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<tr>
<td>AEIF</td>
<td>Association Européenne pour l’Interopérabilité Ferroviaire</td>
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<tr>
<td>ALARP/ALARA</td>
<td>As Low As Reasonably Practicable / Achievable</td>
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<tr>
<td>ASC/ATB/ATC/ATP</td>
<td>Automatic Speed Control / Automatic Train Control / Automatic Train Protection</td>
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<td>CEN</td>
<td>Comité Européen de Normalisation</td>
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<td>CENELEC</td>
<td>Comité Européen de Normalisation Electrotechnique</td>
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<td>CER (CCFE)</td>
<td>Community of European Railways</td>
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<td>COST</td>
<td>[European] Cooperation in the field of Scientific and Technical research</td>
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<td>COTIF</td>
<td>Convention relative aux transports internationaux ferroviaires</td>
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<tr>
<td>EIRENE</td>
<td>European Interoperable Radio for Railways</td>
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<td>ERTMS</td>
<td>European Rail Traffic Management System</td>
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<td>ETCS</td>
<td>European Train Control System</td>
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<td>ETSC</td>
<td>European Transport Safety Council</td>
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<td>ETSI</td>
<td>European Telecommunications Standards Institute</td>
</tr>
<tr>
<td>GAMAB</td>
<td>Globalment Au Moins Aussi Bon (Overall at least as good as)</td>
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<tr>
<td>HEROE</td>
<td>Harmonisation of European Rail Rules for Operating ERTMS</td>
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<td>ILGGRI</td>
<td>International Liaison Group of Government Railway Inspectors</td>
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<td>IM</td>
<td>Infrastructure Manager</td>
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<td>ITSA</td>
<td>International Transportation Safety Association</td>
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<td>NI</td>
<td>Nationalised Industry</td>
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<td>OTIF</td>
<td>Office central pour les transports internationaux ferroviaires</td>
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<tr>
<td>RAMS</td>
<td>Reliability, Availability, Maintainability and Safety</td>
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<td>RSRR</td>
<td>Railway Safety Regulation Regime</td>
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<td>SIL</td>
<td>Safety Integrity Level</td>
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<td>TENs</td>
<td>Trans European Networks</td>
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<td>TO</td>
<td>Train Operator</td>
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<td>TSI</td>
<td>Technical Standard for Interoperability</td>
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<td>UIC</td>
<td>Union Internationale des Chemins de Fer</td>
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<td>UIP</td>
<td>Union Internationale des Wagons Privés</td>
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<td>UITP</td>
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<td>UNIFE</td>
<td>Union des Industries Ferroviaires Européens</td>
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*Note: This list of abbreviations excludes national institutions and most other abbreviations specific to individual Member States. These may be found in the section summarising the Member State’s regime in Appendix 2, in Volume II of this Report.*
EXECUTIVE SUMMARY

Transport has for many years been one of Europe’s fastest growing industries. However this growth has not generally been shared by railways, despite their being environmentally friendly and the safest mode of transport. The European Union has addressed the many reasons for the relatively low growth of rail traffic, and developed a strategy to reverse this.

The Treaty on European Union included the broad aim of creating trans-European networks and promoting interoperability, in particular through technical harmonisation. For railways this is being pursued through three more specific objectives. These are improvement of interoperability; creation of a single market for railway equipment; and restructuring to develop competition and new markets in train operation.

As a consequence of these EU policies and associated national policies the European railway industry is now moving into a new era, very different from the previous world of each Member State’s railway being dominated by a single, unified nationalised railway industry.

Safety regulation has been only in the background of these developments. However safety regulation regimes can have important implications on interoperability, the market in railway equipment, and competitiveness of the industry. These effects are both static: decisions about safety-related harmonisation or prioritisation can have important impacts on expenditure programmes of billions of euro; and dynamic: removing obstacles to innovation or new entrants can encourage evolution and growth.

This study investigates the extent to which European railway safety regulation has adapted, and might usefully further adapt, to the more varied and challenging needs of a world of competition in train operation, a single market in equipment, and new train services, both within and across borders.

