

Final Report for Publication

SONERAIL

Project PL96-1038

Project

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Transport Research and Consultancy (TRaC)
University of North London

Partners:

University of Pardubice
Technische Universität Dresden
ZEUS European Economic Interest Group
Trasporti Mobilita Turismo Pragma Srl. (TMT)
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0. PARTNERSHIP

The SONERAIL Partnership comprises commercial organisations and Universities from the European Union and Eastern Europe, joining together to give a balanced consortium providing a range of skills and expertise from the transport sector.

The consortium consists of:-

<i>Partner</i>	<i>Country</i>
• Transport Research & Consultancy University of North London	United Kingdom
• NEI	The Netherlands
• Technical University of Dresden	Germany
• TMT Pragma Srl	Italy
• ZEUS EEIG	Greece
• University of Pardubice	Czech Republic

TRaC (Transport Research & Consultancy)

Full Name	Country	Type	Role
Transport Research & Consultancy (TRaC)	United Kingdom	EDU	Co-ordinator
Profile			
<p>TRaC (Transport Research and Consultancy) was established in 1989 as an independent research unit within the University of North London. TRaC is a multi-disciplinary research consultancy, which brings together a team of consultants, researchers and training staff involved within the field of transportation. Experience encompasses economics, finance, marketing, human resources, logistics, operational research, strategic policy and planning.</p> <p>A wide range of services are carried out by TRaC. These include research, consultancy projects, course design, and report/article publication. Due to the strength of expertise and range of experience of TRaC staff, we are able to facilitate project work in the following transport areas:</p> <ul style="list-style-type: none"> • the planning and evaluation of transport infrastructure projects; • environmental impact assessment techniques; • investment appraisal, such as cost benefit analysis; • economic and financial analysis of commercial operators; • equal opportunities issues in transport organisations; • the development of modern transport education in Newly Industrialised Countries. 			
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TUD (Technical University of Dresden)

Full Name	Country	Type	Role
Technical University of Dresden	Germany	EDU	Partner
Profile			
<p>The Department of Transportation sciences „Friedrich List“ has been founded in 1992 and continues the long tradition of research and education in transport sciences at the Dresden University of Technology as well as at the College for Transport and Communication.</p> <p>Within this department the Chair for planning of Transport and Infrastructure is a university research team with experience in urban and regional transport planning. Among other topics we are active in investigating interdependencies of urban structure and transport demand as well as in examining how to influence the development of urban and suburban areas by guideway transit.</p> <p>We have a 25-year experience with series of sample surveys based on home interviews. Other main research topics are the configuration of Public Transport facilities meeting the needs of elderly and disabled people and strategies for traffic avoiding or calming.</p> <p>Our research clients since 1990 are the Federal Ministry for Transport, several Saxon State Ministries as well as a number of local and regional authorities.</p>			
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Profile			
<p>TMT PRAGMA S.r.l. started in 1986 as a department of Pragma Ltd., and since 1990 has been an independent company within Pragma group. Its business policy is based on two main points:</p> <ul style="list-style-type: none"> • a selected "package of clients" with whom a continuous consulting relationship can be settled in order to enable a common growth; • the referral to highly specialised research staff performing new survey and data processing techniques, in order to provide clients' requirements with best quality oriented responses. <p>As regards data collection, TMT Pragma avails itself of the 20-year experienced staff of Pragma. In particular, as far as the delivery of the more and more requested telephone surveys is concerned, TMT Pragma pioneered the group by implementing the so-called CATI service (Computer Assisted Telephonic Interviews), which guarantees the best timing and high standard when performing telephone surveys.</p> <p>In recent years, it has established a team of highly qualified experts within the company's special fields of interest: transport, mobility and travel. As a result, over the last couple of years it has been involved in several EC research projects as leader or partner.</p> <p>Its involvement in projects at national level is still very high as shown by the participation at the major national project for a transport decision support software (SISD), financed by the Ministry of Transport.</p>			
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ZEUS European Economic Interest Group

Full Name	Country	Type	Role
ZEUS European Economic Interest Group	Greece	OTH	Partner
Profile			
<p>ZEUS European Economic Interest Group (E.E.I.G.), is a consortium of seven (7) leading companies located in different European cities, recognised officially by the EC in 1994. Its main specialisation is the provision of consultancy services based on its excellent information sources and expertise. The members of its staff share great experience and knowledge concerning the state of the art technology in the area of multimedia, communications, teleworking and support. Based on both the infrastructure and the human potential, different laboratories have been established within the ZEUS head quarters that serve as the place of development of any activity carried out by the group. ZEUS E.E.I.G. is actively involved in topics such as information handling, design and implementation of applications on research development and information technology, including: <i>Multimedia systems, Multimedia communications, Support technology, Teleworking (the first in Greece) Network communication.</i> ZEUS E.E.I.G. is actively involved in a wide range of EU programmes.</p> <p>ZEUS E.E.I.G. offers support in several transport areas including:-</p> <ul style="list-style-type: none"> • Transports and Economy of Transports • Analysis and Feasibility Studies • Air Traffic Control • Urban Transport and Metros • Railway Engineering • Highway Engineering • Pavement Design and Construction • Pavement Maintenance and Management 			
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Full Name	Country	Type	Role
University of Pardubice	Czech Republic	EDU	Partner
Profile			
<p>The Transport Faculty at the University of Pardubice provides education in the field of transport including transport theory, law, crisis management, rail and road operations, infrastructure, transport policy and EU legislation. The Transport Faculty has systematic links to other faculties of the University of Pardubice and consists of 6 Departments which provide further specialisation:</p> <p>Department of Transport Means; Department of Infrastructure; Department of Informatics in Transport; Department of Management, Marketing and Logistics; Department of Transport Techniques and Control; Department of Transport Means and Operational Reliability.</p> <p>The Department of Transport Marketing, Management and Logistics provides education in the field of economics, management science, marketing, logistics, psychology, sociology, accounting, finance, prognostics, statistics, European integration and transport policy. In September 1997 a sub-department for European integration was also established.</p> <p>Main areas of research are:</p> <ul style="list-style-type: none"> • regional mobility and interregional co-operation (especially cross border); • impact of Czech Railways (CR) accession on regional development; • theory of logistical systems; • theory of integrated transport systems; • quality, safety and reliability in transport; • transport and the environment; • harmonisation of legislation of CR and EU in the field of transport; • development of information and management systems in transport. 			
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1. EXECUTIVE SUMMARY

1.0 Background

The modal split in passenger movements has changed significantly over the last forty years and basically reflects the increase in car ownership. In the late 1960s car ownership rates began to rise sharply, partly because of increased consumer spending power and partly due to the decline in public transport services in rural areas. This has been accompanied by a continuing downward trend in passenger loadings by bus and rail which has reflected changes in Europe as a whole. While car travel has increased ten times, bus travel has halved. The number of rail journeys has also fallen, but passenger kilometres have increased slightly, primarily due to a concentration by national railways on inter-urban and cross-country business with a decline in rural branch lines as passengers made fewer but longer journeys.

The change in modal split is shown in Table 1 covering all 15 EU countries for the period 1970-94.

Table 1. EU 15 passenger transport - modal split of passenger kilometres (%)

	Car	Bus	Railways	Air
1970	75.1	12.5	10.3	2.1
1975	75.8	12.0	9.5	2.7
1980	76.9	11.4	8.5	3.2
1985	77.0	10.5	8.1	4.4
1990	79.0	9.0	6.9	5.1
1994	79.7	8.3	6.2	5.8

Source: European Commission (1996) "A Strategy for Revitalising the Community's Railways"; White Paper, COM(96) 421.

Several studies have identified that railways across Europe face problems due to the declining market share, lack of response to market changes and customers' needs along with and related high subsidy requirements and insufficient managerial independence. The EC White Paper "A Strategy for Revitalising the Community's Railways" concludes that a new kind of railway is needed allowing for more customer oriented services being provided less expensive, more efficient with less subsidy needed. Already a number of policy initiatives at national and European level are being implemented following the recommendations from the White Paper. This includes the framework for provision of public services. Increasingly, these should be provided through contracts between State and operator, rather than obligations imposed by the State. The key elements in these contracts are planned to be better value for money, more efficient services, with explicit and transparent compensation and limited time contracts. This development is supported through the EC Council Regulation 1893/91 although this regulation allows for continued public service obligations with respect to "...undertakings confined to the operation of urban, suburban and regional services..".

SONERAIL should be seen in relation to these changes as a study concerned with providing clarity regarding the definition of socially necessary rail services as well as the evaluation criteria to be used in relation to determine the value generated through the provision of such services. This information is of crucial importance regarding the specification of public service contracts.

1.1 Overall aim and objectives

The overall aim of SONERAIL can be stated as follows:-

“to examine the role of socially necessary rail services in order to improve the decision making basis regarding the provision and funding of such services”

In particular, the project seeks to clarify how socially necessary rail services should be defined and the evaluation criteria to be used in relation to their provision. A number of specific objectives were identified for the SONERAIL project:-

- define concepts of socially necessary rail services
- develop evaluation methodology for socially necessary rail services
- apply evaluation methodology
- identify and examine operations scenarios

The accomplishment of these objectives will enable SONERAIL to provide recommendations regarding the provision of socially necessary rail services.

Apart from these objectives it has also been of importance to the SONERAIL Consortium to collaborate extensively with external parties including railway operators, funding and regulatory authorities, transport ministries, user groups, universities and research institutes. This collaboration has been undertaken in order to ensure the relevance of the research findings and to obtain access to information and data of importance for the study. Furthermore, it has been an objective to carry out dissemination activities during the life time of the project such that information about research findings will reach a wider audience among interested parties within the transport field in general and rail in particular.

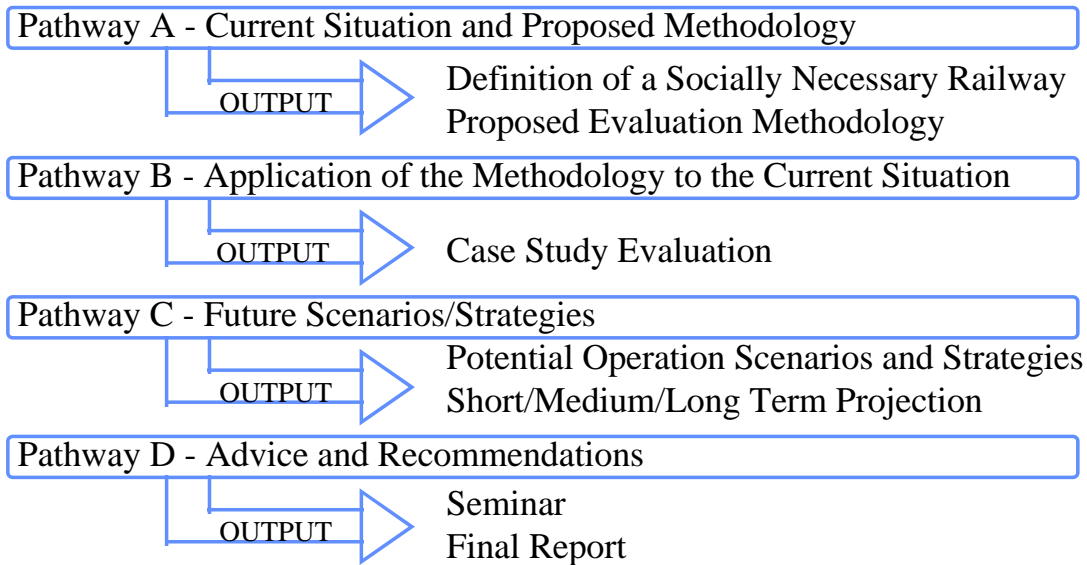
The focus of the research has been identified as:-

- passenger transport not freight
- rail services not infrastructure
- demand side rather than supply side
- heavy rail with other forms seen as alternative public transport provision
- the countries represented in the SONERAIL Consortium

1.2 Project structure

The fulfilment of the SONERAIL objectives has been ensured through a comprehensive work programme addressing the key issues in relation to socially necessary railways. This work programme comprises four pathways. Below, the pathways are presented along with the main outputs from each pathway.

SONERAIL Project Structure



Pathway A concerns the development of a definition and an evaluation methodology for socially necessary rail services. The evaluation methodology is then applied on specific rail services in Pathway B. Subsequently, future scenarios are identified and examined utilising the SONERAIL Evaluation Methodology as part of Pathway C. Finally, advice and recommendations are provided in Pathway D.

This research has been undertaken by six organisations in six European countries:-

- Transport Research and Consultancy (Project Coordinator) United Kingdom
- University of Pardubice Czech Republic
- Technische Universität Dresden Germany
- ZEUS European Economic Interest Group Greece
- Trasporti Mobilita Turismo Pragma Srl Italy
- Netherlands Economic Institute Netherlands

1.3 Defining socially necessary rail services

Reviewing the available literature on rail reveals that the concept of a socially necessary rail service is not clear-cut along with the presence of problematic definitions. Therefore, the first stage of the research concerned the development of definitions which would be valid in different circumstances.

The SONERAIL definition of a socially necessary rail service can be determined as one with a positive net social value calculated with reference to the social benefits and costs identified for users as well as non-users of the service. The basis of the definition is therefore where generalised costs are significantly affected by changes in level of service provision (reduction or increase) and where there are measurable externalities (such as environmental effects). Thus, the definitions are linked to the evaluation methodology. A rail service will only be identified as socially necessary if the outcome of the evaluation results in a positive net social value. Measurement of the social value is in this way crucial and will be based on the impacts included in the evaluation methodology, see section 1.4. Ideally, the calculation includes all relevant impacts which are measurable.

In this way the definition phase provides for an objective tool by which socially necessary rail services can be assessed without including political factors in the analysis.

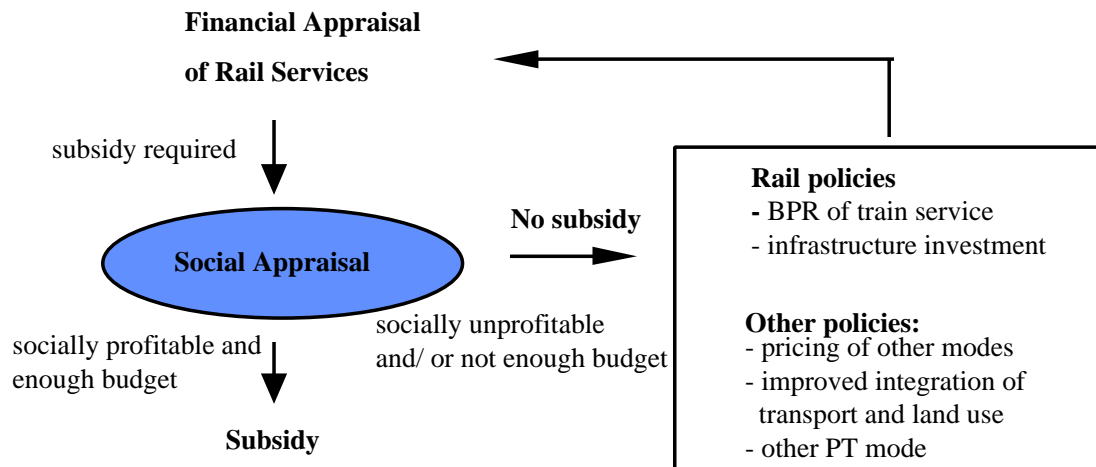
An important aspect regarding this definition is that it avoids the common association between socially necessary rail services and their financial profitability. Usually, loss-making services are defined as socially necessary services. It is possible that profitable rail services are socially necessary; those services are just in a position of being able to generate a positive financial profit apart from the social impacts. On the other hand, it is also possible that a service is loss-making and not socially necessary. In this way, the SONERAIL definition will characterise a service as socially necessary if:-

- it is financial profit-making or loss-making, and
- the social benefits are larger than the social costs.

1.4 The SONERAIL Evaluation Methodology

A major element in the study has been the development of an evaluation methodology for social assessment of rail services, the SONERAIL Evaluation Methodology (SEM).

The aim of SEM is to establish an objective approach by which decision makers can justify public funding support to the provision of rail services. The overall principles of the methodology are set out in Figure 1. Public funding support is not relevant for financially profitable services (such services can still be socially profitable). Public support to a rail service is only relevant if it is financially un-profitable. Justification of support for financially un-profitable rail services is based on whether the social benefits from providing the rail service outweigh the social costs.

Figure 1. Overview of the SONERAIL Evaluation Methodology

Firstly, it has to be determined whether a rail service is financially profitable or not, i.e. is a subsidy required to secure the provision of the rail service. This financial appraisal is not a core element of SEM. In fact, the financial profitability of a rail service could be determined outside this methodology. The core element of SEM is a social appraisal of those rail services for which a subsidy is required because of the financial position, to assess whether a subsidy can be justified and the possibilities to provide such a subsidy. This appraisal will consist of two stages. In the first stage the social benefits and the social costs are assessed in monetary terms, for a given rail service. If the benefits outweigh the costs, the rail service is characterised as socially profitable in monetary terms, and a subsidy can be justified. It should be noticed that the justification of allocating subsidy to a service does not, and cannot, take into account the non-monetary impacts due to the relative character of those impacts.

However, this assessment has focused only on the individual rail service without consideration to the available budget. Therefore, a second phase of the social appraisal process is needed. This phase examines the funding required to support all socially monetarily profitable services compared to the available budget. Only if a rail service is characterised as socially profitable in monetary terms and the budget is sufficient a rail service can be certain to get a subsidy. An insufficient budget will imply that the rail services recommended for subsidy will be those with the highest social value.

The social appraisal in SEM can thus result in two outcomes:-

- a rail service is socially profitable in monetary terms and there is a sufficient budget such that subsidy can be given;
- a rail service is not allocated a subsidy.

The second outcome can be caused by the following two reasons:-

- a rail service is socially unprofitable in monetary terms;

- insufficient budget combined with the existence of other rail services with higher social value.

It should be noted that it is possible that the budget is sufficient to support not only the socially monetarily profitable services but also some of those for which the monetary benefits are less than the monetary costs. The extreme case is when the budget is so large as to allow for support to all financially unprofitable services, although this case is unlikely in practice.

In case the social appraisal for a given rail service results in an outcome with no subsidy provided, a number of measures/policies can be suggested to improve its financial/social position. These measures include business process re-engineering, provision through other public transport mode (e.g. bus service provision), pricing policies for other modes and land use policies.

The main focus of SEM is the social appraisal procedures for rail services. However, recommendations for integrating financial appraisal and improvement strategies into an overall framework for appraisal of rail services have been considered though without being further examined.

The presentation of SEM could be interpreted as if the social appraisal stage could only be applied to those rail services that are financially un-profitable. It should be noticed that SEM could also be used for financially profitable rail services. The social appraisal stage is designed to provide recommendations for decisions regarding subsidies to financially un-profitable rail services, but the techniques used to determine the social value of a given rail service should be applicable irrespective of the financial position.

The innovative elements in the methodology are:-

- integration of different appraisal techniques (cost-benefit analysis and multicriteria analysis)
- iterative procedure allowing for assessment of improvement strategies
- flexibility regarding the type of rail service option to be assessed (marginal change in frequency as well as complete closure)
- possibility to consider alternative modes as valid options

1.5 Application of the SONERAIL Evaluation Methodology

On the basis of the developed evaluation methodology a number of rail services located in the countries represented in the SONERAIL Consortium were examined. This application has been in the form of a case study framework with focus primarily on the cost-benefit part of the methodology. The main purpose of the application was to obtain information about how SEM works in practice with reference to the advantages and problems involved.

In particular, the case study outcomes should be assessed with respect to:-

- data availability;
- calculation principles for impacts;
- appropriateness and reliability of results.

Therefore, if it appears that the data required are available, that a theoretical sound approach is used for the calculation of impacts and the results can be viewed as appropriate/valid then it can be concluded that SEM has passed an important test towards full-scale application.

The approach applied in the application of the selected rail services concerned the situation of having the rail service compared with not having the rail service. In this sense the impacts are associated with the closure/ retention of a rail service.

Overall, SEM has been applied to 25 rail services in European countries, including:-

- 4 rail services in Great Britain;
- 9 rail services in Netherlands;
- 3 rail services in each of the other countries (Czech Republic, Germany, Greece and Italy).

Among these 25 services a total of 15 services appeared to be socially profitable in monetary terms, i.e. higher monetary benefits than costs. The annual net-benefits ranged from -4 mill. ECU to +5 mill. ECU, although only 4 services had net-benefits less than -0.5 mill. ECU. The results show that the main impacts associated with a rail closure were:-

- avoidable rail costs;
- loss in consumers' surplus for the former rail travellers;
- travel opportunity loss for those travellers who decide not to travel;
- travel time effects;
- accident costs.

On the basis of the results obtained it can be concluded that a socially profitable rail service (in monetary terms) is one with:-

- high patronage;
- low cost of operation;
- relative low journey times;
- lack of alternative modes.

The case study application confirmed that the methodology is suitable to assess the social benefits and costs associated with rail service closure or retention. Overall, the data required are or can be made available. In particular, the required rail data exist although confidentiality issues can make it hard to obtain access to the data. A few simplifications were made in the case study analysis, including:-

- infrastructure cost savings from a rail service closure were excluded as the potential for savings depends on the decision regarding the use of the line after

closure of a service. A full scale application should reflect the specific decision taken on line use;

- road data were roughly estimated on the basis of information from traffic counts. A full scale application should include a link to a traffic model;
- the distribution of rail travellers on other modes (including cancellation of the journey) in case of service closure was based on the available information for the case study regions. In a full scale application surveys specific for the services should be undertaken.

