/enhancement and monitoring may also require measures to be applied to actions other than the transportation strategy/measure(s) under investigation. Also, measures may be required to respond to effects remote from the proposed location of the transportation measures.

It is probable that some measures may only be capable of being delivered by parties other than the proponent of the transportation strategy/measure(s). Or alternatively, several administrative jurisdictions and stakeholders may be involved and hence the co-operation of these other interests is needed to ensure that the mitigation/enhancement or monitoring measure is successfully implemented. In these situations, partnerships with local agencies and transport providers are needed. They should also direct further monitoring, other effects-related research, as well as promote the benefits of controls incorporating environmental protection into all planned development.

Recommendations for partnerships of this type may be the only means of addressing complex cumulative effect issues. It is generally unreasonable to expect a single proponent to bear the burden of mitigating effects attributable to other actions in the study area. Often it is more practical and appropriate for regulatory agencies to initiate and help implement these area-wide initiatives, with project proponents providing data relevant to the effects arising from their actions.

While mitigation measures should generally be directed towards the resource being affected or the action causing the effect, the concept of "no-net loss" may be an appropriate mitigation measure in response to area-wide cumulative effects. No-net loss requires that any resource disturbed from its pre-action condition be "replaced" with an area of equivalent capability to ensure that sustainable use of the resource is maintained.

As most transportation measures being evaluated during a MMEA Level 2 assessment, generally have not been optimised from either a transportation or environmental perspective, reflecting their level of design detail, so the appraisal must consider how to evaluate the resulting effects. For example, should the mitigation measures be assumed to be provided or should the assessment be of an unmitigated state?

From a MMEA Level 2 assessment perspective, as there is no certainty that the mitigation concepts would necessarily be included with the transportation measures at the consent stage (MMEA Level 6), it would appear dangerous to base the assessment on a mitigated measure. Equally, it would overplay the adverse effects and underplay the positive consequences if the scope for project optimisation was not recognised. Hence, it is suggested that mitigation/enhancement measures should not be incorporated into the assessment of significance of the cumulative effects during Level 2 assessments, but a clear recognition of the potential for further optimisation to take place should be provided. The only situation where this may be undertaken is when there is absolute certainty that the measures would be implemented and it is fundamental to a quantitatively different outcome. In such situations, a separate option for evaluation should be generated around the transportation measure comprising the mitigation/enhancement measure.

It is appropriate for MMEA Level 2 activities to identify the monitoring programmes needed at other Levels in the process. The key components of a monitoring programme focusing upon cumulative effects are:

- Measurable indicators of the magnitude and direction of change;
- Appropriate timescales;
- Appropriate spatial scales;
- Methods by which causality can be established;
- Appropriate measurement methodologies;
- Cost-effectiveness;
- Institutional arrangements to facilitate monitoring, data assembly and response measures.

Reporting of the assessment should clearly state where mitigation/enhancement and monitoring measures are appropriate and also clearly state that they have not been incorporated into the assessment of significance. The only exception is in the case of options that specifically have been generated to comprise such measures.

During Level 4 and Level 6 of the MMEA process, increasing confidence can be placed on the delivery of mitigation/enhancement/monitoring measures and hence they may be incorporated in the analysis with increased justification. Indeed, during the project level EIA, mitigation/enhancement/monitoring measures should be fundamentally incorporated into the design such that the assessment of significance is on the residual effects after mitigation.

## 5.8 Methodological Transparency

The extent to which an Appraisal Framework is methodologically transparent is likely to be crucial to the acceptability of the results. Factors affecting transparency include:

- **Assumptions and Uncertainty:** As the Multi-Modal Studies address policies, plan and programmes, there will often be variations in the design detail available for the transportation measures. For example, in the initial round of Multi-Modal Studies the road schemes will have generally been developed to a level of detail able to sustain an Environmental Statement. Consequently, there is a risk of implicit bias given the disparities in technical detail associated with each transportation measure, necessitating assumptions on the characteristics of the transportation measures. Potential uncertainty also exists in the data sets describing the environmental setting. Hence assumptions will be required.
- **Scoring and Weighting Ranking Systems:** Differences in methodologies emerge at the evaluation stage, where the various environmental effects are, in some cases, combined to provide an aggregate judgement of performance. Some approaches adopt a numerical scoring system where, for example, the number of properties experiencing visual intrusion is translated into a score on a pre-defined range. Others present quantified data and make qualitative judgements of performance. The issue is whether Appraisal Frameworks should place indicator values on a common basis, with standardised scales, or whether simple absolute data should be presented?