Current safety regulation regimes

The first stage of the study examined the railway safety regulation regimes (RSRRs) of all 15 Member States. This was carried out by eight project partners in their own or in adjacent countries. It included a general analysis of the changing railway structure in each Member State.

In some Member States, with the break up of the vertically integrated nationalised industry, there has been a transfer of system-wide safety supervision to the infrastructure manager (IM), while in others the safety supervisory role is carried out by an independent national body, sometimes described as a Railway Inspectorate. The restructuring has led to considerable diversity in the structure and regulation of functions. This partly reflects the differing speeds at which restructuring has progressed in different Member States, but also reflects substantial differences in choices about how responsibilities should be distributed among operators, regulators and other institutions.

Most existing rules and standards in all Member States are still those created under the previous nationalised industry regime, and it is generally recognised that, however strong
the commitment to reform, substantial change in railway rules and standards cannot be made quickly.

We were invited to examine differences in “safety philosophy”, which we chose to define as covering punitiveness, the acceptance of cost as a consideration in safety policy, the role of the IM, separation of functions, the use of due process, and decision rules.

Strong punitiveness (in the sense of criminal sanctions after accidents, other than for intent or recklessness) is most systematic towards organisations in the United Kingdom, although it has occurred in other Member States after very serious accidents. Some other Member States take stronger punitive measures than the UK against individual members of staff. However punitive measures are virtually unknown in some Member States such as the Scandinavian countries and the Netherlands. We are aware of no evidence, nor has it been suggested to us, that greater punitiveness improves the efficiency of effectiveness of an RSRR. We note that, to the extent that punitiveness encourages secretiveness, it could be a negative influence.

The acceptance of cost as a consideration in safety policy, together with the use of risk assessment, also varied widely across Member State, reflecting differences in culture and in law. So too did the use of due process. These are all issues which were to be developed in later stages of the project.

The separation of functions also varied widely. For example the external regulatory control of specification, compliance, investigation and prosecution was were all carried out by one independent national body in five Member States, but by two bodies, with differing combinations of functions, in other Member States. The most significant of these differences we see as the establishment in some Member States of independent accident investigation bodies, which we recommend.

Some investigation was made into how the institutions regulating safety of metros and tramways overlapped with those regulating the mainline. We also examined for some Member States the interface between these lines and mainline operations. We found that the interfaces are scarce, although there could be more in the future. The differences between safety regimes in these different types of rail transport, while significant, do not appear to be a major obstacle to interworking.

Restructuring of the railways has led to a new framework for liability. Minimum international liability requirements are harmonised in the Convention Concerning International Carriage by Rail (COTIF). However Member States have differing ways of handling claims and differing levels of liability insurance requirements. There are signs that development in the international insurance market, helped by single market Directives, will develop satisfactorily in response to new demands, as interoperability progresses. A small obstacle to new entrants is that national railways are often exempt from requirements to buy insurance.

Turning to activity at the supra-national level, a major influence in co-operation between national railways is the UIC, whose standards are not mandatory in EU law, but are a major
component of acceptance criteria throughout Europe. The UIC’s RIV and RIC codes for international acceptance of goods wagons and passenger carriages are long established, widely used and maintain their authority. The UIC is also proactive across a wide range of harmonisation activity, including safety.

Harmonisation of EU railway standards has focused on compatibility between railways in primarily engineering terms. The harmonisation process involves a large and complex administrative structure, with many technical committees developing standards in CEN, CENELEC and ETSI; further technical work at a more general level developing Technical Specifications for Interoperability under the high speed interoperability Directive; and the further layer of administration in the development of Directives - in particular on railway interoperability and the single market.

However, although safety is often a factor, these EU activities have had very little effect on national RSRRs. Nor do EU initiatives figure prominently in safety debate in Member States. We find in Member States remarkably little curiosity about the likely content of future European requirements.

The establishment, for implementation of the high speed interoperability Directive, of the AEIF, bringing railway operators together with manufacturers at the European level, is a major development. The AEIF has been mandated to accompany its draft Technical Standards for Interoperability (TSIs) with an assessment of the estimated costs and benefits of the technical solutions examined, and we have seen a cost-benefit methodology proposed for this purpose.