1.6 Future operations scenarios

The research elements described above concerned, in the main, the current position of socially necessary rail services. In addition, research has also been undertaken in relation to possible future changes of importance for the provision of rail services. This research consisted of a combination of general identification of possible scenarios and specific assessment of changes in financial and social profitability for the services already examined as part of the application of the SONERAIL Evaluation Methodology. Subsequently, the case study assessment results were examined with respect to the generality of the findings.

Future scenarios were identified on the basis of an examination of likely key influencing factors. These scenarios were defined with respect to the next ten year period covering the short, medium and long term. The scenarios reflect the range of policy initiatives currently being implemented or considered with the aim to revitalise rail in Europe. If the policies are successful it can lead to reduced cost of providing rail, increased demand and hence improved financial and social profitability. The scenario assessment results indicate though that the improvements may be insufficient for some rail services to show a positive value of the social profitability measured in monetary terms. A key element in any improvement of the position of rail services appears to be the extent to which cost efficiency gains can be achieved. Another critical issue will be the approach adopted in the implementation of infrastructure charges. As such these charges can add substantially to the cost of providing rail services which could imply that the services become financial non-viable and/ or require increased subsidies.

The research on future scenarios established an interesting interface between the analysis of scenarios, assessment of social profitability and specification of counter measures/ strategies following an iterative procedure. In this way the approach used provides an integrated approach towards scenario specification, assessment and reassessment. On a full-scale basis it would be possible to include the political decision making bodies at various stages in the process as part of an iterative procedure towards the identification and analysis of future policy options with respect to the provision and financial support given to rail services. The development of such procedures would clearly provide a decision supporting tool through structured consideration to input/assumptions and policy requirements. The detailed implementation of such a system requires further research but SONERAIL could provide a relevant baseline for this work.

1.7 Best-practice recommendations

Best-practice recommendations have been provided at two main levels:-

- case study specific recommendations on the basis of action plans
- strategic recommendations regarding the provision and evaluation of socially necessary rail services

The *action plans* were specified on the basis of an analysis of key issues which would influence the selected rail services over the short, medium and long term period. Across the action plans are a variety of issues reflecting the aftermath of rail privatisation, pending privatisation, state ownership and transition from plan economy to market economy for the Eastern European countries. This results in a diversity of action plan proposals which all evolve around the themes of increasing patronage, reducing costs and measures to instigate a reduction in car use through transfer from road to rail. The need to increase patronage (and revenue) and reduce costs are in general related to the risk of subsidy reductions combined with the possibility for increases in access charges. On the other hand there is scope for increasing rail demand due to the possible introduction of road pricing combined with an overall increase in travel demand. It is worth noticing that the action plans include:-

- improvement in rolling stock;
- track and signalling improvement to allow faster service;
- station facilities improvements;
- integration with other modes;
- consideration to provision by other modes, e.g. light rail or bus services.

The *strategic recommendations* relate to:-

- the evaluation of socially necessary rail services
- the provision of socially necessary rail services

SONERAIL has primarily been concerned with the evaluative aspects of socially necessary rail services. A need for clarification of the definition of socially necessary rail services was identified in the first part of the project. The SONERAIL definition satisfies this requirement. In particular, the definition is linked to the evaluation of socially necessary rail services. As a recommendation this definition can be put forward as a possible basis for characterising rail services as socially necessary or not.

The research also showed the lack of available assessment procedures for rail services including socially necessary rail services. SONERAIL developed an evaluation methodology which is primarily a social appraisal, integrating cost-benefit analysis and multicriteria analysis. This methodology has been applied on a number of rail services and although this application was not a full-scale application it did indicate that the methodology represents a promising tool. As a recommendation it will be suggested to develop SEM into a full-scale application tool. Concerning the provision of socially necessary rail services it will be recommended to study the possibility to

integrate the developed evaluation methodology within the decision-making process as a tool to enhance the information basis. This holds in particular with the move towards public service contracts and requirements about increased value for money and reduced subsidies. The application results suggest that a mixed approach regarding policies for loss-making services is appropriate. It is possible to demonstrate the existence of a large number of rail services which have larger benefits than costs. However, there are also rail services for which the benefits are smaller than the costs. At this stage it should be noticed that negative social net-benefits would not be a sufficient reason for closure. Following the application of the SONERAIL Evaluation Methodology a series of improvement strategies could be put forward in terms of possibilities to increase revenue and/ or reduce costs or provision by alternative modes. The scenario analysis suggests the possibility for some improvement in social and financial profitability. However, given the current pressures on subsidy the positive changes may not be sufficient to ensure continued provision. As a recommendation it will be put forward the need for the actors within the rail industry to consider measures which can increase the demand and reduce the costs to attain best-practice.

1.8 Future research areas

The research undertaken as part of the SONERAIL project has provided important insights into the definition, evaluation and provision of socially necessary rail services. As a result significant recommendations regarding these aspects are provided in this report. In addition, a number of future research areas have been identified during the course of the project. These areas are outside the scope of SONERAIL but are clearly linked to the research undertaken. Below, these research aspects will be outlined. The identified future research areas can be divided into two types:-

- assessment related issues;
- policy specification for rail services.

Assessment related issues

- impacts of rail service closure on rail infrastructure costs;
- estimation and valuation of noise impacts from rail services;
- quantification procedures for non-monetary impacts.

Policy specification for rail services;

- the scope for harmonising cost accounting systems across Europe;
- specification of the total subsidy level for rail services;
- development of full-scale application version of SEM;
- specification of public service contracts for urban and rural railways;
- implementation of tendering/ franchising processes for socially necessary railways;

- integration of rail service evaluation and infrastructure assessment.

1.9 Further information

This report aims to give an overview of the SONERAIL project. Further information can on request be provided from the project coordinator.

2. OBJECTIVES OF THE PROJECT

The overall purpose of SONERAIL is to examine the role of socially necessary rail services. Prior to SONERAIL the concept of a socially necessary rail service was not clear as was the situation regarding the evaluation criteria applied by different EC Member States to assess these services. SONERAIL aims to clarify this position and allowing comparisons with other (rail and road based public transport) modes. This will be carried out within the changing trends of rail passenger services and within the political decision making context. The accomplishment of this research will provide SONERAIL with the basis on which to provide advice on best practice options under alternative decision making contexts.

In particular, this project concerns those railways, which under EC regulations 1191/69 and 1893/91 cannot be provided on a commercial basis and may therefore be financially supported by a Member State.

2.1 Specific objectives

A number of specific objectives have been formulated for the project. These can be listed as follows:-

- define concepts of socially necessary rail services
- develop evaluation methodology for socially necessary rail services
- apply evaluation methodology
- examine operations scenarios
- recommend best practice operations

Define concepts of socially necessary rail services

A clear need for clarification of how socially necessary rail services are to be defined has been identified. SONERAIL should provide valid definitions which are relevant for different institutional frameworks.

Develop evaluation methodology for socially necessary rail services

The SONERAIL Evaluation Methodology (SEM) should provide the framework for assessing socially necessary rail services including the identification of all relevant variables, measurement guidelines for individual impacts and procedures to be used for the aggregation.

Apply evaluation methodology

SEM should be applied to a number of specific rail services within the countries represented in the SONERAIL consortium. The purpose of this application would be to provide information about how the developed methodology functions in practice as well as to obtain specific information about the social profitability of the selected services.

Examine operations scenarios

Operations scenarios influencing the provision of socially necessary rail services should be identified and assessed in terms of demand and supply impacts. The starting point is the selected case study services but the generality of the findings should be considered.

Recommend best practice operations

The recommendations regarding best practice operations for socially necessary rail services should involve several levels including definition and evaluation as well as policy measures and operator strategies. In addition, future research needs should be identified.

2.2 Project focus

The focus of the research has been identified as:-

- passenger transport not freight
- rail services not infrastructure
- demand side rather than supply side
- heavy rail with other forms seen as alternative public transport provision
- the countries represented in the SONERAIL Consortium

Overall, SONERAIL examines issues of socially necessary rail services in relation to passenger operation and not freight. However, presence of synergies or interactions between passenger and freight operations have also been part of the research.

The main focus in the SONERAIL project has been on the currently existing rail services rather than new railway links or alterations to the current ones involving infrastructure investments. In this way, the role and impacts of the presently provided services can be examined. Obviously, SONERAIL recognises the important links between rail infrastructure investments and rail service provision and these relationships have been considered as part of the project.

This approach is consistent with a demand oriented research line with respect to the issues of socially necessary rail services. In this way, it is possible to take full account of user requirement and choices in the detailed analysis. However, whenever supply conditions have been of relevance to the SONERAIL research this has been considered.

The SONERAIL Consortium considers that heavy rail provides a base structure for railways. This excludes metro, underground and light rail systems. These options have together with road based public transport been considered as possible alternatives to heavy rail for the provision of a public transport based transport system.

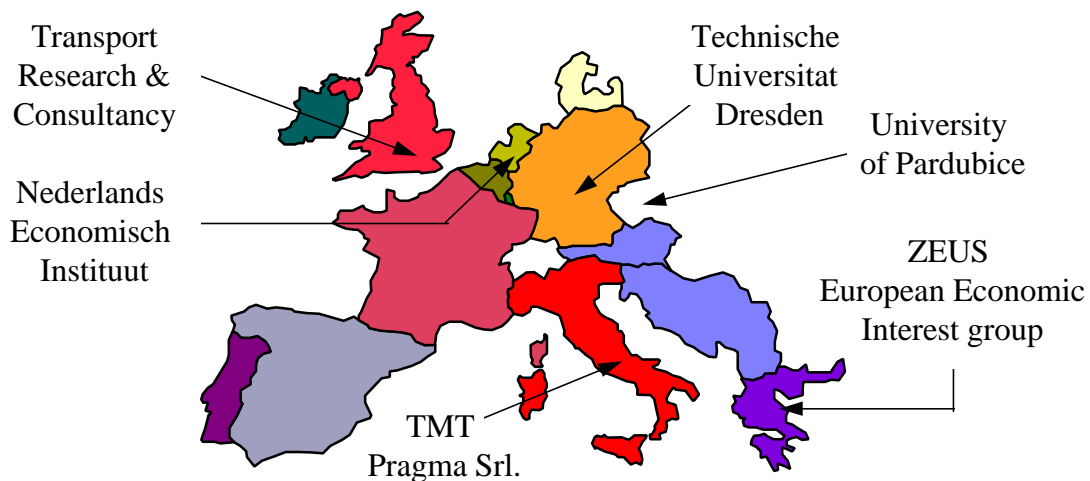
In general, the research undertaken has related directly to the countries represented in the SONERAIL Consortium in order to utilise the specific expertise within the

project. However, the various research findings will have wider applicability across the countries within the EC as well as the CEEC countries.

This research has been undertaken by six organisations in six countries (five EC Member States and one CEEC country). The six organisations are:-

- Transport Research and Consultancy (Project Coordinator) United Kingdom
- University of Pardubice Czech Republic
- Technische Universität Dresden Germany
- ZEUS European Economic Interest Group Greece
- Trasporti Mobilita Turismo Pragma Srl Italy
- Netherlands Economic Institute Netherlands

SONERAIL Project Consortium



The research commenced on 1 February 1997 and continued until 31 January 1999.

There is considerable potential for the use of the SONERAIL research outputs by Government authorities at local, regional and national level. In particular, the SONERAIL Evaluation Methodology will be of importance with respect to improve the decision making basis in relation to strategies for the railway sector including allocation of public funding to rail services.

From a European Union viewpoint the SONERAIL Evaluation Methodology, the case studies and the scenarios may form a basis from which to develop policy recommendations for the railway sector.

3. MEANS USED TO ACHIEVE THE OBJECTIVES

3.1 Work programme

A comprehensive work programme was established in order to achieve the specified objectives. The specific SONERAIL research methodology included the following four stages:-

- Pathway A: Current situation and proposed methodology
- Pathway B: Application of the methodology to current situation
- Pathway C: Future operations scenarios for socially necessary railways
- Pathway D: Advice and recommendations

Pathway A concerned two main elements. Firstly, how socially necessary rail services are and should be defined. This provided the starting point for the research to be undertaken. The research mainly involved interviews with key actors in the rail industry. Secondly, development of an evaluation methodology for socially necessary rail services. The development of the evaluation methodology was undertaken on the basis of a thorough survey of currently used evaluation techniques for rail as well as for other modes and discussions with rail economics experts. This allowed for the specification of an evaluation methodology which improves the state-of-the-art with respect to assessment of rail services.

In Pathway B the developed methodology should be applied to a number of rail services in each of the countries represented in the SONERAIL Consortium. The research included the following elements:-

- consultation with rail operators regarding the selection of appropriate case study services
- data collection for the various aspects included in the evaluation methodology
- assessment of the social value of the rail services
- comparison of the data used, problems experienced and results obtained across the country-specific case studies
- analysis of the rationale behind decisions to allocate subsidies to the selected services

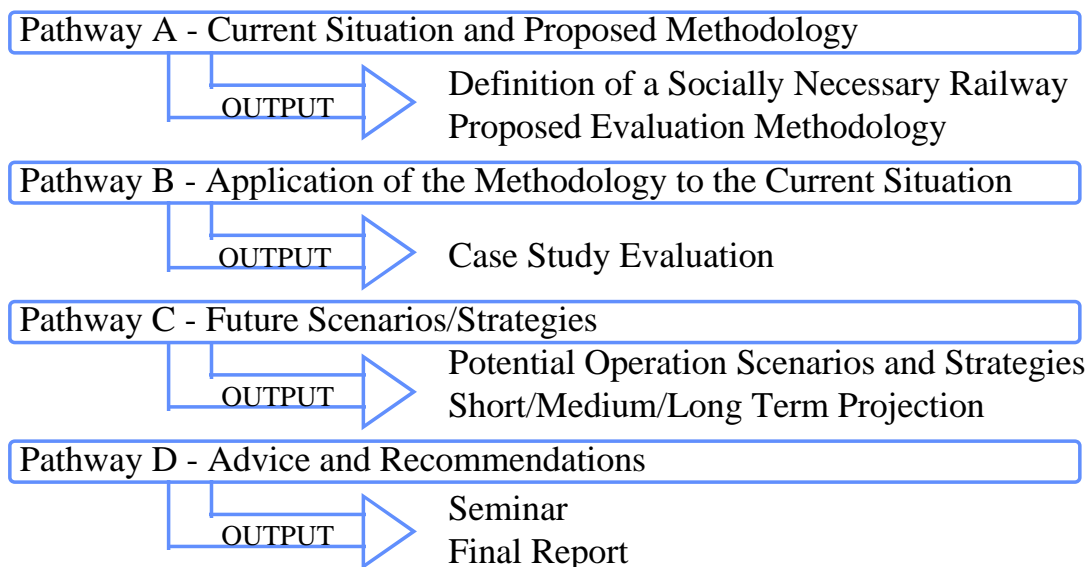
These elements provided a comprehensive application of the methodology giving valuable insight into the opportunities and problems involved, as well as specific information about the social impacts of retaining these services.

The application of the methodology to the current situation was in Pathway C supplemented by an examination of future scenarios. This research involved an extensive survey of key influencing factors including examination of the role of the various policy initiatives being introduced to revitalise railways in Europe. On the basis of the key influencing factors a number of scenarios were specified. Subsequently, these scenarios were assessed with respect to the case studies in terms of changes in social and financial profitability. Finally, the extent to which the scenario analysis could be generalised was considered.

The final stage of the project, Pathway D, has comprised a number of activities to ensure that the objectives for this Pathway as well as for the entire project would be met. Firstly, research was undertaken in terms of preliminary best practice operations of socially necessary rail services with reference to the selected rail services in the form of action plans taking into account rail operator aspects as well as rail industry issues. Secondly, a seminar was organised in order to present the research findings and discuss their relevance with interested parties such as the rail operators, governmental bodies, research institutes and universities. Recommendations regarding socially necessary rail services have been incorporated in the final report including definition and evaluation aspects along with operator measures, policy strategies and future research needs.

The chart below illustrates the structure of the work programme and the main outputs from each stage.

SONERAIL Project Structure



3.2 Internal management activities

Apart from a comprehensive work programme, the achievement of the specified objectives has also been supported by internal management activities. Regular Partners' meetings have taken place throughout the project where all Partners were required to be present. These meetings contributed to provide the necessary monitoring of the progress made on the various research tasks. In addition to full partners' meetings, a number of technical meetings have also taken place, involving fewer of the organisations in the Consortium, to undertake research which concerns several organisations.

The overall project management has been with TRaC as Project Coordinator supported by a Project Secretariat responsible for administrative tasks in relation to the project. TRaC has been involved in all stages of the project thereby ensuring consistent approaches in the various workpackages and outputs.

3.3 Involvement of key actors and experts

The research undertaken in the SONERAIL project has utilised discussions and advice from key actors and other interested parties to ensure that the results are of relevance and based on the state-of-the-art. Firstly, frequent discussions with different organisations within the rail industry as well as authorities have taken place throughout the project. The development of the evaluation methodology was supported with discussions with authorities involved in similar work in order to utilise their experience. Rail operators have also been involved in the project, in particular during the case study phase where many of the required data should be collected. This also gave the possibility for detailed discussions about the research undertaken and the findings obtained.

Secondly, an experts seminar was organised during the project with participation from rail authorities and operators to assess the evaluation methodology developed by the consortium. This contributed to secure relevance and high quality of the final version of the evaluation methodology. Another key event was the SONERAIL seminar held towards the end of the project to present the research and discuss the validity of the results.

Additional feed-back on the research undertaken has been provided through the presentation of a number of papers at various conferences and seminars. This includes two presentations at the UIC/CER Seminars “Shaping the Future of Rail” (I+II).

Finally, frequent contact with the Fourth Framework project (2nd Call) PRORATA has taken place during the course of the project. Although PRORATA and SONERAIL cover somewhat different segments within rail, the projects involve a number of similar aspects. In particular, this contact has been useful with respect to ensure consistency of the developed methodologies.

4. SCIENTIFIC AND TECHNICAL DESCRIPTION OF THE PROJECT

4.1 Defining socially necessary railways

4.1.1 Purpose of definitions

Prior to SONERAIL the definition of socially necessary rail services was not clear although the concept was frequently used, see e.g. British Government (1968). In many cases the definition used reflected loss-making services. This terminology could be interpreted in two ways:-

- the services are socially necessary, therefore they should be supported through subsidies;
- the State is ensuring the provision of these services through subsidy, therefore the services must be socially necessary.

The first interpretation leaves the State with little decision making power, since the services cannot be provided through the market, the State should support them. In effect the State should support all loss-making services. The second interpretation is equally problematic because it assumes optimal decision making in relation to subsidy allocation: given that the State has allocated subsidies to the services, these services must be socially necessary.

The development towards more extended use of public service contracts for the support to loss-making services with requirements for more value for money and less subsidy, makes it paramount to establish coherent and valid definitions of socially necessary railways. As such definitions should support the decision making process regarding recommendations for which services to receive subsidy to secure continued provision. SONERAIL has an objective to clarify this area in order to improve the decision making basis regarding the rail sector.

4.1.2 Approach adopted

The basis of developing the definition is the examination of the key words: socially, necessary, and rail service.

Socially - concerns factors such as the environment, safety, energy efficiency, mobility for all, and reductions in car use.

Necessary - concerns factors such as differing opinions on necessity, indispensability vs. dispensability, and non-availability of alternative modes causing indispensability by default.

Rail services - concerns factors such as service levels, types of service, user groups, operation aspects and usage patterns.

In order to establish a firm basis for recommendations regarding definitions of socially necessary services, a picture of the current position of socially necessary rail services was provided using a broad range of information sources. These sources included:-

- academic research literature
- documents from relevant industry parties
- interviews with relevant industry parties

The recommendations evolved through the following stages:-

- how is the term “socially necessary” rail services interpreted currently?
- how relevant is that interpretation at present?
- will the term “social desirability” represent an appropriate interpretation of socially necessary rail services?

From this procedure, a set of definition components were deduced, for the purpose of identifying socially necessary railways.

4.1.3 Criticism of currently used approaches

4.1.3.1 Socially necessary rail services and loss-making rail services

At the outset it is important to separate the notion of profitability from the definition of socially necessary services, contrary to many current definitions. It is even possible that profitable rail services are socially necessary; those services are just in the position of being able to generate a positive financial profit apart from the social impacts. On the other hand it is possible that a service is loss-making and not socially necessary. This suggests that the definition of socially necessary rail services should not be restricted to the loss-making services (e.g. those services in Great Britain currently subsidised by OPRAF). Rather a position based on the principles for funding allocation in the Netherlands seem appropriate where funding is given to profitable as well as unprofitable routes; this implicitly allows for a broader interpretation of socially necessary rail services. Furthermore, a rail service may be loss-making because of inefficient utilisation of resources or ineffective marketing. Thus, several elements are involved in determining whether a service is socially necessary.

A further complication with the use of profitability or non-profitability to indicate whether services are socially necessary is represented in relation to the time dimension. How should the changed position of a rail service from profit-making to loss-making be interpreted and vice versa? This illustrates that a functional definition should be able to handle the dynamics of the rail service market.

4.1.3.2 Existence of socially necessary rail services

Most rail services are useful to society but describing them as “socially necessary” may be too strong, as this description implies an absolute rather than a relative position (either a service is necessary or not). From the point of economic theory the notion of an activity being necessary is not appropriate as it assumes both that the product or service is indispensable and that there is a lack of alternative ways of providing it. In the case of rail services there is almost always the possibility of a substitute, e.g. bus or car.

What is actually involved is levels of social desirability. Services can arguably be compared on a scale which measures the generalised social and economic costs and benefits of each service. There will be a continuum; some services will be at the “undesirable” end, while other services will be at the “very desirable/socially necessary end” of the spectrum.