## 5.9 Public Consultation and Reporting

Common Appraisal Frameworks, as indicated earlier in the paper are at the core of Strategic Environmental Assessment (SEA) practice for the transportation sector, but as yet, there is no established mechanism for public involvement. It is only where the Appraisal Framework links with an existing statutory process, such as the Structure Plan process, or is called on to justify a civil engineering solution which must pass through a consent process that the Appraisal Frameworks are open to public examination. As options are being foreclosed through the SEA process, ought there also to be some element of public involvement?

As indicated in the MMEA process table (Table 1), the Regional Transport Strategy, being a component of the Regional Planning Guidance will be subjected to Public Examination, but what role should the public have during the actual process, particularly when a large geographic area may be involved. As yet, there is no established mechanism for public involvement within Multi-Modal Studies and it remains to be seen what innovative approaches will be adopted.

Questions exist, such as whether the public should be involved in the establishment of the objectives set for the Appraisal Frameworks, or at least whether a mechanism should be put in place to determine their relative priorities and concerns? How should issues of blight and uncertainty be handled when transportation measures are being discussed? Environmental Assessments are rightly being criticised for being too technocratic, it would appear that SEAs for the transportation sector risk the same criticism.

## 6. M4 SOUTH WALES COMMON APPRAISAL FRAMEWORK

To conclude this paper, a brief review of the first inter-urban Common Appraisal Framework is presented in order to illustrate some the methodological issues indicated above.

## 6.1 Background

In response to anticipated congestion on the M4 motorway in the vicinity of Newport, South Wales, the Welsh Office were proposing a new motorway, the M4 Relief Road, to the south of Newport, but traversing several Sites of Special Scientific Interest. Investigations had reached DMRB Stage 3 – scheme design and assessment. These studies commenced at a time of increasing public concern about road proposals in general the environmental consequences of the proposed M4 Relief Road in particular. Consequently, the Welsh Office commissioned a pioneering Multi-Modal study which had a study area extending from the Severn Estuary to Cardiff and northwards to the Heads of the Valley (see Figure 1). The study now rests with the Welsh Assembly for consideration.

## 6.2 Geographic Study Area

Key to the common appraisal activities is the transportation modelling process. For the M4 study, the transportation model addresses movements across a wide area extending from Swansea to Bristol, the Heads of Valley and Gloucester. Rail connections extended along the Great Western Railway and also to Birmingham.

Using estimates of the amount of change in road or rail traffic that would be required to generate a significant effect, the geographic study area was focussed upon the following four broad character zones:

- North of Newport;
- the M4 corridor;
- Newport;
- Magor, Gwent Levels and Castleton.

The topography of the study area exhibits a sharp contrast between uplands to the north and fenlands (Gwent Levels) bordering the Severn Estuary to the south. The largest urban concentration is at Newport in the centre of the area, bisected by the River Usk. The remainder of the study area is largely rural with settlements at Magor and Caldicot in the east, Caerleon and Malpas in the north, and ribbon settlement to the west of Newport along the valley of the Ebbw River. A significant feature to the east of Newport, on the edge of the Levels, is the Llanwern Steelworks.

To model transportation flows at this regional scale, inevitably meant that there was some reduction in the local accuracy of assignments away from the M4 motorway in the vicinity of Newport. Consequently, the ability of the transportation model to provide data sets for the urban area of Newport was restricted and it was necessary to identify specific transportation links that were of environmental interest, such as Conservation Areas. The spatial scale of the model also meant that turning movements at junctions could not be provided and hence local air quality concentrations could not be calculated. Instead, reliance was placed upon total emission assessments along sections of the network.

## 6.3 Indicator Selection

In developing indicators for the M4 study, the following aspects were taken into account:

- Reflect the five over-arching Government objectives;
- Minimise double counting;
- Use established methods of appraising the relevant impacts; and
- Present a concise overall assessment.

The environmental performance indicators were selected to be:

- Quantifiable so that the performance of transportation options, particularly in relation to targets, can be measured;
- Understandable, realistic and at a level of detail relevant to the decisions being made.

- Minimise data collection activities utilising outputs from the transportation models wherever possible.