The draft conventional interoperability Directive closely follows the structure and provisions of the high speed Directive.

**The impact of safety regulation**

The impacts of RSRRs were investigated in seven Member States - France, Germany, Italy, the Netherlands, Spain, Sweden and the UK mainland of Great Britain. The investigation was based on three case studies, supported by broader discussions with suppliers and railway operators.

**New and/or cross-border train services**

Eleven cross-border freight and passenger train services were studied, with information being sought mainly from the railway operators. It revealed, as would be expected, that most of the obstacles to cross-border traffic arise from infrastructure differences in for example power supplies or signalling systems. However safety regulation issues are important.

Where traction crosses an international border, the norm is “levelling-up”. Each regime requires all of its conditions to be met, in addition to the conditions required by the neighbouring regime.
Four new train operators (TOs) were approached. Where a new entrant wishes to introduce a service, the typical response of the infrastructure manager (IM) is to require the applicant to accept all of the responsibility and cost of persuading the IM that the service meets conditions which the IM may define only loosely, and which may depend on information about the infrastructure which the IM cannot provide. No new operators suggested that there was any deliberate discrimination against them, but most believed, to varying degrees and in different ways, that the established regulatory regimes were a brake on the development of new markets and, sometimes, on technical innovation, to a degree not justified by safety concerns. This was mainly because of a lack of clear definition of the requirements.

We take forward from the study of new and cross-border services the following conclusions:

• The views of “insiders” differ from those of “outsiders”. This is partly because of legitimate demands put on outsiders, but partly also because the procedures are less well adapted than they could be to the interests of outsiders.

• There are many demands of RSRRs in adjacent Member States which are reasonable in isolation but, when taken together, impede interoperability, without apparent compensating safety benefit.

Acceptance of new traction

Thirteen examples of new traction acceptance applications were studied, with information being sought mainly from suppliers.

These responses exposed three areas of criticism: about clarity of requirements or process; about costs, in terms either of the process or the requirements; and about ethos. They also raised two neutral issues: historic differences, and a shift in onus from operators to suppliers obtaining acceptance.

An underlying theme was that the accepting body (which in all cases was a nationalised industry or an ex-nationalised industry IM) did not take a system-wide view. Specific complaints were: off-loading costs on to applicants; unwillingness to take responsibility; fragmentation of the decision process; refusal to be pro-active in dealing with problems; unwillingness to accept test results from another country; and requirements being drawn up in excessive engineering detail.

It is likely that in many cases the accepting authorities would reject the criticisms, or claim that the costs involved were either justified by the safety issues, or attributable to failure by the applicants to understand the processes. We are not able to adjudicate between the positions in every case. In one case, where we could, a consensus emerged that the broad thrust of the criticisms was justified; but that many of the delays and some of the costs were attributable to the applicants. On both sides, the lessons are being learnt.

A common observation was that the onus for obtaining acceptance was now placed on the supplier (as opposed to the train operator(TO) ). This was noted as a change from the previous nationalised industry regime. It was not expressed critically: in particular, it was observed that the supplier generally knows much more about the product than the user-to-
be. Where the product is intended for more than one market, as in many of the cases studied, it is not practical for other than the manufacturer to be in charge of the negotiation of acceptance processes, because the TO or local owner would not be aware of the repercussions of a design change on other markets or RSRRs.

We take forward from the study of certification of new traction the following conclusions:

- There should be some (relatively) immediate benefits from clarifying the requirements placed on operators and suppliers. There can be no safety argument against this - rather the opposite.
- The IM must be required to maintain and provide reliable infrastructure information, and accept the costs of putting the infrastructure right.
- The decision process should fulfil certain basic requirements for rationality.
- The question of ethos runs deeper. Although the industry is everywhere so integrated technically and operationally, and the staff have generally “grown up together”, the division into IM and TOs has led to a loss of system-orientation.