4.1.4 The SONERAIL definition

The SONERAIL definition of a socially necessary rail service can be determined as one with a positive net social value calculated with reference to the social benefits and costs identified for users as well as non-users of the service. The basis of the definition is therefore where generalised costs are significantly affected by changes in level of service provision (reduction or increase) and where there are measurable externalities (such as environmental effects). Thus, the definition is linked to the evaluation methodology. A rail service will only be identified as socially necessary if the outcome of the evaluation results in a positive net social value. Measurement of the social value is in this way crucial and will be based on the impacts included in the evaluation methodology, see section 4.2. Ideally, the calculation includes all relevant impacts which are measurable.

In this way the definition phase provides for an objective tool by which socially necessary rail services can be assessed without including political factors in the analysis.

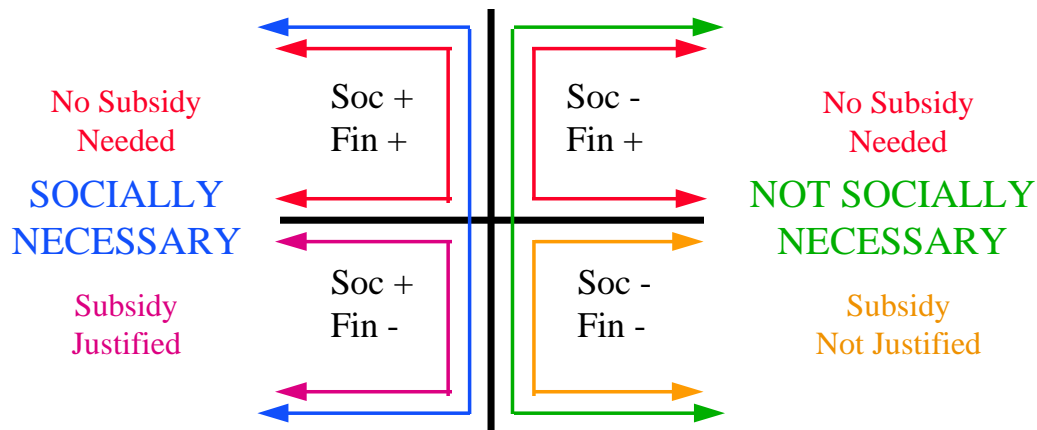
An important aspect regarding this definition is that it avoids the common association between socially necessary rail services and the financial profitability. Usually, loss-making services are defined as socially necessary services. It is possible that profitable rail services are socially necessary; those services are just in a position of being able to generate a positive financial profit apart from the social impacts. On the other hand, it is also possible that a service is loss-making and not socially necessary. In this way, the SONERAIL definition will characterise a service as socially necessary if:-

- it is financial profit-making or loss-making, and
- the social benefits are larger than the social costs.

Figure 2 shows how the SONERAIL definition of socially necessary rail services covers both financial profit-making and loss-making services provided the social benefits are larger than the social costs.

Figure 2. Rail service classification

Interaction of Elements



Four possible combinations are available as indicated by Figure 2.

Positive social value/financially profitable. This rail service reveals its social value through its patronage patterns and other social benefits. It is also financially profitable. Examples would include some of the regional rail service trunk routes.

Positive social value/financially unprofitable. This rail service may have high social value due to total patronage carried and other benefits e.g. reduced car use, but the pattern of patronage such as directional bias, results in a financial loss. An example would be London commuter services.

Negative social value /financially profitable. This type of rail service may enjoy healthy patronage characteristics but could be of high social cost due to noise, severance, land take etc. Although outside the scope of this project, examples may include some high speed rail services.

Negative social value/financially unprofitable. Here the situation theoretically should result in closure. Patronage levels are low, so it provides little mobility, and any other social benefits are lacking. However the decisions of closure will depend both upon the evaluation technique used and political will. Such lines may include some branch line operations which are retained due to political pressure.

The proposed definition of socially necessary rail services has no direct consequences for the funding of rail services as it stands. However, the measurement of social value for rail services would in combination with the profitability provide justification for the funding: non-profitable rail services could be supported according to the level of social value.

The proposed definition of socially necessary rail services is time independent. However, the way in which the elements contributing to social value are assessed will vary according to socio-economic changes.

4.2 The SONERAIL Evaluation Methodology

4.2.1 The Need for a New Methodology

In the majority of European Union Member States, two approaches are being pursued concerning the alteration of railway organisation:-

- the separation of the provision and management of railways infrastructure from the operation of rail services. This process has been initiated and promoted by the EU through the Directive 91/440;
- the promotion of contract based relations between rail service operators and public funding agencies with respect to provision of specific services in return for subsidy, see Council Regulation 1893/91. These contracts will be in relation to rail services which without subsidy would not be financially viable. EC's White Paper "Revitalising Railways" from 1996 emphasises that such contracts can contribute to the introduction of market based conditions even in those cases where services require subsidy support in order to be viable.

The contract based system of public funding support to rail services is a move away from the well-known system where the national railways receive a block grant from the public funding body to secure the operation of services which cannot be justified on financial criteria (public service obligations). It can be claimed that the emergence of contract based provision of specific services is influenced by the splitting of infrastructure provision and management from rail service operation. This splitting has enabled a clearer identification of the cost basis for rail operation and hence improves the basis for specifying contracts.

However, a clear need for a new evaluation methodology can be identified. Currently, evaluation methodologies for railways cover mainly appraisal of rail investment schemes, whereas assessment approaches with respect to rail services are few. One example of an evaluation procedure for rail services is represented by the process used in the Netherlands to select rail services to receive subsidies. An evaluation methodology is not needed for its own sake. An evaluation methodology is required in order to provide information concerning the value of a rail service. In particular, for those services which require subsidies it is important to assess the value obtained per unit of subsidy. The need for an evaluation methodology for rail services is increased due to the promotion of public service contracts. As public funding is scarce, it is important that allocated funds secure the highest possible value for money. An evaluation methodology would enable such assessments being undertaken in a transparent way. Furthermore, if subsidies are allocated according to the evaluation outcome it could imply a more optimal resource allocation.

The main purpose of the SONERAIL Evaluation Methodology (SEM) is to establish an objective basis for assessing the impacts related to the provision of rail services with specific reference to the decision of whether or not to give subsidy to a rail service. In this way, SEM aims to allow for assessments of rail services based on measurable economic and social impacts. The role of political criteria for funding decisions will be reduced following the approach adopted in SEM. Obviously, the final decision regarding public funding support to rail services remains a political one. However, SEM will contribute to enhance the available information for the decision making process.

The details of SEM will be presented in the following sections. At this stage it should be noted that SEM aims to provide a tool whereby a rail service can be assessed not only in terms of the limited financial implications (cost, revenue, profit/loss to the operator) but also consider the wider economic and social impacts. These impacts include travel time effects for rail users and road congestion relief, as well as environmental aspects. Identification, measurement and assessment of the relevant impacts will provide the basis for examining whether funding support for a rail service can be justified. Therefore, the identification of relevant impacts from a rail service, together with specification of measurement guidelines for these impacts, are important components in SEM.

4.2.2 General SEM characteristics

4.2.2.1 Key concepts

The specification of SEM is based on a number of concepts which will be defined below in order to enable a clear and accessible presentation of the methodology.

Rail Service Concept.

As SEM aims to assess rail services it is an important task to establish appropriate definitions of rail services. The clarification covers two dimensions:

- terminology
- aggregation level

A number of terms can be used in relation to rail services:

- service
- line
- route

The first term can be interpreted as a reference to a connection between two points on a specific time of day. The second possibility can be interpreted as a reference to the infrastructure aspects of a rail service. Route appears to be the most appropriate term. This term is concerned with a rail service operated between two points taking into account all connections provided between them. However, it should be noticed that SEM can also be used in relation to assessment of time specific connections.

The second dimension required to be clarified concerns aggregation levels. Three options can be suggested:-

- single route from point A to point B
- group of routes
- network of services

From a practical point it might be easier to use a rail service definition which consists of several routes or even network of routes as the concept corresponds to how railways usually are organised including the role of some routes within a network functioning as feeder services. In addition, the problems represented by joint cost/revenue structure in relation to rail service production can be expected to be on a reduced scale if the rail service concept is based on a group of routes/network of services. However, a concept based on several routes has the disadvantage of being defined at an aggregated level. This implies that it would be possible to conclude from an evaluation of a combination of routes that its social value is zero, with social costs equal to social benefits. Such a result could be obtained, if each route within the combination has social costs equal to social benefits. However, it is likely that socially profitable routes cancel out with socially unprofitable routes.

Therefore, the most appropriate concept is one based on single routes provided that interaction aspects such as the role of feeder services are taken into account in the evaluation of single routes. However, the rail service concept used in empirical applications of SEM might be based on a higher aggregation level as the result of a lack of disaggregated data. In this way, the available data will determine the applied rail service concept.

SEM is applicable to both single routes and groups of routes/networks. The SEM concept can be used for both combinations.

Rail Service Impacts

SEM concerns the evaluation of a wide range of impacts generated from a rail service, related to the actual use of the service. Therefore, impacts are not defined in terms of the effects a rail service has on a set of specified planning objectives. The latter approach to impacts is mainly of relevance in the assessment of infrastructure projects where options are more wide ranging in the sense that different schemes can be selected according to how objectives are influenced.

SEM focuses on existing rail services. The main options in this case are retention or closure. Therefore, SEM impacts will be defined according to the situation with the rail service compared to the without situation, i.e. the influence of the use of a rail service according to a number of different dimensions. The rail service will impact various parties in society such as the rail operator, rail users, users of other modes, and society in general. More details about how specific parties in society are influenced will be given later on. At this stage it should be mentioned that within the set of impacts, some can be measured in monetary terms, while others cannot.

Monetary impacts cover both the ones which are defined in monetary terms as well as those which can be assigned imputed money values. In order to achieve a comprehensive evaluation, SEM will take into account both monetary and non-monetary impacts. The details of the evaluation approach for monetary and non-monetary impacts will be given later.

Financially Profitable vs. Financially Unprofitable

All rail services in a region or country can be grouped according to the financial position: if the revenue generated from a rail service is larger than the costs required to provide the rail service, then it is financially profitable. Otherwise, the service is defined as financially unprofitable and requires a subsidy in order to be provided.

In principle, the subsidy required for a specific service could be calculated as the difference between the service specific revenue and the service specific cost. However, the practical calculation runs into problems. The problems occur in relation to the calculation of service specific costs and revenues due to the presence of jointness in the provision of rail services. Some cost items are only weakly or not at all related to the activity level for specific rail services but rather determined by the overall activity level by the train operating company. Other cost components are fixed even with respect to the overall activity level.

Similarly, jointness with respect to revenue generation is present in relation to provision of rail services. For example, the closure of a main line rail service could imply reductions in revenue for branch lines connected to the service to be closed. This complicates the calculation of service specific revenue level.

Socially Profitable vs. Socially Unprofitable Rail Services

In principle a rail service can be characterised as socially profitable if the positive impacts engendered from the service are larger than the negative impacts. Otherwise the service is socially unprofitable. An assessment of the social profitability requires that all relevant impacts across the incidence groups are taken into account. It should be noted that empirical measurement of social profitability in absolute terms is not possible due to the presence of non-monetary impacts and in particular impacts which are measured on a relative scale. Alternatively two other concepts can be put forward:

1. Socially Monetarily Profitable vs. Socially Monetarily Unprofitable Rail Services

Socially monetarily profitable services are those for which monetarised positive impacts are greater than monetarised negative impacts. Otherwise, a rail service is socially monetarily unprofitable. This concept only concerns the monetarised impacts, whilst the non-monetarised impacts are ignored.

2. Relative Socially Profitable vs. Relative Socially Unprofitable Rail Services

This concept takes into account both monetary and non-monetary impacts. It implies a ranking of the rail services according to their performance for the different criteria.

A service obtaining a high ranking has thus an overall positive performance in relation to the identified monetary and non-monetary impacts.

Combination of Financial and Social Monetary Profitability

If the two concepts - financial and social monetary profitability - are combined, then it allows the categorisation of a given set of rail services into four groups, as shown in Table 2:

Table 2. Categorisation of Rail Services

Financial / Social Category	Socially Monetarily Profitable	Socially Monetarily Unprofitable
Financially Profitable	I	II
Financially Unprofitable	III	IV

Although SEM is applicable to financially profitable services, the main focus will be the financially unprofitable rail services; those which require subsidy to operate, i.e. categories III and IV.

4.2.2.2 Overview of SEM procedures

The aim of SEM is to establish an objective approach by which decision makers can justify public funding support to the provision of rail services. Public funding support is not relevant for financially profitable services (such services can still be socially profitable). Public support to a rail service is only relevant if it is financially unprofitable. Justification of support for financially un-profitable rail services is based on whether the social benefits from providing the rail service outweigh the social costs.

The overall principles in SEM are set out in Figure 1. Firstly, it has to be determined whether a rail service is financially profitable or not, i.e. is a subsidy required to secure the provision of the rail service. This financial appraisal is not a core element of SEM. In fact, the financial profitability of a rail service could be determined outside this methodology. The core element of SEM is a social appraisal of those rail services for which a subsidy is required because of the financial position, to assess whether a subsidy can be justified and the possibilities to provide such a subsidy. This appraisal will consist of two stages. In the first stage the social benefits and the social costs are assessed in monetary terms, for a given rail service (cost-benefit analysis). If the benefits outweigh the costs, the rail service is characterised as socially profitable in monetary terms, and a subsidy can be justified.

However, the assessment has focused only on the individual rail service without consideration to the available budget. Therefore, a second phase of the social appraisal process is needed. This phase examines the funding required to support all socially monetarily profitable services compared to the available budget. In this phase non-monetary impacts should also be incorporated in the analysis, allowing for a ranking of the services through multicriteria analysis. Only if a rail service is characterised as socially profitable in monetary terms and the budget is sufficient a rail service can be

certain to get a subsidy. An insufficient budget will imply that the rail services recommended for subsidy will be those with the highest social value.

The social appraisal in SEM can thus result in two outcomes:-

- a rail service is socially profitable in monetary terms and there is a sufficient budget such that subsidy can be given;
- a rail service is not allocated a subsidy.

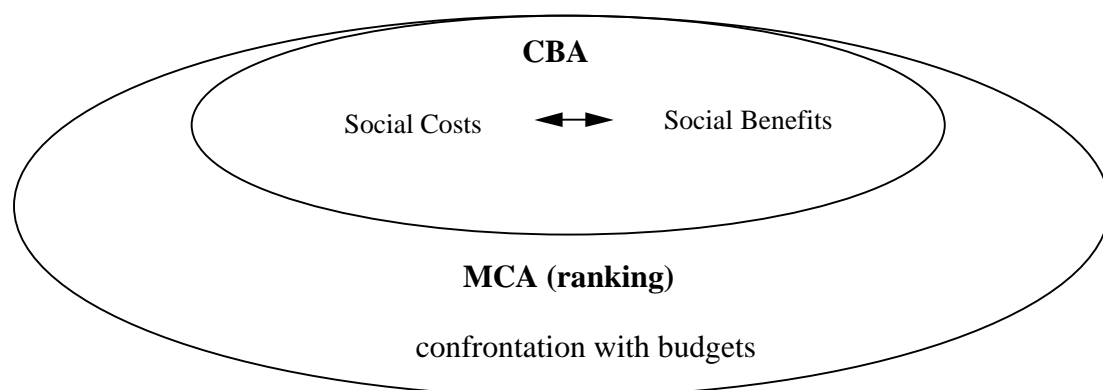
The second outcome can be caused by the following two reasons:-

- a rail service is socially unprofitable in monetary terms;
- insufficient budget combined with the existence of other rail services with higher social value.

It should be noted that it is possible that the budget is sufficient to support not only the socially monetarily profitable services but also some of those for which the monetary benefits are less than the monetary costs. The extreme case is when the budget is so large as to allow for support to all financially unprofitable services. This situation though is rather unlikely.

The two stages of the social appraisal process are presented in Figure 3.

Figure 3. Social appraisal in SEM



In case the social appraisal for a given rail service results in an outcome with no subsidy provided, a number of measures/policies can be suggested to improve its financial/social position. One important measure for the considered rail services could be to undertake a Business Process Re-engineering (BPR) of the rail service in order to reduce the costs and/or improve the revenue. Other public transport measures could involve the examination of the possibility of providing the service with other public transport modes which could have a better cost or revenue structure. Another consideration is whether infrastructure investments could improve the position of the rail service, e.g. by changing from diesel operated trains to electric operated trains. In addition, other policies outside the public transport policy domain could be seen as

potential measures to improve the financial/social profitability of the rail service. Two examples of such policy initiatives could be:-

- pricing of other modes;
- improved integration of transport and land use.

The applied pricing mechanisms for other modes can have an influence on the competitiveness of the rail mode. Obviously, measures which aim to internalise the external costs of car travel could lead to an improved basis for the rail mode, see e.g. European Commission (1998a). It is also important to recognise that land use policies could be utilised as a way to improve the position/role of railways.

The phase of considering measures which could improve the position of a given rail service should be followed by assessing whether the improvements are at such a scale that the service does not require a subsidy (financially profitable) or the improvements justify the rail service receiving a subsidy due to social profitability. It should be mentioned that SEM does not identify the elements which could lead to an improved position for a given rail service. Thus, SEM will not involve the specification of a Business Process Re-engineering (BPR) Model for rail services. What the methodology entail is a tool whereby applications produce, as part of the results, indications about possible problems. These could provide the starting point to a BPR.

The main focus of SEM is the social appraisal procedures for rail services. Also recommendations for integration of financial appraisal/improvement strategies, into an overall framework for appraisal of rail services have been considered though without being further examined.

The presentation of SEM could be interpreted as if the social appraisal stage could only be applied to those rail services which are financially un-profitable. However, SEM could also be used for financially profitable rail services. The social appraisal stage is designed to provide recommendations for decisions regarding subsidies to financially un-profitable rail services, but the techniques used to determine the social value of a given rail service would be applicable irrespective of the financial position.

4.2.3 Details of SEM procedures

4.2.3.1 CBA Element

The CBA element of the SONERAIL Evaluation Methodology (SEM) involves an assessment of the monetary value of the impacts generated by the closure of an existing individual rail service (or a complete network). Impacts are defined as the difference of having and not having the rail service. This assessment includes all the impacts for which it is possible to assign monetary weights. Table 3 provides an overview of the various impacts which are of relevance according to incidence groups.

It is not necessary to consider all these impacts because a number of these represent a benefit for one party and a cost (of similar magnitude) for another party, such that the two impacts cancel out. The shaded cells in Table 3 include this type of impacts. The

overall result for a given rail service is determined as the sum of the monetarisable net-impacts (those impacts which do not cancel out). Monetarisable net-impacts included in SEM are:-

- change in efficiency business travel;
- change in travel time for rail travellers switching to other modes;
- loss of consumers' surplus for rail travellers switching to other modes;
- loss of consumers' surplus for rail travellers not switching to other modes;
- travel opportunity loss for rail travellers not switching to other modes;
- travel time savings for rail travellers not switching to other modes;
- change in avoidable rail costs;
- change in road maintenance costs;
- change in congestion costs for existing car travellers;
- change in emissions;
- change in accidents;
- change in noise.

Although it is necessary only to calculate the net-impacts in order to determine the overall net-benefits, it can still be of relevance to calculate all the impacts shown in Table 3. This would allow for the examination of how a rail service closure affects the various incidence groups.

Table 3. SEM Impacts

	Costs of closure = Benefits of retention	Benefits of closure = Costs of retention
Former train travellers which change mode	- travel time change (commuter, leisure, business) U₁ - change in efficiency business travel U₂ - loss of consumers' surplus U₃	
	- costs other mode U₄	- saving train costs (the fare) U₅
Existing car travellers	- change in congestion costs C₁	
	- change in operating costs (fuel) C₂	
Train company	- change in revenues (excl. subsidy) T₁ - change in subsidy T₂	- change in costs T₃
Government	- change in costs of road maintenance G₁	- change in subsidy to train G₂
Former train travellers which do not travel	- loss of travel opportunity L₁ - Loss of consumers' surplus L₄	- saving of travel time L₂
		- saving of train costs (the fare) L₃
Society	- change in emissions S₁ - change in noise (inside/outside) S₂ - change in safety/accidents S₃	
Other		- change in revenues oil companies/ garages O₁ - change in revenues other transport modes O₂

4.2.3.2 MCA Element

The starting point for the MCA analysis is the obtained net-benefit results for each rail service examined in the CBA. Rail services will be grouped in two groups according to whether the net-benefit value is positive or negative. The rail services in the two groups will be ranked separately in order to ensure that the trade-offs between monetary and non-monetary impacts are reduced such that it is not possible for a rail service with negative net-benefits to be higher ranked than one with positive net-benefits.

In this way the MCA is not allowed to influence the set of rail services from which the ones to be recommended for subsidy will be identified. Socially monetarily unprofitable rail services cannot be recommended for subsidy before all the socially monetarily profitable rail services have been recommended. In this way the MCA procedure is based on a non-compensatory approach with respect to the set of rail services to be considered for subsidy support. However, the MCA procedure is compensatory with respect to impacts such that the ranking of the socially monetarily profitable with inclusion of the non-monetary impacts can be different from the one obtained with the monetary impacts only. A relatively good performance for non-monetary impacts can compensate for bad performance with respect to monetary impacts, and vice-versa.

The following non-monetary impacts are included in the MCA analysis:-

- change in chemical pollutants;
- change in flora/fauna;
- change in visual intrusion;
- change in vibration;
- change in employment;
- change in productivity;
- change in actual GDP (actual) as proportion of potential GDP;
- change in stress levels for car travellers;
- change in stress levels for inhabitants.