In seeking comparability of assessment between transportation options and different modes, it was necessary to develop indicators that address environmental effects, rather than those that reflect the location of features of interest in relation to the transportation networks. The environmental objectives and indicators adopted in the M4 study are presented in Table 6. The various transportation options under consideration were then evaluated against these objectives extending beyond the traditional economic and transportation appraisal techniques that were formerly so dominant. The results were then reported in an Environmental Summary Table to enable those indicators that had no bearing on the option selection process to be removed from further consideration.

The process of reducing the fourteen indicators to a core set to present in the summary report to decision makers proved to be one of the challenging aspects of the study. While those indicators which failed to provide any basis for discriminating between the transportation options were easily eliminated, others proved to be more problematic. While the noise and vibration indicator was considered to be worthy of reporting, in practice, the nature of assumptions taken in its calculation meant that its use as a headline indicator could not be sustained. Also, as some indicators were essentially telling a similar story to decision-makers, surrogates were selected to summarise other sets of indicators.

#### **6.4 Thresholds and Significance Criteria**

The Institute of Environmental Assessment (IEA) Guidelines for the Environmental Assessment of Road Traffic advises that a change of traffic flows of 10% can be used as a threshold for determining environmental change in a sensitive area, with 30% being used in other situations. As many of the highways in the vicinity of the M4 can be viewed as being sensitive given the proximity to residential property, schools, hospitals etc, a 10% figure was selected. Where a change in traffic flow of less than 10% from the do minimum forecast then no significant change was assumed to result.

As an increase in 18 hour traffic flows of at least 25% or a reduction of 20% is needed to give rise to a 1dB(A) change in noise levels, it was considered unlikely that any transportation measures would result in such a change. Nevertheless, to accommodate uncertainty in both the transportation modelling and the derivation of an 18 hour flow from the peak hour flows, a 20% change in the am peak hour flow was been selected.

A change in the number of trains along existing routes would alter the number of acoustic events, but would be unlikely to give rise to a significant change in overall noise levels. As a result, the appraisal focused upon new sources of rail noise and existing lines where the change in the number of train paths exceeds 25%.

#### **6.5 Assessment Year**

The Appraisal Framework was faced with the transportation options that are capable of implementation in different time periods. This raised the question of not only the timing of transportation benefits, but also the timing of any environmental effects. The issue was however, addressed by the greater imperative to secure consistency with the existing M4 Relief Road investigations and to obviate any additional dimensions to the appraisal which would not aid decision-making. Hence an appraisal year of 2007 was been selected.

#### **6.6 Do Minimum**

The Do Minimum Scenario comprised measures within the highways, rail and freight networks that potentially alter the state of the environment from the present day. These were as follows:

**Table 6: M4 CAF Objectives and Strategic Indicators**

Issue	Objective	Strategic Indicator
<b>ENVIRONMENT</b>		
Noise & Vibration	Traffic noise levels in the vicinity of transportation infrastructure are minimised (EO1)	* Length of main transportation network with a change in noise levels
Air Quality	Total greenhouse gas emissions from transport are minimised (EO2).	* Change in CO <sub>2</sub> emissions in the regional transportation model area
	Any increase in the acidification loading due to transport is minimised (EO3).	* Change in NO <sub>x</sub> emissions in the regional transportation model area
	Emissions from transport affecting local air quality are minimised (EO4).	* Percentage change in total emissions of NO <sub>x</sub> within Newport
Landscape/ Townscape	Minimise adverse change in designated or historic landscapes (EO5).	* Area of transportation infrastructure affecting designated or historic landscapes
Biodiversity/ Nature Conservation	Minimise any adverse effects on the integrity of designated sites of national importance (EO6).	* Area of transportation infrastructure affecting designated sites * Extent of direct or indirect risk to designated sites
	Minimise adverse effects upon locally designated sites of irreplaceable value (EO7).	* Area of sites of local ecological value directly or indirectly affected
Cultural Heritage	Minimise adverse affects on the integrity of nationally designated sites of cultural heritage (EO8).	* Number of SAMs or conservation areas experiencing a change in their setting
Water Resources	Minimise any increase in the susceptibility of land use activities to flood risks (EO9).	* Area of floodplain occupied by new transportation infrastructure
<b>ACCESSIBILITY</b>		
Community Severance	To reduce community severance or conflict between motorised and non-motorised travellers (EO11).	* Length of transportation infrastructure with a change in severance
<b>INTEGRATION</b>		
Land Use, Plans and Policies	Minimise the need for property demolition or land take (EO12)	* Potential for property to be demolished or relocated
	Maximise support to transportation, land use planning, environmental sustainability and health policies (EO13).	* Extent to which plans and policies are assisted or hindered
Resource Use	Minimise the amount of energy consumed by the transportation network (EO14).	* Change in the consumption of energy within the regional transportation network.
Construction	To minimise risk of extensive construction disturbance to sensitive features (EO15)	* Area of major construction works within 100m of properties or designated sites