An examination of how risks and costs are balanced: The case of trackworkers

The study examined an application where some trade-off between risk and cost is de facto accepted in all Member States. (Every year trackworkers are killed, but train services are allowed to continue, even though the hazard which they pose could be eliminated by ceasing normal train operations when people are at work on the track.)

The Case Study sought information about the extent to which the different RSRRs recognise that there are options, which involve different levels of safety; and, given such options, how the RSRRs handle the problems they present, including making the choices between them.

The pattern of responses was clear-cut. Three RSRRs recognised the existence of options explicitly: Netherlands, Spain and Great Britain. Three recognised the existence of options indirectly and reluctantly: France, Germany and Italy. (The Swedish authorities felt unable to provide a full response.)

There were several strategies for taking the decision on what the rules should be:

- Decision by specialists: France (and probably others).
- Formulae which legitimise other than the maximum safety solution without explicit acknowledgement of economic factors: France, Italy, Spain.
- A criterion which explicitly accepts the legitimacy of economic considerations: GB, Netherlands.

We take forward from the study of rules for work on the track the following conclusions:

- There are difficulties in acknowledging explicitly the choices which are made between safety and other factors such as the costs of cancelling train services.
- Several Member States have however made this step, which seems essential to the development efficient regulation based on rational debate and choice.
Overview of current regimes and their impact

Industrial and transport safety hazards are widely regulated for good reason. The development of railways into a more dynamic industry, with more innovation, more operators including new entrants, and a wider range of suppliers, makes safety regulation even more important, to ensure safety. However regulation also imposes costs which, if it is not based on rational, consistent principles, can for some measures greatly exceed the benefits.

It is widely held within the railway industry that national RSRRs are not a material obstacle to innovation. Nor is the impact of differences between national regimes on the cost of supply widely seen by established operators or regulators as a major issue. A different view is generally held by those outside the established regime, such as train operators from another country or another industry, or suppliers wishing to develop wider European markets.

Whichever of these views is taken, experience in Member States points to the need for clearer requirements on infrastructure managers to provide information; meet costs arising from infrastructure not meeting standards; adopt a problem-solving, system-oriented ethos towards innovation; use criteria which balance costs and benefits; and consider existing equipment as well as new equipment when making decisions.

In addition to any avoidable costs in national RSRRs, the differences between national rail systems, including their RSRRs, also impose many costs. As with national regimes, some of these costs are static, such as the loss of economies of scale in production, and redundancy of approval procedures. Others are dynamic, such as obstacles to industrial restructuring, and to the entry of new suppliers or operators.

Continuing diversity is inevitable for many years because of inherited differences in infrastructure design; and some differences are efficient, as adaptations to local circumstances. However there is scope for reducing these diversities to achieve considerable cost savings, with no reduction and possibly an increase in safety. Many differences in standards appear to be accidents of history, reflecting differences of technical judgement, which could be removed at little if any cost in safety or commercial terms, if agreement could be achieved between the national authorities. Others are less clear cut, where the best degree of harmonisation could only be derived by detailed analysis.

One other important obstacle to cross-border operations, with some safety implications, is language.

There are many potential policy responses to diversity, most of which are already applied to European railways to some degree. These include in particular common standards (or “strict harmonisation”), mutual recognition, policed decentralisation, and self-regulation by the industry. All of these, and others, have a useful role.

Discussion
Executive Summary

There are differing views about the distinction between safety and non-safety issues. If, for example, a document refers to “safety equipment”, then a precise definition is needed for the term in that context. Railway enterprises also need a specific safety function within their management structures. However in general we see serious drawbacks to confining safety to a special category, separate from the other functions of a railway, such as engineering design, operations, or training. We take the view that safety is one factor to consider in most issues of railway management and regulation, and that generally definitions of some issues as ‘safety’ and others as ‘operational’ should be discouraged.

The main driver of institutional change in the railways is restructuring of the railway operators, reinforced by globalisation of the supply market. These are further reinforced, for safety, by factors such as an increasing public concern with safety, the development of accident investigation as a trans-modal function, and a long term trend towards a more analytical approach.