In addition, the estimated net-benefit value (normalised) is included as a composite measure for the monetary impacts.

Data for the non-monetary impacts can be based on quantitative indicators or verbal statements from experts. The choice of source will depend on data availability. Depending on resources available it is likely that in most cases the non-monetary impacts related to the closure of a rail service will be measured through expert statements on the basis of an ordinal scale. The ranking procedure can be applied for both types of data source but below the procedure will be outlined with reference to the situation with expert based statements about impacts. For each of the rail services the impacts of closure/retention should be recorded. The impacts could be indicated according to a seven-point scale:-

+++	large positive impact
++	positive impact
+	small positive impact
0	neutral
-	small negative impact
--	negative impact
---	large negative impact

A positive impact implies that the retention of a service involves benefits (e.g. higher level of employment compared to the situation without the rail service). Consider a set of 3 rail services to be ranked through the SEM MCA procedure with impacts as follows, see Table 4.

Table 4. An MCA example

	Service 1	Service 2	Service 3
change in chemical pollutants;	++	+	++
change in flora/fauna	+	++	++
change in visual intrusion	+	+	++
change in vibration	-	+	++
change in employment	0	++	+
change in productivity	--	++	+
change in actual GDP as proportion of potential GDP	---	+	+
change in stress levels for car travellers	+	0	-
change in stress levels for inhabitants	+	0	-
CBA net-benefits (normalised)	0.7	0.3	1.0

The ranking of the services will in addition to the information about impacts, require indications regarding the relative importance of the various impacts, i.e. weights. The SEM MCA ranking is based on the so-called Regime Analysis, see Nijkamp et al. (1990). This method is well-suited in situations where some or all information is ordinally measured. The method is based on pairwise comparison of the rail services for the various impacts. Regime Analysis only requires the relative order of the various impacts to be defined along with an assumption that the weights sum to 1.

On the basis of the impact and impact importance information, the Regime Analysis proceeds to determine the probability that one rail service is overall higher ranked than another one. This requires an assumption concerning the distribution of the true importance weights which satisfies the order given and sum to 1. Usually, it is assumed that the weights follow a uniform distribution but other assumptions about the distribution could be used.

The outcome is a ranking score for each rail service, determined as the average probability for a service to perform better than the other services within the sample of socially monetarily profitable rail services or unprofitable rail services. The individual ranking scores can be summarised through the ranking order, identifying the highest ranked service as the one with the highest average probability of best performance, followed by the second one, the third one etc.

4.2.3.3 Subsidy recommendations

So far it has not been examined in detail how the public funding budget size influences the evaluation outcomes in terms of subsidy recommendations. Possibilities for the budget size are outlined below:

- budget corresponds exactly to the total required funds for the socially monetarily profitable services;
- budget corresponds exactly to the total required funds for the financially unprofitable services;
- budget is smaller than the total required funds for the socially monetarily profitable services;
- budget is larger than the total required funds for the socially monetarily profitable services but smaller than the total required funds to support all financially unprofitable services.

The first two possibilities are straightforward. If the budget corresponds to the funds required to support all socially monetarily profitable rail services then the MCA determines a ranking, but all the services will be supported, i.e. the ranking results will have no real consequences. If the budget corresponds exactly to the total required funds for all financially unprofitable services, then neither CBA or MCA will have any consequences.

However, if the budget is smaller than the total funds required for all the socially monetarily profitable services to be supported, then the MCA ranking can influence which of these services will be supported. If the budget is larger than the total required funds for the socially monetarily profitable, but smaller than the total required to support all financially unprofitable services then two rankings will be established:

- firstly, the socially monetarily profitable rail services which will all be recommended for subsidy
- secondly, the financially unprofitable and socially monetarily unprofitable rail services will be ranked.

Recommendation for subsidy allocation could be based on the calculated ranking score as well as information about subsidy required for each service, through mathematical programming models (MP). This could involve of maximisation of ranking scores subject to funding available.

$$\begin{aligned} & \text{MAX } \sum d_i r_i \\ & \text{s.t.} \\ & \sum d_i s_i = S \\ & d_i \in \{0;1\} \end{aligned}$$

The notation in the integer programming problem (IP) is as follows: r_i is the ranking score for the i 'th service, s_i is the subsidy requirement for the i 'th service, d_i is the choice variable in the problem (d_i is equal 0 if the i 'th service is included, otherwise 0) and S is the total subsidy budget.

This integer programming problem allows for allocation of subsidies to that combination of services which gives the highest sum of the ranking scores.

4.2.4 Limitations to the SONERAIL Evaluation Methodology

SEM can contribute significantly to improve the available information regarding the value of rail services. However, the selected approach excludes a number of issues, including:-

- Business Process Re-engineering Model;
- Financial Appraisal;
- Current Public Transport Budget Levels.

It has already been mentioned that SEM does not include a BPR model as such. The development of a BPR model was outside the scope of the project. However, the developed methodology can be viewed as providing the starting point for a BPR model for rail services. Results from an application of SEM could provide significant information as to which areas to examine in more detail in order to identify the specific problems and design improvement strategies. Furthermore, the social appraisal methodology could easily be linked to other elements including a BPR model.

Financial appraisal is not a core element of SEM and could be placed outside the methodology. Obviously, the financial position of a rail service is important for SEM, as it determines whether a subsidy is required for a rail service and hence whether it is necessary to undertake the social appraisal. However, the information on the financial position can simply be one of the inputs required for the assessment.

Current budget levels with respect to the available funds for subsidies to rail services will not be a variable in the assessment of a given rail service. This implies that the budget level will be assumed to be fixed. In particular, the available budget for subsidies will be determined prior to the application of SEM. In this way the SONERAIL approach does not aim to determine an optimal overall budget size for revenue subsidies. The objective is to measure social profitability and to ensure that the rail services with highest social value are recommended for funding given the available budget. The scope for enhancing optimal social value, is limited to the evaluated rail services. Any improvement in social value, achieved from changing the budget level, is excluded from consideration.

4.2.5 SEM impacts

4.2.5.1 Monetary impacts

A complete list of monetary impacts was given in Table 3. Below, we will only describe the net-impacts, i.e. those which are not a benefit to one party while a cost of the same magnitude to another party. The capital letter after each impact refers to the notation used in Table 3. For each of these impacts is described what it consists of and how it could be measured. These measurement principles have been followed as much as possible in the case studies given the resources available.

Travel Time Change for Travellers Switching to Other Modes - U_1

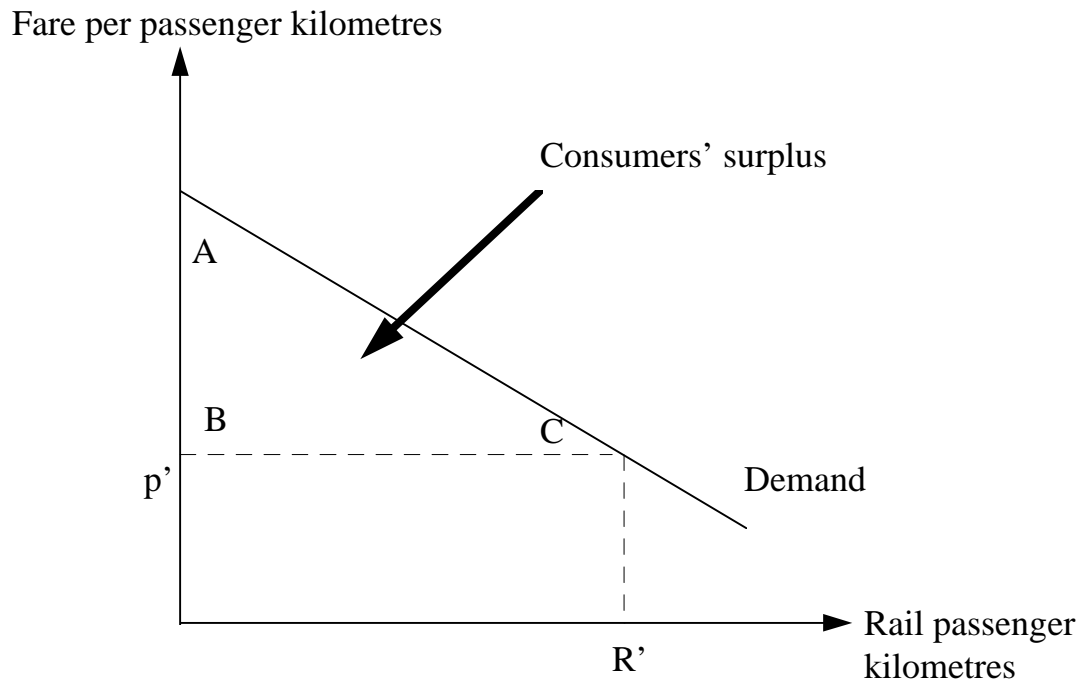
This impact is based on changes in travel time which former train travellers experience when they choose alternative modes in the situation without the rail service. It can be defined as the difference in total travel time between rail and alternative modes, for the passengers which would use alternative modes if the rail mode was not available. Monetisation can then be based on information about value of time. However, because the value of travel time depends upon trip purpose, it is necessary to distinguish between different trip purposes, e.g. commuting, business and leisure.

Change in Efficiency of Business Travel - U_2

The closure of a rail service can influence the extent to which persons travelling can work during the journey. Rail allows for work to be undertaken during the journey. The conditions for work during a journey are limited if not impossible for other modes. Therefore, SEM takes this element into account. The change in business travel efficiency is defined in terms of total hours worked during business travel business, using rail, for those switching to alternative modes if the rail service did not operate. This definition assumes that no work will be undertaken during travel with an alternative mode. It is possible to modify this assumption in the application of SEM. The monetary value of the number of worked hours lost can then be established using value of time information.

Loss of Consumers' Surplus for Rail Travellers - U_3 and L_4

This impact is included because the closure of a rail service will imply that the consumers' surplus for the rail passengers will be lost. Consumers' surplus measures what rail travellers are willing to pay in excess of what they are actually called on to pay to use a rail service. In this way, it measures the loss to rail travellers if they lost the opportunity to use the rail service. Therefore, it should be taken into account in the assessment of a rail service closure. The concept can be illustrated as follows, see Figure 4.

Figure 4. Consumers' surplus

The demand curve represents the demand for using a rail service (in this case measured in passenger kilometres) as a function of the fare paid. If the fare is p' then the demand would be R' . At this fare level the consumers' surplus equals the area ABC. This area will represent the loss of consumers' surplus if the rail service was closed. From a theoretic point of view consumers' surplus could thus be estimated with respect to the area between the rail demand function and the current price line. It should be noticed that two possibilities for calculation of consumers' surplus are available:-

- calculation using the rail demand function with respect to fare only;
- calculation using the rail demand function with respect to generalised costs (time and money).

In order to simplify the approach it was decided to use a fares-only based demand function.

Travel Opportunity Loss for Non-Remaining Travellers - L_1

The former rail travellers which do not travel, incur a travel opportunity loss. This loss is caused by the inability to undertake the activities associated with the journey (work, education, shopping) due to the restricted mobility from the closure of a rail services. The benefits enjoyed from these activities are lost as the result of the closure and the impact measures this loss. It is not possible to know the exact magnitude of the travel opportunity loss. However, an appropriate assumption would be to assume that the loss is at least equal to the generalised costs (time+money) faced by the travellers who would cancel the journey without the existence of the rail service. If the travel opportunity loss was less than the generalised costs it would not have been optimal to undertake the rail travel in the first place. Therefore, it can be claimed that the travel

opportunity loss is greater than or equal to the generalised cost. As such it can be approximated by the generalised cost plus the part of consumers' surplus going to non-remaining travellers (this part has already been accounted for under the previous impact). It should be noted that there could also be some additional amount which cannot be measured in monetary terms (e.g. reflecting non-user value).

Saving of Travel Time for Non-Remaining Travellers - L₂

Former train travellers which do not travel in the case of the rail service closing will obtain a saving in travel time. This impact can be calculated with information about the number of passenger kilometres not transferred to alternative modes and the average journey speed (km/hr) in which rail trips are undertaken. Passenger kilometres for non-switchers divided by the average speed for rail, measures the total travel time saved for the non-switchers. If information about the value of time is available, it is possible to calculate the monetary value of the travel time savings. If possible, the monetary valuation should reflect differences in values of time according to journey purpose.

Change in Avoidable Rail Costs - T₃

Closure of a rail service will imply rail cost savings. The impact concerns the cost savings obtained as the result of the rail service closure, i.e. the cost with the rail service subtracted by the cost without the rail service - the avoidable cost concept, see e.g. Harris et al. (1992). In practice, it is difficult to compute the avoidable costs because of the presence of joint/common costs when several services share a resource making it difficult to establish the link between a specific rail service and those cost items which are incurred jointly with other rail services. Joint costs refer to those cost items which cannot be reduced at all if a given service is withdrawn. In contrast, common cost can be reduced to some extent if a service is withdrawn. As such joint costs are unavoidable with respect to the individual service, while common cost changes should be taken into account in the avoidable cost for a given service.

Some cost components can be identified and allocated easily on individual services such as labour, materials and traction. Others are more problematic including rolling stock and track infrastructure costs. Rolling stock cost changes would depend on the value derived from using the released rolling stock in the next best alternative use. Track infrastructure cost savings would reflect wear and tear and other elements changing as the result of the closure of a service, e.g. time tabling resources. It should be noticed that the avoidability of rail cost is viewed not from the operator's point of view but from society. The principle of avoidable costs has been followed in the case studies.

Change in Costs of Road Maintenance - G₁

The closure of a passenger rail service is likely to have very limited effects on road maintenance costs as the result of passenger traffic transferred from rail to road as changes in road maintenance costs are mainly determined by heavy goods vehicles and buses. This is supported by research in UK, see Department of Transport (1995). Closure of a passenger rail service will involve transfer to car (as driver or passenger), bus, other rail services, other modes (bicycle). However, when the rail service closure is assessed separately only transfer to car driver will generate additional motorised vehicle kilometres because the transferral to bus will not imply extra buses; that is a

new decision separate from the decision to close the rail service. Therefore, it has been decided to assume the change in road maintenance costs to be equal to zero as a default.

Change in Congestion Costs - C_1

The impact concern the time penalty for existing car travellers as the result of the passengers switching from rail to car based transport. This time penalty occurs because additional traffic flows on roads can lead to reduced speed levels and hence longer travel times. The effect can be estimated through flow-speed relations on the basis of regression analysis. From the speed flow relationship it is then possible to calculate the change in speed as the result of the increased traffic flow from the transfer of traffic from rail to road, see Newbery (1994). The calculated change in speed can subsequently be used to estimate the change in travel time for existing car travellers utilising information about average journey length. This estimation should take into account the car occupancy in order to relate to travellers rather than vehicles. If information about the value of time for car travellers is available, it is feasible to calculate the monetary value of the change in travel time. If possible this valuation should take into account variations in value of time according to journey purpose.

Change in Emissions (Air Pollution) - S_1

Emission levels can be affected by the closure of a rail service and are therefore included in SEM. Two main effects can be identified:-

- reduced emissions from rail;
- increased emissions from road.

It should be noted that only the transfer from rail to car driver will result in increased emission levels from road on the basis that this transfer is the only one which generates additional motorised vehicle kilometres. Therefore, it is possible that closure of a rail service can imply reduced emission levels from an overall point of view. This depends on how rail traffic will distribute on alternative modes. The economic values used to obtain a monetary value of the change in emission levels are based on a resource cost approach in the form of production loss/lost working days and health costs expressed as a value per emitted tonne. The emission types considered include:

- Carbon Monoxide (CO);
- Nitrogen Oxide (NO_x);
- Hydrocarbons (HC);
- Sulphur Dioxide (SO₂);
- Particles.

Change in Noise - S₂

As part of the SONERAIL project much attention has been given to the impacts on noise of closure of a rail service. Two impacts will occur as the result of closure of a rail service:-

- reduced noise levels from rail;
- increased noise levels from road.

Again, it should be noticed that noise increases from road will only occur as the result of transfer from rail to car driver as this is the only source for additional motorised vehicle kilometres.

Change in accidents - S₃

Transport related accidents will be affected by the closure of a rail service in two ways:-

- reduced number of accidents from rail transport;
- increased number of accidents from road transport.

Change in accidents is calculated for fatalities, serious injuries and slight injuries. The monetary assessment is based on a resource cost approach taking into account police, hospital costs, loss of output, damage to vehicles as well as an allowance for the pain, grief and suffering from injury and death. Monetary values are available for each of the three accident categories, see Highways Agency (1996). Closure of a rail service results in a higher level of accidents from transport because accident rates for road based transport are much higher compared to the accident rates from rail based transport. In addition, it should be taken into account the extra motorised vehicle kilometres influencing accident levels for existing as well as new users of road based transport.

4.2.5.2 Non-monetary impacts

The non-monetary impacts included in the SEM model will be briefly described in this section.

Change in Chemical Pollutants

It is likely the use of a rail service influences the level of land and water pollution compared to the situation without the rail service. These effects should concern impacts not implied by changes in emission levels as these have already been considered in the CBA, otherwise double counting would occur. In principle the impact of the rail service should be determined as the difference between the land/water pollution level with the rail service compared to the situation without the rail service. However given the nature of this impact, this calculation is not possible. Alternatively, the measurement of this impact should be based on how the level of chemical pollutants changes. This should be concerned with the alteration of the levels of chemicals in water/soil which could cause environmental problems.

Change in Flora/Fauna

This impact concerns whether population sizes and distribution along with indicators of species diversity, occurrence of extinctions and presence of aliens have changed as result of a rail service closure. On the basis of measures for these different dimensions it would be possible to assess whether changes would occur. For most of these elements it would be feasible to obtain quantitative measures, e.g. population sizes could be measured in terms of the number of animals of a given type, or species diversity could be measured by the number of different types of animals or plants. Any changes in these dimensions could be established with reference to a control area without a rail service. The data for measuring the changes could be provided through surveys.

Change in Visual Intrusion

Visual intrusion impacts concern rail (due to closure) and road (due to the transfer of traffic from rail to road). If the rail service is closed any visual intrusion generated by the service is removed. Visual intrusion from road based transport concerns the perception of the landscape/townscape. In addition, consideration should be given to the influence on visual intrusion of parked cars. The closure of a rail service can lead to increased road based transport and could increase the number of parked cars at various locations. Ideally, the indicator changes in visual intrusion, as a result of closing a rail service, should be determined through examination of maps and photographs combined with field survey and interviews.

Change in Vibration

In the CBA element the impacts on noise levels of closing a rail service, were taken into account. It is likely that vibration changes might occur as well. These impacts will be considered below. The vibration impacts concern decreased vibration from rail and increased vibration from road and other modes, as a result of a rail service closure. For rail, the vibration is the result of the interaction of steel wheels rolling on steel rails as well as from low frequency sound waves. Vibration from rail will depend on factors such as surface conditions of wheels and rail, train speed, train suspension and the rail support structure (Thanacanamootoo, 1992). Overall, the level of vibration should take into account the number of trains per day. The effect of a given vibration level is determined by aspects relating to the surroundings, i.e. urban or rural area, population density, topography, noise protection measures and distance between the vibration source and the monitor. Vibration from road based transport is caused by the contact of the vehicle with the road surface and low frequency sound waves. Vibration from road based transport depends on speed levels, wheel type as well as the state of the road surface. Overall, the level of vibration should take into account the traffic flow per day. The effect of a given vibration level is determined by aspects relating to the surroundings, i.e. urban or rural area, population density, topography, noise protection measures and distance between the vibration source and the monitor. Ideally the impact on vibration of closing a rail service should be measured as the difference in vibration with the rail service and without the rail service.

Change in Employment, Productivity, Actual GDP as Proportion of Potential GDP

These impacts relate to the possibility for the rail closure to influence the economic development and regeneration. Economic regeneration/development impacts of a rail service closure, cannot be precluded from a theoretical point of view, but are difficult to measure empirically. It should be noticed that the impacts can be positive as well as negative depending on the economic context. It should also be noticed the problems regarding double-counting with respect to these aspects. However, productivity changes should reflect real economic impacts providing changes in the growth potential. Changes in actual GDP as proportion of potential GDP would indicate some form of catch-up effect and could also be assumed to be a net-impact. The inclusion of employment should only reflect net-gains in employment unless redistributive objectives enter into the analysis. Ideally, the change in the three indicators should be calculated as the difference between the region where the rail service exists and a control region without a rail service.

Change in Stress Levels for Car Travellers, Change in Stress Levels for Inhabitants

Congestion costs have so far only been considered with respect to the time penalty which existing car travellers face as a result of the transfer of rail passenger traffic to road. This element was included in the CBA part of SEM. However, other impacts in relation to congestion could be relevant. In particular, it seems appropriate to take into account change in stress levels for existing car travellers, car travellers transferred from rail and inhabitants. These impacts will, in general, only be associated with urban areas. These impacts could be measured by the indicators:

- change in proportion of car travellers who characterise travel conditions as stressful or very stressful;
- change in proportion of inhabitants who characterise road conditions as stressful or very stressful.

4.3 Application of the SONERAIL Evaluation Methodology

4.3.1 Objectives of case study application

The SONERAIL Evaluation Methodology (SEM) has been applied to a number of rail services in the countries represented in the consortium. This application has been in the form of a case study framework with focus primarily on the cost-benefit part of the methodology. The main purpose of the application was to obtain information about how SEM works in practice with reference to the advantages and problems involved.

In particular, the case study outcomes should be assessed with respect to:-

- data availability;
- calculation principles for impacts;
- appropriateness and reliability of results.