Note: Transportation infrastructure includes all transport related works having a discernable physical presence and applies to cycle routes, bus routes, pedestrian facilities and traffic management measures as well as roads and railways.

## *Highways*

The following schemes were included within the Do Minimum, but none were considered to affect the environmental performance of the transportation measures from a physical dimension (traffic related effects are addressed through the traffic model):

- Upgrading Junction 28 - Tredegar Park;
- M4 Widening Castleton - Coryton;
- Cardiff PDR - Eastern Bay Link Road;
- Newport Southern Distributor Road;
- A465 Heads of the Valleys Dualling.

## *Rail*

The rail network was characterised in four separate sections to comprise the Valley Lines emanating northwards from Cardiff through to Caerphilly and Pontypridd, the main line from Cardiff to Newport, the section from Newport to Bristol and finally from Newport to the Midlands.

## *Freight*

The Do Minimum assumed that there would be a 72% increase in HGV traffic between 1996 and 2031 with articulated vehicles expected to increase by 131%. It is also assumed that trend towards larger road vehicles will continue. In terms of rail freight the South Wales European Railfreight Terminal at Wentlooge has been approved and would amount to 160 HGV movements per working day. The implications of changes in the rail freight movement patterns were that this would amount to approximately 3 additional freight trains per day using the main line.

## *Environment*

An environmental Do Minimum was developed drawing upon the development plans for the area, which were unfortunately being revised. Nevertheless, allocations of land within the Gwent Levels for further industrial development were counted as being within the Do Minimum. Existing trends were assumed to continue for other environmental features.

## **6.7 Cumulative Effects**

Cumulative effects were only partly explored in the Assessment Framework. One of the key areas for cumulative effects was the interaction of the Newport Southern Distributor Road within the Do Minimum scenario with the Road Building option comprising the M4 Relief Road. As these roads would in parallel through a section of the Gwent Levels SSSI, so there were several cumulative effects. For example, the Southern Distributor was assumed to affect the drainage network of the SSSI such that the M4 Relief Road would not have the same effect. Also, the isolated land between the roads was, in areas, considered no longer to be viable due to the combined severance that would result. The effect of industrial development to the west of Newport and the Southern Distributor Road was also considered to degrade an impaired section of the historic landscape, such that the consequences of the M4 Relief Road were in this area were reduced.

## **6.8 Methodological Transparency**

While the CAF methodology avoided any numerical scaling or manipulation of numbers, issues of clarity did emerge in the resulting data for the air quality and noise indicators. For example, while the analysis for the noise indicator produced quantified outputs, because of the large assumptions needed to estimate the change in noise levels, it was considered that they were not sufficiently robust to constitute a headline indicator.

A further complication arose in relation to air quality, where the indicator selected was that of the length of highway with a change in NO<sub>x</sub> concentrations from the Do Minimum. On completion of the forecasts, it was apparent that simply presenting the net change across the highway network risked mis-representing the situation. For example, it was not obvious whether a scenario with a small change generated over a large area, was to be preferred over one with a large change over a smaller length of the highway.

## 7. CONCLUSIONS

The key conclusions to emerge from this review of emerging UK practice in SEA are:

- There are a wide variety of appraisal frameworks being formulated serving different needs;
- The use of SEA is likely to expand;
- Setting appropriate geographic boundaries is crucial if all significant effects are to be captured;
- Clear definition of the transportation modelling functions to support the environmental assessment is needed;
- A lack of predictive techniques and evaluation methodologies is currently been addressed;
- The approach to SEA will need to be integrated into regional planning processes;
- There is a need for links with other appraisal methodologies e.g. sustainability appraisals;
- A lack of public consultation and reporting currently exists and there is a risk that SEA will become a technocratic exercise similar to that of EIA.

## REFERENCES

Department of Environment, Transport and the Regions, 1998a: Transport White Paper - The Future of Transport

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