The degree of restructuring varies greatly across Member States. In several Member States the IM functions remain within an integrated nationalised industry. In others contestable markets are developing for train operation, but there are many variants of the IM role. In some cases the IM is drawn closer to government than it was when with a nationalised industry; in others it is moved further away from government. In some cases the original IM functions of traffic management, safety regulation and infrastructure management may be separated. There may be an increase in the number of smaller IMs, independent of the dominant mainline IM. Perhaps predictably, we found no enthusiasm for any prospect of infrastructure management transcending national boundaries.

During the course of the study we received several comments about commercial incentives and railway safety. We discuss these and conclude that commercial incentives are as likely to be good as to be bad for the level of safety, given a sound regulation regime; and that some forms of subsidy can be bad for the efficient provision of safety.

We have considered the feasibility of estimating figures ex ante for the total cost of safety regulation, or the total benefits of harmonisation of safety regulation regimes. There would be presentational value in such numbers. However there are no alternatives to the status quo which are well enough defined and quantified, bearing in mind that any comparison would need to cover both the comparative costs and the comparative benefits of the present and hypothetical alternative regimes. Such numbers would also have to distinguish arbitrarily between ‘safety’ and ‘operational’ requirements on many fronts. All that can be said is that the gains from more efficient safety regulation, apart from some net gain in safety, can run to tens of millions of euro per year; and that it is most important that, although the calculation of ex ante aggregate figures of this kind is not feasible, individual proposals can and should be rigorously analysed.

As principles of good regulation we propose effectiveness, efficiency, fairness and transparency and accountability. Fairness and transparency and accountability are important even in an integrated, professionally managed system. However they are crucial for an efficient, open system with independent and changing participants.
Executive Summary

To achieve all these principles there is a need for due process, which we define as meaning that a procedure must follow formal, well defined and generally open processes, as set out in key recommendation R1 below.

There is also a need, to the extent that it is possible, for quantification and valuation of costs and benefits, and for explicit rules about the policy criteria for choosing between alternatives. Formal analysis brings with it the potential difficulties of admitting in a political context that, at the design stage, trade-offs are made between safety and other benefits. We believe however that there is scope for a considerable further development of such analysis, and we include some discussion of issues such as individual risk, tolerability limits and societal concerns.

We briefly examined the handling of safety in other transport modes. Road safety provides an example of where the valuation of safety benefits is well established in most Member States. Aviation, which in most respects is much closer to railways, provides an example of international openness of accident investigation from which railways would benefit. This openness is attributable largely to the use of independent accident investigation bodies which, for European railways, are so far established only in Finland, Sweden and the Netherlands, and in a limited way in Denmark. Aviation also provides a good example of clear acceptance processes. However standard setting in aviation, while generally open with the industry fully involved, is not based on substantive decision rules which are clear and consistent. We conclude that there are reasons why due process, including clear and consistent decision rules for standard setting, are more important for railways.

As we considered the national safety regulation regimes there emerged a picture, which we believe is broadly uncontroversial, of what would constitute good practice. In this picture a regulator takes into account safety and operational considerations, seeking the best balance on the basis of expert analysis and the interests of all those concerned - the industry, its customers and wider society. The decision process is open, subject to privacy concerns and the safety interests of confidentiality, and follows due process for all parties. It makes appropriate use of expertise, and explicit quantitative comparisons of costs and benefits are employed where necessary. It recognises explicitly that there are choices to be made, and that sometimes it is right to incur avoidable risks because the cost of avoiding them cannot be justified. The basis on which such judgements are made is public. The regulator’s job is to ensure that operators strike the right balance between safety and other factors, although there are times when the regulator presses for safety, to the extent that operators have incentives to under-provide safety rather than over-provide.

We have gone on to construct two stylised sets of characteristics for safety regulation regimes. In one set (type A), safety issues are essentially separated from operational issues, and the explicit comparison of costs with safety benefits is denied. The other set (type B) follows the good practice ideal. In any regime the balance between these characteristics may (and perhaps needs to) vary between regulatory functions. However we suggest that, in most applications, movement further away from the first of these sets of characteristics towards the second would be good for railway safety regulation in Europe today.
Interoperability is now becoming a major driver for development of the European railway. In relation to the implementation of the high speed interoperability Directive, we found evidence of a lack of awareness of potentially far-reaching developments within the AEIF process, stemming in part from the inaccessibility of some key documents emerging from that process. In respect of conventional interoperability, union policies are still being formulated.