Therefore, if it appears that the data required are available, that a theoretical sound approach is used for the calculation of impacts and the results can be viewed as

appropriate/ valid then it can be concluded that SEM has passed an important test towards full-scale application.

In addition, the case study applications provide specific information about each of the examined services in terms of the impacts generated by the provision of the service. It should be noticed that the application is not a full-scale testing of SEM due to the lack of control data. However, the application can be used to assess the relevance and appropriateness of the results provided.

4.3.2 Approach adopted

The approach used in the application of SEM to the selected rail services concerned the situation of having the rail service compared with not having the rail service. In this sense the impacts are associated with the closure/ retention of a rail service. It should be noticed that the methodology can also be applied to marginal changes in service provision, e.g. the reduction in frequency. Furthermore, in assessing the impacts of closure/ retention of a rail service, it is assumed that this change is the only discretionary policy change considered.

This implies that if the closure of a rail service induces a bus company to operate more buses then this is considered to be a separate decision which should not be taken into account in the assessment of the rail service. The case study assessment is only an intra-country assessment and not an inter-country one. This restriction is due to the lack of harmonisation of available data between the countries in the consortium. For example, rail cost accounting systems are not yet harmonised between the EC Member States.

4.3.2.1 SEM CBA demonstration module - overview

In order to facilitate the calculation of the various CBA impacts considered in SEM, a demonstration computer model has been developed with reference to the case studies. The model is programmed in Excel 5.0 and consists of six sheets:-

- rail input sheet
- road input sheet
- parameter sheet
- output sheet (calculation of impacts)
- summary sheet with all impacts
- summary sheet with all net-impacts

The first two modules are the elements where input data are placed for each rail service. It is required that all data specified in these two modules are collected for each rail service. Otherwise, it is not possible to run the SEM computer model. These data are thus basic inputs. The data to be inputted concern current traffic and activity information such as passenger kilometres, vehicle kilometres, length of trips for rail and road traffic. These modules will be specified further below.

The next module concerns parameter values used in the calculation of the various SEM monetary impacts. A set of standard parameter values have been specified. However, it is possible to include country-specific values if available. This specification gives enhanced flexibility with respect to the application of the SEM computer model - it is only necessary to specify the basic data in the two input modules. It should be noticed that the same parameters should be used within a given country unless regional variations are present. The module includes parameters such as accident rates, emission factors, imputed money values for time and accidents.

On the basis of the data included in the two input modules and the parameter module, the various SEM impacts are calculated in the output module. The module computes net benefits for the various incidence groups along with a calculation of the overall social profitability in monetary terms for a given rail service. The results are calculated as annualised net benefits. It is possible to present the obtained results in various ways including as a table showing all impacts and overall social profitability in terms of net-benefits or only the net-impacts with overall net-benefits.

4.3.2.2 SEM CBA demonstration module - inputs

The rail data used in the computer model include the following elements:-

- passenger kilometres by purpose (commute, business, other);
- average length of passenger trips by purpose (commute, business, other);
- passenger trips by purpose (commute, business, other);
- train kilometres by traction type (diesel and electric);
- total avoidable costs;
- length of rail line;
- government subsidy.

Road data are included in the SEM computer model in order to determine the effects of rail service closure on road congestion. The variables used in the model includes:-

- vehicle kilometres on the roads which will be affected by a rail service closure;
- vehicle trips on the roads which will be affected by a rail service closure;
- vehicle flow composition for the roads which will be affected by a rail service closure;
- percentage change in speed if car traffic increases by 10 per cent with reference to the roads affected by closure.

The calculation of the various SEM impacts require, in addition to the data on rail and road aspects, information about a range of parameters. A set of default values for the parameters could be used in case other information was not available. Below, the included parameters are listed:-

- redistribution of passenger kilometres by mode;
- redistribution of passenger trips by mode;
- average journey speed by mode;
- travel time validation per hour by mode;

- % work time during business travel time by rail;
- cost per mode per passenger kilometre;
- energy consumption per train kilometre;
- emission per energy consumed (train);
- valuation of emission types;
- energy consumption per vehicle kilometre (road);
- emission per energy consumed (road);
- unit cost rate for noise from road;
- accident rates for road and rail traffic;
- accident cost rates for road and rail traffic;
- vehicle occupancy;
- vehicle operating cost parameters;
- consumers' surplus parameters.

Redistribution of passenger kilometres by mode concerns how the passenger kilometres for the rail service being assessed can be assumed to distribute on alternative modes. The modes considered in the analysis include:-

- car driver;
- car passenger;
- bus;
- other rail service;
- other;
- cancellation of journey.

As such the module only requires a limited amount of data in order to allow for a calculation of the SEM impacts.

4.3.2.3 SEM CBA demonstration module - outputs

The main outputs obtained from applying the SEM CBA Demonstration Model consist of:-

- impacts distributed according to incidence group;
- net-impacts (excluding the impacts which merely cancel out);
- overall net-benefits.

The following incidence groups are included:-

- former rail travellers which change mode;
- former rail travellers which do not travel;
- existing car travellers;
- train company
- government;
- society;
- other.

The net-impacts calculated corresponds to the list of net-impacts given in Sec. 4.2.5.

4.3.2.4 SEM MCA demonstration module - main principles and structure

In the case studies the so-called **Regime Analysis** was used to undertake the MCA ranking of the selected rail services. This method requires only ordinal impact and weight information and determines then the ranking by calculating the probability for one rail service to be higher ranked than another rail service. These pairwise comparisons are undertaken for each possible combination. This information is used to calculate overall probabilities for each of the selected rail services which determine the ranking.

The MCA impacts consist of monetary impacts and non-monetary impacts. Monetary impacts can be taken into account in the MCA as the calculated net benefits (normalised) because of the common measurement unit. In contrast, the non-monetary impacts need to be included as separate elements. The non-monetary impacts are the ones listed in sec. 4.2.5.2 Let be non-monetary impacts be listed as follows:-

- I₁ = change in chemical pollutants
- I₂ = change in flora/fauna
- I₃ = change in visual intrusion
- I₄ = change in vibration
- I₅ = change in employment
- I₆ = change in productivity
- I₇ = change in GDP (actual)/GDP (potential)
- I₈ = change in stress levels for car travellers
- I₉ = change in stress levels for inhabitants

Therefore, the complete set of MCA impacts comprises of I₁ -I₉ and

- I₁₀ = monetary social net-benefits (normalised)

The impacts I₁ to I₉ are measured on an ordinal scale:-

+++	large positive impact
++	positive impact
+	small positive impact
0	neutral
-	small negative impact
--	negative impact
---	large negative impact

I₁₀ is measured cardinally (monetary units, eg: EURO). The regime analysis is, as the starting point, focusing on the sign of the pairwise comparison of rail services for each criterion. Consider rail service 1 (in terms of which rail service performs better than the other) compared to rail service 2, and let rail services 1 and 2 be characterised by the following impact vectors:-

Rail Service 1 = [+ , - , + , + , - , + , - , + , + , 0.5]

Rail Service 2 = [-, +, +, -, -, -, +, -, +, 1]

In this case two regime vectors can be defined:-

$$r_{12} = [+1, -1, 0, +1, 0, +1, -1, +1, 0, -1]$$

$$r_{21} = [-1, +1, 0, -1, 0, -1, +1, -1, 0, +1]$$

r_{12} is concerned with whether rail service 1 performs better than rail service 2, while r_{21} is concerned with whether rail service 2 performs better than rail service 1. A +1 would hence denote that the rail service listed in the first place performs better than the second listed, while a -1 would imply that the rail service listed as first performs worse than the second listed service.

Obviously: $r_{21} = -r_{12}$

The number of regime vectors depends on the number of rail services to be ranked. In fact, the number of these vectors is equal to $n \times (n-1)$ with n being equal to the number of rail services. Half of the regime vectors can though be derived from the other half because of symmetry relations as illustrated in the case of two regime vectors.

The next step in the regime analysis is to order the criteria in terms of importance. In the case studies it was left to the Partners to order the criteria with reference to the local country specific situation. In essence the criteria should be presented as:

$$W_1 \geq W_2 \geq W_3 \geq W_4 \geq W_5 \geq W_6 \geq W_7 \geq W_8 \geq W_9 \geq W_{10}$$

Where W_1 is the most important criteria and W_{10} the least important one. Adding the normalisation restriction that:-

$$\sum_{i=1}^{10} W_i = 1$$

it is possible to determine the probability for a given rail service to perform better than another one taking into account the performance for each criterion, with an assumption about the probability distribution for the weight factors. In the case studies, a uniform distribution was assumed (in accordance with standard practice, see Nijkamp et al. (1990)). From the pairwise based probability scores it is possible to calculate an aggregated probability score for performance dominance for each rail service calculated as the mean of the pairwise probabilities. Each aggregated probability score measures the probability that the given rail service performs better than the other rail services (on average). The probability score can be used to rank the rail services such that the highest ranked rail service has the highest probability score.

The SEM MCA demonstration module has been programmed in Excel 5.0 and consists of three sheets:-

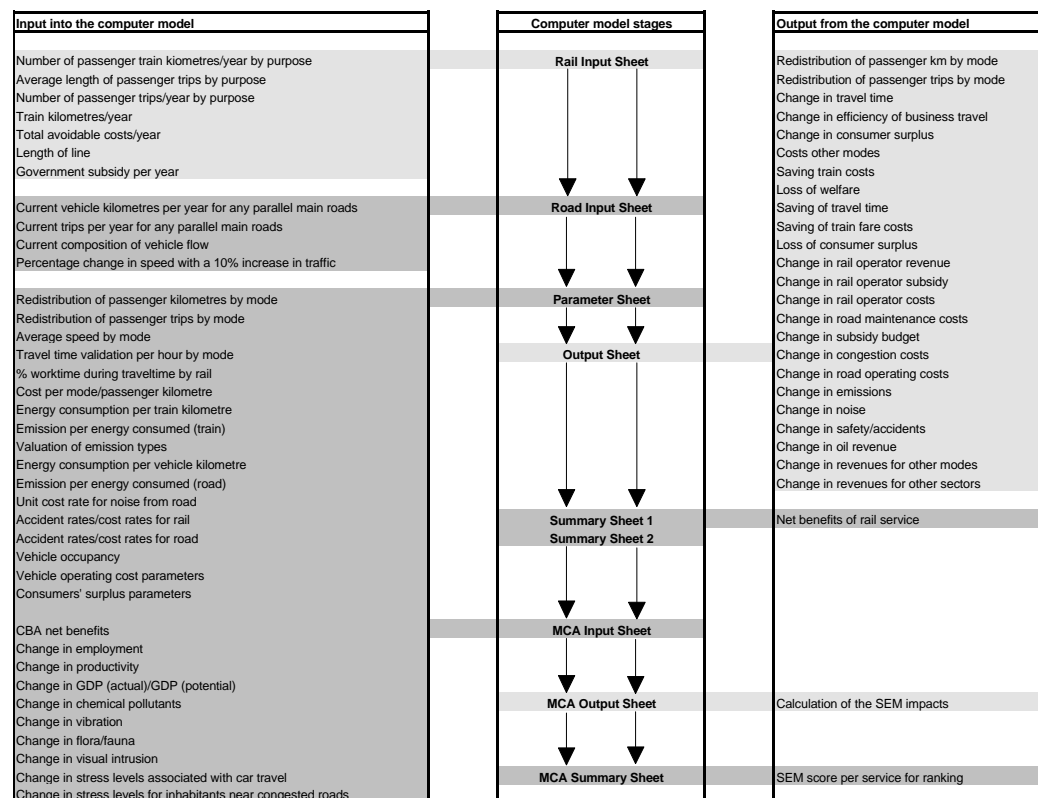
- MCA input sheet;
- MCA output sheet;
- MCA summary sheet.

In the MCA input sheet ordinal data regarding the different impacts are inputted, together with an indication of the relative importance of the impacts included. Subsequently, the calculation of the average probability for each rail service to dominate any of the other rail services is undertaken in the output sheet. This is based on a random selection of weights satisfying the given order of importance. In the MCA summary sheet the obtained ranking scores are presented. At the moment the MCA module is restricted to consider up to 3 rail services as the development of the module concerned the case study application. However, research has been undertaken to assess the scope for increasing the number of rail services which can be included in the module. It appears that this extension is relative straightforward in programming terms.

4.3.2.5 Overview of the SONERAIL demonstration models

In Figure 5 an overview of the SONERAIL demonstration model is given, showing how the CBA outcome has an interface to the MCA module. In this way the CBA and MCA modules form an integrated model for rail service assessment.

Figure 5. Structure of the SONERAIL computer models.



4.3.3 Application results

Overall, SEM has been applied to 25 rail services in European countries, including:-

- 4 rail services in Great Britain;
- 9 rail services in Netherlands;
- 3 rail services in each of the other countries (Czech Republic, Germany, Greece and Italy).

An overview of the selected rail services is given in Table 5.

Table 5. Selected case study services

Country	Service
United Kingdom	UK1 Single route (name of service is confidential)
United Kingdom	UK2 Single route (name of service is confidential)
United Kingdom	UK3 Single route (name of service is confidential)
United Kingdom	UK4 Network (Cardiff Valley Railways)
Netherlands	NL1 Single route (name of service is confidential)
Netherlands	NL2 Single route (name of service is confidential)
Netherlands	NL3 Single route (name of service is confidential)
Netherlands	NL4 Single route (name of service is confidential)
Netherlands	NL5 Single route (name of service is confidential)
Netherlands	NL6 Single route (name of service is confidential)
Netherlands	NL7 Single route (name of service is confidential)
Netherlands	NL8 Single route (name of service is confidential)
Netherlands	NL9 Single route (name of service is confidential)
Germany	DE1 Dresden - Leipzig (via Doebeln)
Germany	DE2 Zwickau - Johanngeorgenstadt
Germany	DE3 Bautzen - Hoyerswerda
Czech Republic	CZ1 Route 34, Smrzovka - Jozefdv Ddl
Czech Republic	CZ2 Route 36, Liberec - Zelezny Brod
Czech Republic	CZ3 Network (Routes 34, 35 and 36), Route 35 runs from Tanvald to Harrachov
Italy	IT1 Siena - Chiusi
Italy	IT2 Siena - Grosseto
Italy	IT3 Lucca - Aulla
Greece	GR1 Athens -Thessaloniki
Greece	GR2 Athens - Patras - Kyparissia
Greece	GR3 Athens - Chalkida

4.3.3.1 Case study CBA results

Among these 25 services a total of 15 services appeared to be socially profitable in monetary terms, i.e. higher monetary benefits than costs. The annual net-benefits ranged from -4 mill. ECU to +5 mill. ECU, although only 4 services had net-benefits

less than -0.5 mill. ECU. The results show that the main impacts associated with a rail closure were:-

- avoidable rail costs;
- loss in consumers' surplus for the former rail travellers;
- travel opportunity loss for those travellers who decide not to travel;
- travel time effects;
- accident costs.

In particular, avoidable rail costs and travel opportunity loss are important. Therefore, it is of crucial importance to estimate correctly the avoidable costs and the proportion of former rail travellers who choose not to travel if the rail service is closed.

The specific results for the selected rail services are shown in Tables 6a-f. It should be noticed that the numbers shown for the different net-impacts for a given service cannot be added to give the net-benefits because the values for two impacts categories have not been shown. The exclusion of the values for two impact categories (including change in rail costs) reflects the concern about confidentiality regarding rail costs expressed by the train operators which participated in the case studies.

Table 6a CBA results United Kingdom (mln. ECU per year)

	Route 1	Route 2	Route 3	Network
Change in Efficiency Business Travel	0.06	1.17	0.01	3.78
Change in Travel Time for Remaining Travellers				
Loss of Consumers' Surplus for Remaining Travellers	0.20	0.35	0.06	2.32
Loss of Consumers' Surplus for Non-remaining Travellers	0.01	0.01	0.00	0.10
Travel Opportunity Loss Non-remaining Travellers	0.23	0.63	0.09	4.38
Travel Time Savings Non-remaining Travellers	-0.11	-0.47	-0.05	-2.93
Change in Rail Costs				
Change in Road Maintenance Costs	0.00	0.00	0.00	0.00
Change in Congestion Costs	0.01	0.17	0.03	4.59
Change in Emissions	-0.03	-0.02	-0.01	-0.21
Change in Noise	0.01	0.02	0.00	0.18
Change in Accidents	0.02	0.03	0.00	1.15
NET-BENEFITS	-0.5	0.95	-0.46	1.1

Table 6b CBA results Netherlands (mln. ECU per year)

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Route 8	Route 9
Change in Efficiency Business Travel	0.15	0.27	0.35	0.37	0.50	0.08	0.23	0.20	0.18
Change in Travel Time for Remaining Travellers									
Loss of Consumers' Surplus for Remaining Travellers	0.88	1.82	2.28	2.32	3.08	0.51	1.43	1.39	1.10
Loss of Consumers' Surplus for Non-remaining Travellers	0.34	0.74	0.95	0.87	1.21	0.23	0.63	0.57	0.47
Travel Opportunity Loss Non-remaining Travellers	3.40	7.20	9.25	8.61	11.96	2.21	6.11	5.61	4.58
Travel Time Savings Non-remaining Travellers	-1.27	-2.66	-3.41	-3.23	-4.47	-0.81	-2.25	-2.06	-1.69
Change in Rail Costs									
Change in Road Maintenance Costs	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Change in Congestion Costs	0.02	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00
Change in Emissions	0.00	0.00	0.00	0.00	0.00	-0.04	0.00	0.00	0.00
Change in Noise	0.01	0.02	0.02	0.03	0.03	0.00	0.01	0.01	0.01
Change in Accidents	0.04	0.07	0.08	0.11	0.13	0.01	0.04	0.05	0.03
NET-BENEFITS	0.21	1.86	4.68	2.96	4.99	-0.29	1.11	0.07	1.25

Table 6c CBA results Germany (mln. ECU per year)

	Route 1	Route 2	Route 3
Change in Efficiency Business Travel	0.08	0.06	0.01
Change in Travel Time for Remaining Travellers			
Loss of Consumers' Surplus for Remaining Travellers	1.65	0.71	0.12
Loss of Consumers' Surplus for Non-remaining Travellers	0.31	0.10	0.01
Travel Opportunity Loss Non-remaining Travellers	4.78	2.08	0.26
Travel Time Savings Non-remaining Travellers	-2.39	-1.22	-0.15
Change in Rail Costs			
Change in Road Maintenance Costs	0.00	0.00	0.00
Change in Congestion Costs	0.60	0.11	0.01
Change in Emissions	0.07	-0.19	-0.16
Change in Noise	0.08	0.02	0.00
Change in Accidents	0.36	0.07	0.00
NET-BENEFITS	0.49	-1.96	-2.59

Table 6d CBA results Czech Republic (mln. ECU per year)

	Route 1	Route 2	Network
Change in Efficiency Business Travel	0.01	0.08	0.07
Change in Travel Time for Remaining Travellers			
Loss of Consumers' Surplus for Remaining Travellers	0.08	0.46	0.53
Loss of Consumers' Surplus for Non-remaining Travellers	0.01	0.14	0.19
Travel Opportunity Loss Non-remaining Travellers	0.23	2.00	2.54
Travel Time Savings Non-remaining Travellers	-0.16	-1.10	-1.36
Change in Rail Costs			
Change in Road Maintenance Costs	0.00	0.00	0.00
Change in Congestion Costs	0.06	0.25	0.20
Change in Emissions	0.00	0.00	0.00
Change in Noise	0.00	0.00	0.01
Change in Accidents	0.02	0.07	0.08
NET-BENEFITS	-0.27	0.96	0.92

Table 6e CBA results Italy (mln. ECU per year)

	Route 1	Route 2	Route 3
Change in Efficiency Business Travel	0.05	0.09	0.04
Change in Travel Time for Remaining Travellers			
Loss of Consumers' Surplus for Remaining Travellers	1.21	2.21	0.94
Loss of Consumers' Surplus for Non-remaining Travellers	0.30	0.56	0.24
Travel Opportunity Loss Non-remaining Travellers	3.03	5.55	2.36
Travel Time Savings Non-remaining Travellers	-1.09	-1.99	-0.85
Change in Rail Costs			
Change in Road Maintenance Costs	0.00	0.00	0.00
Change in Congestion Costs	0.28	0.77	0.26
Change in Emissions	0.00	0.00	0.00
Change in Noise	0.02	0.03	0.01
Change in Accidents	0.21	0.39	0.17
NET-BENEFITS	-0.13	1.65	-0.49

Table 6f CBA results Greece (mln. ECU per year)

	Route 1	Route 2	Route 3
Change in Efficiency Business Travel	2.27	0.33	0.16
Change in Travel Time for Remaining Travellers			
Loss of Consumers' Surplus for Remaining Travellers	4.16	0.77	0.44
Loss of Consumers' Surplus for Non-remaining Travellers	0.00	0.00	0.00
Travel Opportunity Loss Non-remaining Travellers	0.60	0.23	0.13
Travel Time Savings Non-remaining Travellers	-0.25	-0.12	-0.09
Change in Rail Costs			
Change in Road Maintenance Costs	0.00	0.00	0.00
Change in Congestion Costs	0.30	0.08	0.34
Change in Emissions	-0.10	-0.06	-0.07
Change in Noise	0.20	0.03	0.06
Change in Accidents	0.89	0.16	0.30
NET-BENEFITS	0.28	-2.2	-4.07

In the comparison of the results with respect to specific net impacts the following observations can be made:-

- *change in efficiency business travel* is positive for all selected services because service retention implies that work can be undertaken during travel compared to the situation without the service where other modes offer fewer possibilities for work. The variation in the magnitude depends on the level of rail demand with a business purpose and the proportion of travel time which is used for work activities;
- *loss in consumers' surplus for remaining travellers* is positive in all cases since it reflects the difference in what the journey costs to the traveller and their willingness to pay for the journey. This difference will be greater than or equal to zero; if it was negative the rail traveller would be better off not undertaking the journey in the first place;
- *change in travel time for remaining travellers* is negative in most cases. The sign depends on the travel time by rail compared to other modes. If it is positive, it implies that rail is faster than the modes which these travellers would transfer to in case of a rail service closure. As such this would mean that closure would lead to additional time used for travel purpose - a benefit of retention;
- *loss in consumers' surplus for non-remaining travellers* is positive in all cases since it reflects the difference in what the journey costs to the traveller and their willingness to pay for the journey. This difference will be greater than or equal to zero; if it was negative the rail traveller would be better off not undertaking the journey;
- *travel opportunity loss for non-remaining travellers* is positive in all cases because those rail travellers deciding not to travel if the rail service is closed will not be able to undertake the activities for which the rail journeys were made. This loss should at least reflect the opportunity costs to those travellers, i.e. the sum of the money and time spent;

- *travel time savings for non-remaining travellers* is negative in all cases as it represents a benefit to these travellers if the rail service was closed;
- obviously, *avoidable rail costs* represent a negative aspect in relation to rail service retention as it implies that resources used in the provision of a service cannot be used elsewhere in the economy. The cost level for the different services vary significantly reflecting different scale of operation, productive efficiency and price level differences between the countries represented in the SONERAIL consortium;
- for all case studies it is assumed that the *change in road maintenance costs* is zero as the transfer to road of former rail traffic is assumed to involve only car based transport which have an insignificant contribution to road maintenance costs changes compared to heavy goods vehicles.
- *change in congestion costs* in the form of extra time consumption for existing travellers is in most cases zero or close to zero such that the retention of a service is not linked to significant changes in congestion costs. It should be noticed that this result refers only to the case study services. If services located in large urban areas were assessed it is likely that the congestion impacts would be larger;
- the impacts on *emissions* of retention of a service are in all cases quite small and in most cases negative such that the monetary value of the reduced emissions from rail is larger than the increased emissions from road if the rail service is closed. This reflects that rail engender emissions and the transfer of traffic to roads is only assumed to involve additional motorised vehicle kilometres for car-driver;
- *change in noise* is for all case studies positive but insignificant. This implies that retention generates small benefits in terms of reduced noise nuisance. It should be noticed that it has not been possible to take into account noise changes from rail;
- *change in accidents* represents in all cases a positive impact because accident rates for rail transport are smaller than for road and the effect of transferring additional motorised vehicle kilometres to the roads on car accidents and accidents among other road users.

On the basis of the results obtained it can be concluded that a socially profitable rail service (in monetary terms) is one with:-

- high patronage;
- low cost of operation;
- relative low journey times;
- lack of alternative modes.

Fortunately, these elements are hardly surprising.

4.3.3.2 Data availability in case study applications

The data required to run SEM in its current form concern rail data, road data and a range of information regarding parameters and values. This data enables a computation of the various CBA impacts. In addition, data is required for the MCA although in its current format the MCA module can be run without a significant amount of data as the impacts are ordinally assessed. A full scale application of the SEM MCA will require improved data collection. However, the resources required for this could not be justified in the small scale application in the case studies. Possible extensions of SEM data collection would include an improved data collection for the MCA involving at least environmental and economic impact assessment along with surveys among travellers and inhabitants. These extensions are described further in Section 4.3.4. Below the data availability concerning rail, road and parameter data will be considered.

4.3.3.3 Rail data

Although the required rail data exist (provided by the rail service operator) confidentiality issues can make it hard to obtain access to the data. In general, it has been possible to obtain this data although the collection will require assistance from the rail operators. The main problems concerned the availability of activity data categorised according to trip purposes as total levels are available (e.g. commute, business and other). However, for all case studies it has been possible to split the activity data on trip purposes. Another problem concerned the provision of information about total avoidable costs. The important issue is that these costs should be avoided for society and not only the rail operator. In particular, the presence of joint utilisation of resources is an aspect which can cause difficulties in measuring avoidable costs. Information on avoidable costs were obtained from the rail companies in order to utilise their detailed knowledge about cost structures with reference to the selected services. The calculation of social profitability in the case studies only required information about total avoidable costs. Due to differences in rail cost accounting systems across Europe the obtained costs are not comparable between countries although the costs included should be similar. In the SONERAIL case studies it was decided to include all cost items which could be directly attributable to a service as well as those which could be allocated to specific services using an appropriate key provided the costs would be avoided if the rail service was closed. The costs would mainly include:-

- train traction costs
- train formation costs
- dispatch costs

Infrastructure cost changes associated with the closure of an individual rail service have been excluded from the case study assessment. However, in a full-scale application of SEM these cost changes should be taken into account. The magnitude of infrastructure cost savings with a rail service closure will depend on:-

- whether the rail service closure is a complete closure or just a reduction in

frequency;

- the physical context, is the rail service a branch line or placed along a corridor;
- the time horizon, short vs. long term: the infrastructure cost impacts are likely to increase over the long term.

The closure of a passenger rail service could be followed by a decision to use a lower infrastructure quality or indeed complete track closure. Therefore, the infrastructure savings vary according to what decision is made concerning the use of the line following service closure. SEM can be used irrespective of the specific decision concerning the line following a service closure. The user of SEM will have to identify the infrastructure cost savings. These will be determined by the decision on the future use of the line, e.g. intensive passenger service (high costs remain), occasional light rail-set passenger service (costs reduced), freight operations only (costs significantly reduced) etc. Thus in each individual case of rail service reduction, a separate analysis is required.

4.3.3.4 Road data

In general, a large amount of information about road traffic flow level and composition is available through traffic counts undertaken by traffic authorities. The difficulty in relation to the collection of road data for SEM is linked to the lack of a traffic model. In this way, the collected road data can only be a rough approximation of the road traffic flow affected by the closure of a rail service. However, with information about the area where the rail service is placed, it is possible to indicate which roads are likely to be affected and then through available traffic counts determine the traffic flows involved.

The composition of traffic flow is in general available in terms of vehicle type but seldom in terms of trip purpose. Furthermore, it is difficult to get information about the percentage change in speed for a given change in traffic flow because it depends on many factors including the design of the road, the time period concerned and present traffic flow level. A precise figure would require the estimation of speed flow relations on the basis of traffic counts.

4.3.3.5 Parameter Data

The parameters included could be used as defaults in the case studies, but it was attempted to use local/regional/country specific values as much as possible in order to reflect the local context. In particular, it was emphasised to use the default redistribution parameters with care. These parameters were derived from an analysis of rail passenger responses in the Netherlands due to a national rail strike. However, these responses reflect short-term decisions rather than long-term decisions which would be required with the permanent closure of a rail service. The availability of information concerning alternative mode choices varies considerably from case to case. Some train operators in the case studies had undertaken surveys to examine these aspects.

For all the case studies rates of emission for energy consumed for road as well as rail were based on information from the German Infrastructure Evaluation Model (FTIP).

Although emission rates vary between countries and even within countries, it was decided that these values would represent a reasonable approximation to the true values.

The specified default value for percentage time worked during train travel (40%) has not been used in all case studies as it reflects the situation in the Netherlands and might not be representative in other regions. This percentage will depend on the distances travelled hence for very short journeys 40% appears to be too high. In general, it was possible to obtain data which reflected the local/regional/country situation, apart from the unit monetary values on noise, emissions and accidents where the default values were used.

4.3.4 Possible extensions to achieve full-scale application

In some cases it would be possible to improve the procedures used to incorporate data in the model allowing for a full-scale application of SEM. These improvements are considered below.

4.3.4.1 Traffic Model

An interface between SEM and a transport model is of importance as it would improve the analysis of the consequences of a rail service closure in terms of effects on former rail travellers transferring to other modes and the effects on other travellers with reference to specific roads. In this way, it would be possible to determine the various SEM impacts with more precision. In particular, the calculation of travel time changes for the former rail travellers and other travellers would be smoother. In addition, the road related data can be provided in a more refined context, as it would be possible to determine, via the transport model, the roads which will be affected along with the traffic flows involved.

4.3.4.2 Data collection on rail costs

The measurements of avoidable cost for a rail service could be supported through the inclusion of rail cost allocation systems (based on marginal cost accounting). This system would ideally enable the allocation of costs on specific services, according to a principle about cost causation.

The cost allocation system should include links between infrastructure costs and services. Obviously the system should relate to the use of variable costs, as the fixed costs per definition do not vary according to activity level. In relation to this, it is important that the cost allocation system should be applicable for different time horizons as the extent to which costs are fixed depends on the time horizon. The ideal solution would be a cost allocation system which could be used in different regions/countries irrespective of differences in organisational/institutional frameworks for railways.

4.3.4.3 Data collection on MCA - Environmental and Economic Impact Assessment.

Most of the non-monetary impacts included in the MCA analysis in SEM relate to environmental/ economic regeneration/ development, apart from the two impacts concerned with stress levels for travellers and inhabitants. A clear need for improved data collection in this area can be identified. Improved data collection would enable a quantification of these impacts, even if it is not possible to provide for monetarisation and inclusion in the CBA module. Techniques are available for the assessment of the outlined impacts. This holds in particular for the environmental aspects.

The economic impacts are, as described, difficult to quantify due to the effects occurring over the long term, the lack of control areas, and the problems of defining economic impacts as distributive or generative. However, a system of indicators could be utilised to obtain a more robust and refined indication of the direction of these impacts. These data collection procedures could, without problems, be linked to the MCA, thereby improving the possibility to specify the impacts correctly.

4.3.5 Summary of application results

SEM has been applied on specific rail services in the countries represented in the consortium. The application results suggest that SEM represents a promising tool for evaluation of rail services. Obviously, a full-scale application of SEM requires further development including traffic modelling to provide better estimates of the road congestion effects and forecasting tool to provide inputs on variables for future periods.

SEM can be applied to all types of rail services given its generic characteristics, although it is of particular relevance with respect to those rail services which require subsidy support in order to ensure their provision.

As such SEM can be a relevant tool for a variety of actors involved in the rail industry, including:-

- funding authorities;
- European Commission;
- rail operators.

The main role of SEM would be to provide important information in relation to the decision making process regarding assessment of the social value derived from rail services.

4.4 Future operations scenarios

4.4.1 Objectives

The purpose of the research into future operations scenarios is to enable getting information about how financial and social profitability of rail service provision can change in the future as a result of changes in key influencing factors. This information can assist in the specification of appropriate policy responses including strategies by rail operators to counter eventual adverse changes. Such analysis could be seen as a way to create the opportunities for achieving a more optimal provision and use of rail in particular, and transport in general. The specific objectives for the research were in relation to the next ten year period divided into the short term (0-2 years), medium term (3-5 years) and long term (6-10 years). As such the coming ten year period involves a range of changes in relation to the supply of rail services, funding and market position. In this period it is possible that the use of public service contracts will be generalised as the basis for providing and supporting rail services. The emphasis will be to provide better services in a more cost-effective way in order to increase the value for money.

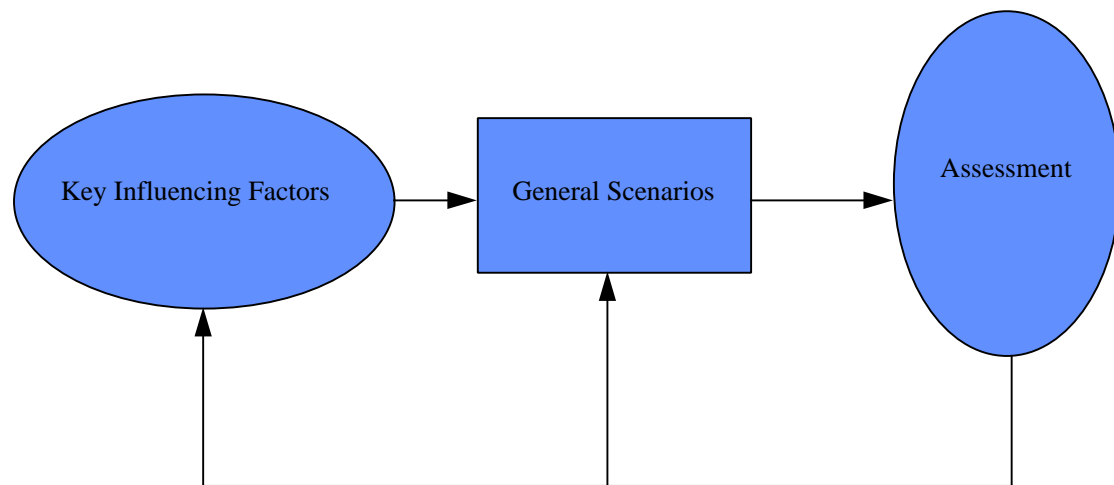
4.4.2 Approach adopted

The approach used to undertake the analysis of future scenarios is presented in Figure 6:

- analysis of key influencing factors;
- scenario specification;
- scenario analysis.

It should be noticed that the assessment of the specified scenarios was undertaken with respect to the rail services examined earlier in the SONERAIL case study phase. Subsequently, these service specific results were considered in terms of their generality.

This approach could be generalised to a scenario analysis module where counter measures or action plans are formulated according to the outcome of the assessment of a rail service. The action plan/strategy could then feed back into the specification of key influencing factors forming part of an iterative procedure for the specification of scenarios. In this way, the information provided would enable a comparative assessment of different strategies/scenarios and thereby allow for improved decisions relating to appropriate measures to be implemented by rail authorities/operators.

Figure 6. Future scenario analysis

4.4.3 Key scenario findings

4.4.3.1 Influencing factors and scenarios

As part of the identification of future operation scenarios, research was undertaken to establish influencing factors which are of significant importance to the changes in the future position of rail. The research revealed that the main factors of importance for rail will include:-

- overall change in mobility demand;
- degree of market orientation/ customer focus for rail in relation to improving the share of travel demand;
- scope and implementation of efficiency improvement/ cost reduction strategies for all actors related to the provision of rail transport;
- policy changes as reflected in Directive 91/440, Council Regulation 1893/91 and related legislation;
- spatial development, although the impacts on demand patterns are likely to appear in the longer term;
- special aspects in relation to the situation in the Eastern European countries associated with the transitional phase from a plan economy system towards a market economy based system.

The various aspects are obviously interlinked. For example, the scope and implementation of efficiency improvement strategies will be influenced by the initiatives introduced through the policy changes in relation to open access and public service contracts.

These factors have been used to form a number of scenarios. The identified scenarios are listed below:-

- base scenario;

- improved efficiency scenario;
- fair and efficient competition scenario;
- rail service quality improvement scenario;
- Czech Republic Scenario I: Further decline of rail;
- Czech Republic Scenario II: Rail maintains its modal share.

The base scenario is a continuation of current demand trends. Among the alternative scenarios, the improved efficiency scenario involves reductions in the cost of providing rail services. The fair and efficient competition scenario concerns the effects associated with introducing charges for the usage of transport infrastructure according to the costs incurred as the result of their usage. The rail service quality improvement scenario examines the effects on demand and costs of improved service quality in terms of enhanced service frequency.

These scenarios have been specified with respect to the next ten year period categorised as:-

- short term (0-2 years)
- medium term (3-5 years)
- long term (6-10 years)

The scenarios have been assessed for each of the rail services examined in the SONERAIL case study phase. Results from this assessment will be discussed below.

The importance of access charges have been considered in the medium (3-5 years) and long term (6-10 years) of the next ten year period. However, the introduction of access charges was not considered in the short term (0-2 years). The exclusion of access charges in the short term is caused by the SONERAIL Team's assessment of the implemented access charging system. Although access charges have been introduced in some of the SONERAIL countries this has not been based completely on the principles put forward in the Commission's Green Paper "Towards the Fair and Efficient Pricing in Transport". Implementation of these principles was felt to be outside the short term period and more likely to happen in the medium and long term. The decision to exclude access charges in the short term scenario analysis is further supported from the recent EC White Paper "Fair payment for infrastructure use". A plan for 3 phase process towards the implementation of access charges based on short run marginal social costs has been put forward, where the process of implementing this system will be initiated in the short term but not completed until after 2004. In particular, the planned activities in the short term would mainly involve preparatory work along with further research regarding the issues involved to establish the basis for the charges. As such this implementation plan corresponds exactly with the approach taken in the scenario analysis concerning the access charges. In the first two years of the coming ten year period access charges are excluded from the analysis, in the medium term access charges are considered corresponding to the 2nd phase of the implementation plan.

4.4.3.2 Scenario impacts and indications for case study services

The approach used in assessing the scenarios was to consider the financial and social profitability by the end of the short, medium and long term periods. It should be emphasised that the scenario results obtained can only be seen as possible patterns not as definite outcomes.

The scenario impacts concerned, in the main, influences on the demand for rail services and changes related to the cost of rail operation. These changes will have impacts on the social and financial profitability. Financial profitability changes as a result of the changes in demand (revenue) and costs. Social profitability is effected by the various benefit and cost elements as specified in the SONERAIL Evaluation Methodology (SEM). These elements are directly linked to the level of rail demand and costs.

Overall the impacts from the different scenarios can be summarised as follows; covering the short, medium and long term.

Base Scenario

The impacts of the base scenario are minimal due to the assumed low annual increase in rail demand. This specification leads to a small improvement in social and financial profitability. The small improvement is present in the short, medium and long term. As a result, none of the rail services change from being socially unprofitable to socially profitable.

Efficiency Improvement Scenario

This scenario generates positive impacts on social as well as financial profitability due to the assumed reduction in rail costs. Reduced rail costs induce in turn a positive impact on the demand for rail. The possibility for cost reductions in the rail industry has been demonstrated in several studies including the EC funded PRORATA project. PRORATA results suggest wide variations in the cost reduction potential across Europe ranging from 0% to 65%, see PRORATA (1997). Table 7 shows the efficiency scores for the countries represented in SONERAIL except Czech Republic calculated with respect to a deterministic cost frontier.

Table 7. Deterministic efficiency scores (1995)

Great Britain	71.47%
Italy	59.91%
Netherlands	69.06%
Germany	82.62%
Greece	66.51%

Source: PRORATA (1997)(Deliverable D2, Table 8.2)

On this basis it has been assumed that rail costs could be reduced by up to 22% over the next ten year period with the main changes occurring over the medium and long term. This assumption appears to be in the lower end of the potential for cost savings.

A conservative estimate is appropriate given that 10 years may prove insufficient to attain the full cost reduction potential. The assumed pattern in cost savings over the short, medium and long term is as follows: 5 per cent in the short term, an additional 7 per cent in the medium term and further 10 per cent in the long term. This pattern can be justified given the time lag necessary to undertake restructuring and rationalisation processes. It should be noticed that the influence on demand will depend on how the reduced costs translate into reduced fare levels and the fare elasticity for rail demand.

Fair and Efficient Competition Scenario

According to the principles put forward in the European Commission's White Paper "Fair payment for infrastructure use" users of transport infrastructure should be charged according to the costs caused by their usage. This scenario has been limited to consider the implementation of access charging. The fair and efficient competition scenario has been added to the efficiency improvement scenario for the medium and long term analysis. It was decided not to incorporate this scenario in the short term analysis because the SONERAIL consortium felt that the introduction of access charges according to the fair and efficient pricing principles was outside the scope for the short-term period, due to the time needed for implementation and the requirement for additional information about the cost basis for access charges as well as the link between usage of the rail infrastructure and the costs incurred by the infrastructure owner/manager. In particular, this corresponds to the time plan in the White Paper where the period until 2000 should be concerned with establishing the basis for such charges.

The results show the importance of access pricing being introduced in parallel with efficiency improvements. Otherwise, the isolated effect is increased rail cost leading to reduced demand and hence reduced social and financial profitability. Another issue in relation to introducing access pricing for rail is whether it is implemented together with similar systems being implemented for other modes. In the analysis it was not possible to take this aspect into account. However, if other modes are charged according to those principles the negative impacts on social and financial profitability are likely to be reduced given the possibility for a level playing field between the modes. This would though depend on the coverage of the system, e.g. whether other roads than motorways will be included.

Rail Service Quality Improvement Scenario

This scenario was examined for the short, medium and long term. It was analysed assuming an increase in train kilometres (increase in service frequency) which leads to increased rail costs but also to a higher level of rail demand. The scenario was modelled as an additional element to the efficiency improvement scenario. As such the results suggest that this scenario, viewed in isolation, reduces the financial and social profitability because of the assumption that demand response to improved service quality is weak. In addition, rail costs increase more strongly than the demand. This result is based on two elements:-

- change in demand from a change in service frequency;
- change in costs from a change in service frequency.

Demand increases from an increase in service frequency because of a reduction in the time penalty for rail travel. This can be translated into reduced generalised journey time. However, a 10 per cent increase in service frequency imply a smaller reduction in generalised journey time (because the main component in generalised journey time, in-vehicle journey time, remains unchanged). Therefore, the demand change will be rather modest: for a 10 per cent increase in service frequency demand will increase between 1.0-3.5 per cent depending on the assumptions used for the generalised journey time elasticity.

On the cost side the available statistics on national railways in European countries (see PRORATA (1997)) indicate that the variation in unit costs (operating cost per train kilometre, i.e an average cost concept) cannot be explained by the level of train kilometres. In other words it can be justified to assume that unit costs are constant for small changes in train kilometres. On this basis a 10 per cent increase in train kilometres could be assumed to lead to a 10 per cent increase in total costs. Therefore, comparing the increase in demand to cost increases for a change in service frequency would imply that financial and social profitability will be reduced. As such this finding illustrates the importance of careful consideration with respect to how a service is improved; focus should be on those service characteristics which show a high degree of demand responsiveness.

Obviously, these assumptions are of importance for the results obtained. It should be noted that this scenario should be viewed more as a sensitivity testing of the base/efficiency improvement scenario.

Czech Republic Scenarios

Czech Republic Scenarios I and II were included in order to examine the possibility and likelihood of different patterns of change within the Czech Republic (and Eastern Europe) compared to the EC countries. It is not surprising that the results obtained show reduced financial and social profitability where a further decline in the demand is assumed; while improvements in the financial and social profitability of the services appear in the situation where rail maintains its modal share.

It appears that the decline in rail demand over the past few years in the Czech Republic has somewhat stabilised. Therefore, it is possible that rail in the future will not experience further decline and its market share may even begin to increase. This also takes into account the findings for case study services regarding the transfer in 1997-98 of the operation to a private operator with significant increases in rail demand as a consequence.

4.4.3.3 Implications of scenario results

The results for the different scenarios in the long term provide a good basis for considering their implications as the longer time frame allows for more pronounced effects. Table 8 shows for each of the scenarios the outcomes for the rail services in terms of net-benefits.

Table 8. Long term scenarios - social net-benefits (mln. ECU)

	Social Net benefits Current position	Social Net benefits Base scenario	Social Net benefits Efficiency improvement scenario	Social Net benefits Fair and efficient scenario	Social Net benefits Service quality scenario
UK1	-0.50	-0.51	-0.13	-0.42	-0.18
UK2	0.95	0.99	1.70	1.12	1.68
UK3	-0.47	-0.46	-0.29	-0.42	-0.33
UK4	1.10	1.28	5.49	2.19	4.98
NL1	0.21	0.25	2.30	0.55	2.15
NL2	1.86	1.97	5.94	2.50	5.74
NL3	4.68	4.87	9.41	5.38	9.33
NL4	2.96	3.12	7.83	3.73	7.62
NL5	4.99	5.24	11.45	6.00	11.24
NL6	-0.29	-0.26	1.10	-0.06	0.96
NL7	1.11	1.19	4.57	1.64	4.37
NL8	0.07	0.13	3.51	0.62	3.24
NL9	1.25	1.32	3.78	1.64	3.66
CZ1	-0.27	-0.27	-0.08	-0.23	-0.11
CZ2	0.96	1.00	1.77	1.10	1.75
CZ3	0.92	0.96	1.99	1.10	1.94
DE1	0.49	0.56	2.96	0.98	2.80
DE2	-1.96	-1.97	-0.49	-1.66	-0.73
DE3	-2.59	-2.63	-1.94	-2.45	-2.16
GR1	0.28	0.37	6.28	1.62	6.01
GR2	-2.20	-2.21	-0.57	-1.83	-0.80
GR3	-4.07	-4.13	-2.75	-3.75	-3.10
IT1	-0.13	-0.08	2.29	0.31	2.09
IT2	1.65	1.80	5.77	2.39	5.52
IT3	-0.49	-0.46	1.49	-0.13	1.29

The results show that in terms of social net-benefits only marginal changes occur for the base scenario compared to the current situation. All services currently with negative net-benefits (10) are still so by the end of the long term period. This

highlights the problems such services can face with respect to justifying subsidy support unless significant improvement strategies are successfully implemented.

The most optimistic scenario is represented by the efficiency improvement scenario where it is assumed that rail costs can be significantly reduced. As such the results show an important improvement in the social profitability with three of the services previously with negative net-benefits now having positive ones. However, seven services remain with negative net-benefits and hence would require further cost reductions. In particular, two services (DE3 and GR3) have still very negative net-benefits.

Both the fair and efficient competition scenario and the rail service quality improvement scenario are modelled as additions to the efficiency improvement scenario. Therefore, these scenarios show improvements compared to the base scenario. However, assessed with respect to the efficiency improvement scenario both scenarios indicate that the services will have reduced net-benefits. This pattern highlights two issues:-

- the importance of introducing infrastructure charges for all modes rather than rail only in order to avoid biases;
- the approach undertaken with respect to service quality improvements should be in areas which has strong demand responsiveness and where cost will not increase to a large extent.

These aspects lead into considerations as to the recommendations for services which continue to have negative net-benefits in the most optimistic scenarios. Obviously, the simplest recommendation would be that those services should be closed because a subsidy cannot be justified with regard to the monetary net-benefits. However, this is not the approach suggested in the SONERAIL Evaluation Methodology. Instead it is recommended to consider the scope for improvement strategies. Some of these have been applied in the scenario analysis (cost reduction and service improvement). The scenario results showed that the cost reductions were insufficient to allow all services to obtain positive net-benefits. In this case it is necessary to consider the scope for further cost reductions. Furthermore, the possibility to improve the position of the services through alternative quality enhancing measures should be examined. If the cost reducing/quality enhancing measures prove insufficient it remains a possibility to assess the provision of the service using alternative public transport modes which may be more cost-effective.

4.4.3.4 Generalisation of scenario results

The specific results obtained in the scenario analysis concern the selected services used in the case studies. As such these results indicated possible outcomes regarding financial and social profitability on the basis of a range of assumptions regarding demand and cost changes. This section will consider the scope for generalising the scenario results from the case study basis to a broader level.

The identified scenarios did not relate specifically to the selected case studies but concerned global trends influencing the rail mode in general. Therefore, from this

point of view the scenario analysis has some generality beyond its reference to the case study services. On this basis the key issues involved in determining the generality of the scenario results are whether the identified scenarios are appropriate and the assumptions used relevant. The scenarios have been developed taking into account current trends and planned policy initiatives. Concerning the assumptions used to examine the scenarios a number of points should be noted :-

- Firstly, the assumed potential for cost efficiency gains appear to be possible comparing it to empirical studies (eg. PRORATA). Obviously, the current slack will vary between rail services such that in some cases the potential cost reductions will be larger than assumed, in others it will be smaller. Furthermore, the assessment of the efficiency improvement scenario implicitly involved the assumption that it is possible to obtain these improvements. In practice, the efficiency improvements could be reached in the future through the various rail liberalisation measures along with other planned or considered measures.
- Secondly, in the European Commission (1997), it is argued that the implementation of the elements involved in the strategy “Towards Fair and Efficient Pricing in Transport” could have a positive impact on the scope for reducing costs. This is due to the harmonisation of costs structures creating the possibility for increased transparency regarding costs incurred and prices charged. In this way the achievement of possible efficiency gains from the liberalisation programme are linked closely to the implementation of the fair and efficient pricing principles. Although it was not possible to build this policy interaction in the scenario analysis, the alternative construction with the fair and efficient competition scenario as an additional element to the efficiency improvement scenario reflect the positive impacts rather well. In this way the combined efficient improvement scenario and fair and efficient competition scenario point towards an improved position for rail services in terms of improved financial and social profitability.

This result could be of relevance for rail in general. In this respect, it is of importance to distinguish between financial profit making and loss making services. As such the result concerns both types, that is the financial and social profitability could improve if these scenarios occurred. However, the two cases differ with respect to one key aspect; the need for revenue support to sustain a market based service provision. To some extent the services which are financially profit making can be excluded for further consideration because they do not require a subsidy. In contrast, for the loss-making services where the judgment of changes in financial and social profitability is more complex.

Although improvements could occur for such services over the next ten year period, the services are influenced from another aspect as well; the possibility that subsidy budgets could be reduced over the next ten years. This could be a problem in relation to services which cannot demonstrate social profitability in monetary terms taking into account improvement strategies. Obviously, such services can continue to be provided due to other reasons such as political factors.

4.4.3.5 Wider impacts

Apart from the direct results from the scenario analysis described above, it is of importance to consider the indirect results in relation to the research undertaken. The identification of possible scenarios along with the assessment and the subsequent discussion and interpretation of the results allow for information about future possible patterns of change in relation to the provision of rail services. It has already been mentioned that the results provided regarding financial and social profitability should only be seen as possible indications.

Information of this type can be used as a form of benchmark in the formulation of measures at authority or industry level to counter eventual adverse trends. Improved information can as such improve the basis on which decisions regarding the provision of rail services are undertaken. In effect, the process of scenario analysis followed by specification of counter measures represents the SEM methodology, where the scenario analysis concerns an appraisal (CBA and MCA) of rail services while the counter measures form the elements in the feedback loop, see Figure 1. Subsequently, it would be possible to repeat the appraisal of the rail services with the counter measures taken into account. In this way the approach used provides an integrated approach towards scenario specification, assessment and reassessment. On a full-scale basis it would be possible to include the political decision making bodies at various stages in the process as part of an iterative procedure towards the identification and analysis of future policy options with respect to the provision and support to rail services. The development of such procedures would clearly provide a decision supporting tool through structured consideration to input/assumptions and policy requirements. The detailed implementation of such a system requires further research but SEM could provide a relevant baseline for this work.

4.4.4 Conclusions

A number of findings from the scenario analysis can be listed:-

- i. The identified scenarios and influencing factors appear to be relevant with respect to the next ten years. These elements were determined on the basis of current trends and indicated policy plans.
- ii. The obtained scenario results relate specifically to the selected case studies. These results indicate possible future patterns of change with respect to social and financial profitability dependent on the assumptions used.
- iii. A full scale analysis of the likely future changes with a traffic model and forecasting tools for each of the selected rail services would provide more certain estimates rather than indications.
- iv. It was noted that in none of the specified scenarios counter measures to the primary change were incorporated.
- v. The different scenarios assumed explicitly or implicitly changes in variables within the control of rail operators of authorities. These assumptions appeared to be appropriate.

- vi. Although the assessment of the scenarios concerned the selected case study services it is possible to generalise the results to wider segments of rail services. The scenarios as well as the assumptions used in the assessment did not relate specifically to the selected rail services.
- vii. It is important to recognise the wider impacts of the scenario analysis. In particular, the identification of relevant procedures for enhancing the information basis for making decisions in relation to the provision of rail services could prove significant.
- viii. SONERAIL could provide the base line for the detailed specification of procedures to analyse scenario possibilities taking into account the various policy options.

4.5 Best practice recommendations

4.5.1 Action plans

4.5.1.1 Objectives

The main objectives of the action plan identification within the SONERAIL project are as follows:

- to identify the main operational and market issues surrounding the rail service, which may help or hinder future service development in terms of costs, revenues, market growth and modal split
- to demonstrate how proposed solutions to the issues identified within the operational and marketing environment are advantages or disadvantages to the rail service, and how any potential opportunities and threats interact
- to assess how the proposed action plan will impact on the service within the short, medium and long term in dealing with the issues, and what the prospects for the rail service could be

4.5.1.2 Approach

In formulating the Action Plans for the selected rail services, a systematic approach has been followed. There are effectively two stages in formulating the action plans and a supplementary impact assessment stage.

The first stage concerns the identification of the issues which will be addressed by proposed measures in the action plan itself. These issues should be identified under the following headings:

Infrastructure

Costs

Revenues

Business

Environment

- | | | | |
|-----------------|----------------|---------------|-----------------|
| • trains | • staff | • fares | • competition |
| • track | • track access | • advertising | between train |
| • stations | • train costs | • subsidies | companies |
| • depots | • maintenance | • leasing of | • competition |
| • network | • marketing | property etc. | between modes |
| characteristics | • information | | • market growth |
| | | | opportunities |

In the second stage, the issues under the headings need to be projected across the short, medium and long term. The main theme under which these projections lie is cause and effect, i.e. in terms of market share growth, this may depend on both an increase in the number of trips and increased congestion on the parallel road network causing a potential shift to the rail network.

The result of these two stages is a series of issues which are presented over a flexible timescale. In the UK case, the timescale is a franchise term, under the recently introduced privatised operating structure.

The action plan itself draws together the identified issues and potential strategies to overcome or improve the situation, presented over the short, medium and long term. However, as indicated by the table column heading “Business Environment”, the action plan should not just concentrate on the rail service itself. It should also incorporate how the rail service interacts with other factors which have wider scopes. Such factors could include future transport and economic policy, land-use planning, population dynamics, changes to the national rail business, and social trends e.g. car ownership. This is best presented through a SWOT analysis grid, which is also part of the third stage.

The synthesis, or third stage, is a supplementary impact assessment stage. The role of this stage is to provide conclusions concerning the actual application of the action plan and to present what the ideal operating and market environment aspects would be.

4.5.1.3 Main Conclusions

Through application of the above process to the case study rail services, the following overall conclusions can be made. These conclusions are not line specific, but rather they indicate the general components of what the individual action plans should contain:-

- short term action plan components include immediate assessment of the operational and market position, identification of any cost reduction/revenue increasing measures which can be implemented in the short term, assessment of both on-line and inter modal competition, and initial actions to promote the service within the locality;
- medium term action plan components include completion of rolling stock and station refurbishment, a more rigorous approach to service marketing and promotion, continued assessment of competing rail and road modes, if the results

- of the action plan so far are positive, assessment of potential capacity constraints, and implementation of service enhancements;
- long term action plan components include securing franchise renewal, long term investment plan finalisation, if appropriate, and continued assessment of any competition.

The conclusions of the impacts surrounding the implementation of the action plan recognise there is both a potential spiral of growth and a spiral of decline which could act upon the rail service. Which type of spiral acts, and to what extent, will depend upon the interaction between the strategies adopted by the operator, and the other external factors contained in the business and operating environment in which the service is placed.

4.5.2 Examples of action plans: United Kingdom and Czech Republic

4.5.2.1 Action plan - UK case study service A

Overview of Key Issues

Short Term Issues

As with all rail services in Great Britain, this line will feel the initial effects of privatisation through the transition from public to private ownership. From the operator's view, an initial objective is an in-depth assessment of the inherited facilities, such as the trains and stations. In this case there are two types of train used. Most of the services on this route are provided using trains which are modern but low standard diesel units. These trains comprise of a two car unit, on rigid four wheel chassis, with under-floor mounted diesel engines. The quality of passenger environment on this type of train is poor with bench seating, no air-conditioning and no noise insulation. For the few services which originate on this route, but are travelling beyond the route, higher speed, comfortable diesel units with well appointed passenger facilities are used. Apart from the two larger stations on the route, facilities at the stations are basic. Some of the stations are merely bus shelters placed next to the track. In order to fulfil objectives concerning increased patronage, an initial plan of investment and project selection has to be carried out. Also the company must work hard to establish itself within the local area, and win the confidence of present users. There is the added problem of one section of the route being served by both other services of the same company, and more crucially, high speed services from another train operating company. Early realisation of the established market, and a preliminary assessment of potential market growth areas is crucial, to ensure success of the route within its new overtly commercial operating environment. The regulatory authorities will be looking for compliance to the new contract/franchise agreements, and a continuation and improvement of service standard.

Medium Term Issues

In the medium term, implementation of certain service improvements (low/medium investment) will have to begin. Such projects would include rolling stock refurbishment, improved information systems and timetable changes (within the remit

of the franchise agreement) to allow better utilisation of resources whilst not reducing the level of service. All attention must be given to attracting increased patronage to increase revenue and cover the short fall due to a reducing subsidy level. An assessment of capacity/demand during peak periods is also required, as the effects of natural growth in passenger numbers, and the potential results of the aforementioned service improvements begin to be realised. Options to be considered in the medium term would include an increase in fares in order to control the passenger growth, whilst a long term strategy should include plans to increase capacity. There is also a need to monitor flows on the section of route which has competition from the high-speed train operator. Assessment needs to be made concerning market share, market impact, and the requirements of passengers on this link. Market share retention and prediction are critical to justifying service improvement. Behind all this activity will be the question of whether the franchise will be renewed or not. This aspect will have direct impact on the level of investment to be made, in the long term; if indeed there is a long term, i.e. if the franchise is not renewed. This service may gain some benefit from recent national government policies concerning integrated transport initiatives. The route corridor is flanked by high capacity main roads and a motorway (for part of the route length), with high vehicle flows especially during the peak commuter periods. If plans go forward for road pricing, and changes to the car tax system, current car users may consider using the train instead. There may also be changes to the access agreements to the rail network, from a European level, resulting in further rail industry reorganisation in Britain, through an open tracks policy. This could mean increased competition, especially on the section of the route which already has inter train operating company competition on it.

Long Term Issues

If the franchise is renewed, then further investment/renewal of facilities (high investment) can be considered. By this stage, if the earlier implemented plans for patronage attraction, and the continued natural growth have occurred, there will be a need to address capacity/demand problem. This could either mean increase in the service frequency, using additional trains of the same type, or the introduction of dedicated high capacity trains for the peak periods e.g. double deck units, or complete renewal of the fleet with flexible, higher capacity trains which are both suitable for commuters and short distance leisure passengers. Future changes to the track access charging system may also help the operator through using more variable charging mechanisms according to the weight/speed of the trains, number of trains or somehow revenue dependent.

Action Plan

Short Term Elements

- initial assessment of inherited facilities
- implementation of cost cutting measures, and efficiency drives
- high impact/low cost measures to smarten up stations and make the train interiors more comfortable, such as repainting and thorough cleaning
- replacement of original signage with new company logos and motifs
- rapid assessment of current and potential markets
- impact study on potential threat of both rail and road mode competition, and any benefits from integrated transport policies
- assessment of potential bus/rail scheduling and ticketing integration

Medium Term Elements

- systematic train refurbishment project
- active provision of improved station services to a basic standard, i.e. information systems, security/lighting, and possibly toilets/catering
- service promotion through advertising and publicity, such as road side hoardings, and local newspapers
- assessment of any demand/capacity problems, in terms of any long term investment needs
- medium term demand control through the fare box, within the confines of the franchise agreement
- continued assessment of on-rail competition, plus investigation of any potential co-operation between companies
- impact of any open tracks access policy

Long Term Elements

- resolution of any demand/capacity problem through service frequency changes, additional dedicated peak period trains, or fleet renewal
- impact of changes to the access charging system

Synthesis

SWOT Analysis

SWOT Analysis - Service A

STRENGTHS

- modern trains
- route connects 2 urban areas with a large regional centre
- service fulfils a commuter function

OPPORTUNITIES

- integrated transport projects
- road pricing schemes
- open track policy
- changes to access charging system
- bus/train integration

WEAKNESSES

- low quality trains
- poor station facilities
- capacity constraints on both trains and track
- parallel high capacity road network

THREATS

- on-line competition from high-speed train operator
- competition from road modes
- decreasing subsidy
- non-renewal of franchise
- open track policy
- changes to the access charging system

Discussion of Impacts of Action Plan

The short term impacts of the action plan on the rail service, will be to reduce costs and gain efficiency savings. This should result in an immediate change in the service resource consumption and hence cost/revenue ratio. Schemes such as station redecorating and train cleaning should have the effect of retaining current users, through showing that the new operator does intend to make the service better. These schemes are unlikely to attract additional users, as the service is yet to attain an minimum standard let alone a quality of service beyond basic expectations of potential users. The impact of market analysis and publicity campaigns are more likely to be felt in the medium term, due to the need to alter behavioural characteristics of non-users. However, these market studies and publicity initiatives must commence in the short term for maximum benefit to be gained within the franchise period. Competition is a critical issue, as the service is in direct market competition with both road modes and other train operators. The potential threat and opportunity this competition will bring to the rail service have to be evaluated, in conjunction with integrated transport plans. Due to the subsidy conditions, the need for market place orientation is strong, as the service must establish itself as a viable option within the total demand for trips along the corridor. If demand is not sustained and generated from the short term, a spiral of decline could commence.

Outside the service, the impacts of the action plan on other modes, in the short term, will be slight. This is due to the rate of change in behaviour of non-users, and the

poor service foundation on which this potentially commercial operation is based, i.e. it is currently not attractive to enough users.

In the medium term, if the above mentioned cost/efficiency improvements, marketing and small service enhancements are made, together with any Government policy induced modal transfer, patronage and revenues ought to be increasing. However the quality of service will still be poor, in comparison to the perceived travel benefits of other modes and train operators. Real service improvements together with a concerted publicity programme ought to be implemented, to further generate traffic, fill spare capacity, and maintain growth within the market. If the initial incentive of incremental patronage increase over the short term was not achieved, then the position of the rail service in this case is difficult, due to the constant reduction in subsidy, and the high proportion of fixed costs associated with rail service provision. In this case improved short term plans could be re-applied, and a policy of service sustainment as opposed to development adopted, with any patronage growth as a bonus.

The action plan, in the medium term, will not have a significant impact on the number of private road transport users. This is due to the sheer number of them, moving across the corridor's network of main roads and motorways, in proportion to the maximum capacity of the rail service. However, if the action plan works in terms of generating patronage on the rail service, these new rail users will be abstracted from both private and public road modes. The impact will be greatest in the road based public transport sector, on routes which are parallel to the rail service. Impact on inter train operator competition is difficult to judge, as both operators offer very different styles of service.

In the long term, the picture could be either of a rail service which has become attractive to road users, established within its local market and potentially beginning to encounter capacity problems during the peaks, or it is a service which is little changed since privatisation, not seen any significant growth in patronage and is focused on trying to avoid penalties from the regulator, further cost reductions and measures to counter a falling subsidy. If the former scenario is the case, then the impact of the action plan in the long term could be the creation of capacity problems, which could be solved by investment in a combination of track improvements and/or additional rolling stock.

Again, the impacts on modes outside the service will be varied. There will still be little to no impact on the number of private road trips, but a potentially significant impact on parallel bus services, which by this time may have re-aligned their service routes to feed the rail service, as well as to compete with it. As for competition with other train operators, this will depend on the effectiveness or otherwise of their action plans, on the services offered on the relevant section of the route.

4.5.2.2 Action Plan - All Czech Republic Case Study Services

Overview of Key Issues

Short Term Issues

After transfer of the selected lines to a private operator in 97-98 there was some improvement in different areas of the operation. In order to maintain passenger numbers, the basic objective for the operator is to improve services in ways which will not cost too much but will be customer friendly.

The lines are operated using diesel multiple units, which are far beyond their life span. This means customer comfort is at a minimum level. However, the selected lines are very short, so people may temporarily accept a lower level of quality. In the short term the coaches could be improved by cleaning.

All lines are interlinked into a small regional network. Quality and equipment at the stations on the network are different, very basic, and sometimes even less than basic. Relatively good facilities are provided at the stations which serve as an interchange point between different lines, but there is still very much to be improved. Small stations are in some cases only open platforms without any building or even a roof against bad weather. In the short term making facilities cleaner and rail employees more customer friendly would be a significant improvement.

As for changes in service patterns and the addition of new trains, which was already implemented by the private operator there is almost no space for improvement in this area. Some improvement also occurred in relation to public transport integration, which was relatively poor, but there is still room for more action. Progress in this field under the private operator was not satisfactory because they were perceived by the bus company as competitors.

A slight problem for Czech Railways in relation to these services in this area is that the customers got used to the private operator and accepted it because they had the feeling of the services being operated by a local company who understood what the needs of the local customers. After the return of Czech Railways customers can be very sceptic and it is obvious the company has to re-gain customers' trust and loyalty.

In summary, in the short term the crucial point is to maintain the current level of customer demand by maintaining improvements which were introduced by the private operator. At the same time detailed analysis of the real economic performance of the lines has to be carried out. Predictions for the future have to be made concerning demand and improvements on the supply side together with estimation of necessary maintenance and repairs of the infrastructure. What is also necessary is improvement in communication with the public and preparation of marketing plans for the medium and long term. Among the first steps could be an estimation of transport needs in the region together with a definition of the current situation which will also include alternative transport modes and other possible developments in the area. This activity,

if it is to be performed with enough detail, should be perceived more as a medium term than as a short term activity.

Medium Term Issues

The basic problem is financial restrictions due to the general situation regarding the national economy. Perspectives over the next few years do not indicate too much improvement. This is the first and crucial issue, which will influence all proposed actions.

Assessment of all property in financial terms has to be performed in the medium term. This is currently one of the major problems for Czech Railways. This assessment does not currently exist and makes any privatisation more than difficult due to uncertainty concerning the real value and ownership aspects.

A further issue which has to be resolved in the medium term is the clear division of costs and incomes on specific lines. There is also a problem with subsidies which has to be solved; precise definition of a level of subsidy which will be stimulating for service operators. This will help to keep customers on the trains and allow revenue accumulation for new equipment. The level of subsidies, their allocation and spending was one of the issues, why the selected lines were returned from private hands to the state operator. The costs per line as well as per train have to be identified, otherwise it is not possible to operate on a valid economic basis.

Concerning specific issues for the selected services, in the medium term these will include rolling stock refurbishment and improvement in their technical condition. Much more work can also be done with staff to train them to think from the customers' point of view. Concerning stations, although no investments are realistic in the medium term, there is room for improvement by changing un-used space in the current stations to create an environment which is friendly to the customer and which can provide additional services. This is especially applicable for interchange stations, where people wait for connections. Due to the rural character of the lines some marketing activities such as trip promotion and destination promotion can be seriously helpful.

Improvement in track maintenance will be required although accident preventing measures have already been implemented in the past as a result of serious accidents on these lines. In the medium term there is the possibility to attract some car users and to build a park and ride system. At the major interchange points (Liberec, Jablonec, Tanvald, Smržovka) the stations have adjacent free space which can be used for parking with minimum investment.

Fares will definitely have to increase in the medium term, due to strong regulation from the State having a negative impact on the economic performance of Czech Railways. Before this, the operator should ensure, customers are aware of the need to increase the fares. The explanation should be based on a quality communication strategy from Czech Railways, indicating the customers will get real value for money from clean, reliable, safe and frequent trains. This change should also be linked with an increase in the price of road transport. This increase is definitely expected in the

medium term due to the Czech Republic's effort to become a member of EU resulting in further increases in tax on fuel and charging for infrastructure. An increase in rail fares will also follow.

It will also be necessary to examine in detail, future transport demand patterns, the transport development, and the impact of transport on society in the region. Also research into integrated transport plans should occur in this time horizon followed by implementation.

Long Term Issues

In the long term it is likely that the financial situation will be solved and the transport market in the region will be relatively stabilised. A stabilised market is a long way off yet as it is still very much in the process of development. Indicators supporting this include increasing number of private cars, decreased number of customers for public transport, changes in demography. There will be a need to obtain new trains as current trains in the main are completely depreciated, as the accounting system and the system of redistribution of profit did not provide any room for investment. Also further investment in infrastructure and facilities will be required. This has to be implemented in order to improve the service product for the customers and the safety and reliability of the trains. To realise these steps, the company has to be prepared for this situation. In order to realise this, the financial issues, mentioned for the short and medium term, have to be solved.

Concerning journey time improvement; this is not currently relevant for the selected lines because the lines are very short and travel time is not too long compared to other modes. However with continued improvements in the road network infrastructure, the issue of travel time advantage will become critical to the economic viability of the rail service.

Issues dealing with attracting demand from other transport modes have already been mentioned, but based on the actions taken in the short and medium term, in the long term an integrated public transport system should definitely be developed, in the region. There is also a possibility of road traffic reduction which could further induce demand for the train. Change to electric traction is not possible and realistic in the long term due to the character of the selected lines, and the cost of the required infrastructure/rolling stock.

Action Plan

Short Term Elements

- definition of marginal costs per train
- to maintain the service frequency at the same level as the private operator
- measures to smarten up the stations and trains (especially to clean them)
- training of employees in customer communication
- improved communication with the public (users as well as non-users) in the region
- improved signage on the station

- assessment of potential bus/rail scheduling and ticket integration
- estimation of potential market demand and market development

Medium Term Elements

- assessment of property and its value
- cost allocation systems
- rolling stock refurbishment and improvement in their technical condition
- renting of station facilities and creation of pleasant environment for travellers
- marketing activities towards trip and destination promotion
- track maintenance
- park and ride system
- market segmentation and promotion of different approaches to different segments
- fare increase but only in line with inflation

Long Term Elements

- new trains
- development of regional integrated system
- fare impact studies (fares will not be as heavily subsidised as currently)
- long term marketing approach based on experiences and studies from previous years

Synthesis

SWOT Analysis

SWOT Analysis - Czech

STRENGTHS

- habit to travel by train in the region
- in certain areas there are no parallel roads
- in winter it is the best possible connection even when there is a parallel road
- low prices
- majority of travellers are commuters
- during the weekend the area is of high tourist importance
- regional dependence on certain segments of the network

WEAKNESSES

- quality of the trains
- behaviour of staff
- poor station facilities

OPPORTUNITIES

- development of tourism in the area
- increased charging for road transport
- development of integrated public transport
- park and ride schemes
- introduction of marketing approach to different target groups

THREATS

- competition from road transport
- decrease in subsidy and not clarified subsidy policy
- passive marketing policy from the operator which can easily result in a decrease in customer demand
- fare increase

Discussion of Impacts of Action Plans

As a result of the implementation of the action plan the rail service should in the short term be able to retain the current level of customer demand and to improve efficiency of the service. One of the important aspects is cost reductions.

Definition of the real costs per train connection and of marginal costs of services, will help to define the number of train services, which can currently be provided. This calculation has never been performed before, so many assumptions have to be made. If the service frequency is maintained, it should be possible to retain the number of passengers. The private operator was able to attract mainly bus users thanks to a different tariff policy, and some car users, especially from the lower income groups.

Measures to smarten up the stations and trains are activities, which will probably not attract new users, but will definitely help to keep current customers satisfied. Significant contribution to customer satisfaction can be achieved through better behaviour of the railway staff and improved signage on the station and surroundings.

Any service improvements should be communicated to the public. If an advertising campaign is accompanied by significant improvements, it could also attract some non users. It is extremely important to explain to the public the different steps which are taken in the field of transport. Competition will not be seriously influenced in the short term, as bus and rail service compete only on certain parts of the line. An important question is the future of public transport in the area, due to changes in the economic potential of the region and transport policy on different transport modes.

As bus and rail connections are not highly integrated, there is room for improvement. Ticketing integration adds to customers satisfaction. There is a need to estimate the potential market demand and market development in the region. Such a study has not been done before, but is crucial in order to define future development and transport improvements.

In the medium term financial issues are still critical. The assessment of property, and definition of cost and revenue allocation on different lines, will contribute to make private operation viable. Without this assessment it is impossible to operate lines which require further investment.

Rolling stock refurbishment and improvement of their technical condition should be done in the medium term. With improvement of station facilities for travellers there is the possibility to keep the current level of demand, and potentially gain customers from other modes. Park and ride systems can be a very good incentive for car users to transfer to trains. The precondition is all the above mentioned points which concentrate on increasing quality and comfort of travel.

In terms of infrastructure problems, the selected lines are in a mountaineous area with many tunnels and bridges. In the medium term the operator has to assess service costs with certain improvements in infrastructure.

If all the above mentioned activities are implemented, there may be impacts on the external environment through attracting car users, but improvements in the rail service may increase tourism, which could have negative impacts on the environment.

In the long term rail will have to increase fare levels. If at the same time road transport will not be charged higher, this could mean a decrease in demand. If as a first step road transport will be more expensive and rail transport will follow, no significant change in demand will appear. At this time integrated transport system should be developed, to produce a more customer friendly transport system. Impacts on the external environment can vary. This depends though on road capacity in the region, further road construction, and on the introduction of road transport charging.

4.5.3 Strategic recommendations

The strategic recommendations emerging from the SONERAIL project relate to:-

- the evaluation of socially necessary rail services
- policies for socially necessary rail services
- operation of socially necessary rail services

These dimensions are obviously interlinked. As such all these aspects are of importance in relation to the future situation for socially necessary rail services in particular, and rail in general. It is worth noticing that the evaluative dimension should be seen as an integrated component together with policy and operational issues.

4.5.3.1 Evaluation

SONERAIL has primarily been concerned with the evaluative aspects of socially necessary rail services, although the other dimensions have also been given attention. A need for clarification of the definition of socially necessary rail services was identified in the first part of the project. The SONERAIL definition satisfies this requirement. In particular, the definition is linked to the evaluation of socially necessary rail services. As a recommendation this definition can be put forward as a possible basis for characterising rail services as socially necessary or not.

The research also showed the lack of available assessment procedures for rail services including socially necessary rail services. SONERAIL developed an evaluation methodology which is primarily a social appraisal, integrating cost-benefit analysis and multicriteria analysis. This methodology has been applied on a number of rail services and although this application was not a full-scale application it did indicate that the methodology represents a promising tool for policy authorities as well as rail operators and other actors in the rail industry. As a recommendation it will be suggested to develop SEM into a full-scale application tool.

4.5.3.2 Policy and operation

Concerning the provision of socially necessary rail services it will be recommended to study the possibility to integrate the developed evaluation methodology within the decision-making process as a tool to enhance the information basis. This holds in particular with the move towards public service contracts and requirements about increased value for money and reduced subsidies. The application results suggest that a mixed approach regarding policies for loss-making services is required. It is possible to demonstrate the existence of a large number of rail services which have larger benefits than costs. However, there are also rail services for which the benefits are smaller than the costs. At this stage it should be noticed that negative social net-benefits would not be sufficient reason for closure. Following the SONERAIL Evaluation Methodology a series of improvement strategies would be put forward in terms of possibilities to increase revenue and/ or reduce costs or provide the service with alternative modes. The scenario analysis suggests the possibility for some improvement in social and financial profitability over the next ten year period. However, given the current pressures on subsidy the positive changes may not be sufficient to ensure provision. As a recommendation it will be put forward the need for the actors within the rail industry to consider measures which can increase the demand and reduce the costs to attain best-practice. A range of possible tools have been put forward as part of the action plan development.

At this stage emphasis will be put on the role of policy authorities to promote efficiency and effectiveness regarding the provision of rail services in order to ensure value for money. The following elements appear to be important:-

- public service contract arrangement
- benchmarking facilities
- public-private and private-private partnerships
- irreversibility considerations

Obviously, the contract framework is of significance in relation to the promotion of cost-efficient provision of rail services, e.g. through performance regimes and the tendering process. The competition between prospective candidates for the service contract can ideally substitute the competition on the track.

Enhancing patronage and reducing cost could be supported through benchmarking exercises. In many cases it can be difficult to provide the information from the private service operators due to confidentiality concerns. Therefore, it could be a possibility to organise benchmarking facilities through the public authorities. This could include the collection of information about best-practice.

Formation of public-private/ private-private partnerships could be promoted as ways to ensure the viability of service improvement initiatives. In particular, partnerships between rail service operators and infrastructure managers could be of importance.

In the process towards decisions regarding the future provision of a rail service, i.e. continued revenue support, irreversibility considerations should be taken into account.

It is possible that the closure will make it difficult in cost and market terms to re-open a service.

As a recommendation somewhat outside the scope of the SONERAIL project it appears that the future position of rail will be influenced by the extent to which other modes will be required to pay for the cost of infrastructure usage, e.g. in the form of road pricing. The implementation of infrastructure charging for all modes will allow a level playing field for the competition between the modes. This is in accordance with the recommendations given in European Commission (1998a).

5. CONCLUSIONS

5.1 Summary of findings

The European Commission funded project SONERAIL has fulfilled its main objective regarding the development of an evaluation methodology for socially necessary rail services.

The first step concerned the definition of what a socially necessary rail service is. On the basis of the research undertaken it was decided to define it as a rail service which is either financially profitable or unprofitable and socially profitable.

In the second step the SONERAIL Evaluation Methodology (SEM) was developed. It comprises a CBA component as well as a MCA component. The methodology starts with an assessment of the monetary benefits and costs related to the closure/ retention of a rail service, in order to determine whether the benefits are larger than the costs. This is followed by a ranking of the considered rail services using a MCA technique (Regime Analysis). The methodology allows for a feed-back loop where it is possible to re-evaluate the rail service following various improvement strategies including revenue increases and cost reductions.

This methodology has been applied on specific rail services in the countries represented in the consortium. The application results suggest that SEM represents a promising tool for evaluation of rail services. Obviously, a full-scale application of SEM requires further development including traffic modelling to provide better estimates of the road congestion effects and forecasting tool to provide inputs on variables for future periods.

SEM can be applied to all types of rail services given its generic characteristics, although it is of particular relevance with respect to those rail services which require subsidy support in order to ensure their provision.

As such SEM can be a relevant tool for a variety of actors involved in the rail industry, including:-

- funding authorities;
- European Commission;
- rail operators.

The main role of SEM would be to provide important information in relation to the decision making process regarding assessment of the social value derived from rail services.

In addition to the examination of the current position, research was also undertaken regarding possible future changes. This analysis consisted of two main elements:-

- scenario identification and assessment;
- specification of action plans.

The scenario analysis was initiated at a general level through the analysis of key influencing factors which could determine the future position of rail. These influencing factors were then used to specify possible global scenarios. Subsequently, these scenarios were translated to data assumptions with specific reference to the case studies. Assessment of the possible future social profitability of the case studies was undertaken utilising SEM. The results show that it is possible that social profitability (and financial profitability) can increase over the next ten year period. However, the pressure on subsidy levels should be recognised.

On the basis of the information provided about the case study services including issues of importance for the future context action plans were specified. These action plans aimed to specify measures to be used to enhance the position of these rail services within the overall travel market.

5.2 Potential uses of SEM

From the preceding sections, it is clear the main role of the SONERAIL results will be to aid decision making regarding justification and allocation of subsidies to rail services. It is the aim of SEM to be a useful tool for decision making bodies, responsible for allocating subsidies to rail services. The methodology will also be of use as a source of information regarding the social value derived from different rail services. On the basis of the methodology it is feasible to compare different rail services (at least within a given country), in terms of social value. This comparison could be based on the so-called benefit-cost ratio or a MCA based ranking score. Furthermore, provided the appropriate harmonisation of relevant data between the different European countries is undertaken, it would be possible to undertake a Pan-European comparison of rail services and social value. This could be based on either the benefit-cost ratio or a MCA derived ranking score. However, this latter application is not considered in the above outlined specification of SEM.

This application requires harmonisation of data such as cost accounting systems used in the different European countries. The suggested comparisons (national or European level)) can contribute to establish best practice among rail services. Obviously, the definition of best practice is easier at a small scale/national level, where the context in which the rail services show a relative low variation. On the other hand the large scale comparison allows for a more robust statistical basis along with the possibility that it is possible to define best practice for different categories of rail services, e.g. rural against urban, alternative modes against no alternative modes, privatised against state run, deregulated against regulated, etc. This form of analysis can contribute to information regarding the type of rail service which provide the highest level of social benefits compared to the social costs, given the context in which the rail service is placed. It would be possible to extend the analysis to specific types of benefit/cost elements in order to evaluate whether the rail services differ with respect to the relative magnitude of these elements. It should be mentioned that the use of SEM could involve both social appraisal elements: (i) social profitability calculation, (ii) ranking of rail services. However, it would also be feasible to consider the use of one of these elements separately from the other. In this way SEM allows for flexible applications.

5.3 Potential users of SEM

The range of possible users of SEM seems to be broad. Along with the details on the information provided from applying this methodology, an impression about potential users has been obtained. Hence the main users can be expected to be government departments responsible for the allocation of subsidies to rail services. The precise users at the governmental level will depend on the structure of the public sector in relation to support for rail services. In some countries decision making in relation to support for rail services is organised at the central government level. Other countries have adopted a more de-centralised structure where regional and local government agencies are responsible for the allocation of subsidies to rail services. The difference in decision making context creates a specific problem in relation to SEM. Consider a situation where rail subsidies are decided at the regional/local level. As such, the methodology can be applied at this level. However, it creates a problem when some benefits occur outside the region in which the decision regarding support is made. The basic question is whether a given region should provide support to benefits occurring outside this region. This is an example of a collective good: the persons benefiting from a given good/service cannot be limited to the persons providing the funds. If the aim is to achieve a social optimum, the evaluation of a rail service should include all relevant impacts irrespective of where and to whom they occur. In order to solve the apparent dis-incentive for regional/local decision making bodies to fund such services, this problem should be solved through inter-regional transfers. In this way other regions could be called upon to fund part of the costs of providing the rail service.

If the decision making body responsible for allocating subsidies to rail services is placed at central government level then the problem will be on a reduced scale. In this case the impacts concerned will be those occurring outside the national level, i.e. in other countries. It can be expected that the provision of a given rail service supplied in one country will have very limited impacts in other countries. The only case where such impacts could be on a higher scale would be border areas. Again the optimal solution with respect to the application of SEM would be to include all impacts irrespective of where and to whom they occur. Transfers between the countries concerned should then remove the dis-incentive to include impacts in other countries. As mentioned already, it can be expected that these types of impacts will occur on a very limited scale.

Another issue to consider is the role of the European Commission as a potential user of SEM. Possibilities include:-

- The EC will use the methodology as a basis for giving guidelines as to how evaluation should be undertaken in the different member states with respect to justification and allocation of rail service subsidies.
- The EC will use the methodology to enable comparisons of the performance of rail services in the different member states. This option will not only require harmonisation of methodology but also harmonisation of data in order to

secure analysis results which are not caused by different data definitions/measurements.

Summing up, SEM represents a promising tool for a range of different users. The next step should be to develop a full-scale application version.

5.4 Future research areas

The research undertaken as part of the SONERAIL project has provided important insights into the definition, evaluation and provision of socially necessary rail services. As a result significant recommendations regarding these aspects are provided in this report. In addition, a number of future research areas have been identified during the course of the project. These areas are outside the scope of SONERAIL but are clearly linked to the research undertaken. Below, these research will be outlined. The identified future research areas can be divided into two types:-

- assessment related issues;
- policy specification for rail services.

Assessment related issues

- impacts of rail service closure on rail infrastructure costs;
- estimation and valuation of noise impacts from rail services;
- quantification procedures for non-monetary impacts.

Policy specification for rail services;

- the scope for harmonising cost accounting systems across Europe;
- specification of the total subsidy level for rail services;
- development of full-scale application version of SEM;
- specification of public service contracts for urban and rural railways;
- implementation of tendering/ franchising for socially necessary railways;
- integration of rail service evaluation and infrastructure assessment.

ANNEXES

List of Publications

PUBLICATIONS AND PRESENTATIONS

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SONERAIL Deliverables

Deliverable D1:	Definition of socially necessary railway services
Deliverable D2:	Currently used evaluation methodologies
Deliverable D3:	Preliminary SONERAIL Evaluation Methodology
Deliverable D4:	Preliminary report on SONERAIL evaluation methodology with comparative-forms analysis techniques
Deliverable D5:	Experts Seminar Proceedings
Deliverable D6:	SONERAIL Evaluation Methodology Manual
Deliverable D7:	Report on SONERAIL Evaluation Methodology
Deliverable D8:	Evaluation Case Study 1 - UK
Deliverable D9:	Evaluation Case Study 2 - Netherlands
Deliverable D10:	Evaluation Case Study 3 - Germany
Deliverable D11:	Evaluation Case Study 4 - Greece
Deliverable D12:	Evaluation Case Study 5 - Italy
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Deliverable D18:	Future Operations Scenarios
Deliverable D19:	Assessment of Short Term Scenarios
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Deliverable D21:	Role of Operations Scenarios
Deliverable D22:	Case Study Action Plans
Deliverable D23:	SONERAIL Seminar Proceedings
Deliverable D24:	Draft Final Report
Deliverable D25:	Final Report
Deliverable D26:	EC Presentation