We draw a wide range of conclusions set out in section 6.1. Our key recommendations which are reproduced in full below are seen as high priority and in principle realistic. These relate to administrative effectiveness, and to some increase in emphasis on the final objective of competitiveness, as distinct from the intermediate objective of harmonisation.

For most of the recommendations implementation would depend upon expert and powerful bodies, within which differing views no doubt prevail, being persuaded that they are for the common good and worth supporting. They are in all cases designed to help steer the very high professional skills, energy and commitment within the industry, which have been evident throughout this study, most effectively into the changing transport environment of the 21st century.

Key recommendations

Due process, decision rules and the definition of safety

R1 We recommend that the EU policy should be designed to steer European rail safety regulation progressively towards due process, within which procedures:
  • are documented;
  • make relevant information available to all parties; and provide for all affected parties to be heard;
  • are applied consistently, with specified substantive (as well as procedural) decision rules;
  • give reasons for decisions;
  • are subject to independent appeal; and
  • are preferably subject to staged timetables (whether triggered by passage of calendar time, or triggered by particular events).

R2 We recommend that information on safety performance (relating to both accident investigations and overall statistics) should be publicly available.

R3 We recommend that EU policy should be designed to steer European railway safety regulation towards stronger analysis of costs and benefits and explicit substantive decision rules.

R4 We recommend that decisions made under EC Directives involving railway safety (which may include most standard setting), at all stages from first proposal to submission for final approval (for example to the Article 21 Committee), should be required to be supported by a statement:
  • outlining the proposal and alternative ways of achieving the given objective;
• setting out relevant costs and benefits, quantified where possible;
• making explicit any political or other judgements superimposed on quantitative analysis of costs and benefits.
• justifying the proposed course of a action by reference to those costs and benefits which can be valued, and an explicit account of other significant factors;

This approach should be adopted for informal as well as formal decisions.

R5 We recommend that, when European legislation is used to harmonise on technical, engineering and operational matters, safety issues should be dealt with explicitly, but as an integral part of those rule-making processes. Safety regulation and safety management will always be specific and important tasks, but the separate classification of issues as either ‘safety’ or ‘operational’ should generally be avoided.

EU promotion of actions at Member State level

R6 We recommend that the EU should seek to encourage, through legislation, the railway safety regulation regimes of Member States to provide the due process, separation of powers and availability of information needed for the satisfactory development of interoperability, the single market, new operators and other innovation.

R7 We recommend that the Commission should encourage the development of independent accident investigation in Member States and consider a Directive to this effect.

EU promotion of actions at the European level

R8 We recommend that bodies at the European level should be created or strengthened to carry forward a number of key central tasks, including the following. (While some of these tasks extend beyond safety, they are necessary for the effective development of safety regulation.)

• Appointment of an engineering project management team to manage the coordination of the output of the many technical committees which are contributing to the development of European railway standards and to promote due process.
• Development of methodology for risk assessment, including procedures for the identification of options, and for quantifying and valuing the costs and benefits of safety regulation proposals.
• Widening of public access to the TSI process - for example by release to a website of relevant documents and current drafts.
• Clearance of new national standards, with the explicit requirement that Member States do not to make rules or take decisions on rail safety issues that materially detract from interoperability or the development of the single market.
• Negotiation of recognition by Member States of relevant conformity approvals in other Member States.
Executive Summary

- Identification of “zero-cost” and other potential measures for harmonisation which may be cost-effective. Assessment of the costs and benefits of such measures and realistic timescales.
- Development of safety performance and other safety-related data.
- Promotion of European level debate on the problems of language.

R9 We recommend that these tasks should be carried forward by:
1) A much strengthened railway industry body, extended from and including the joint representative body function of the interoperability Directives, now carried by the AEIF; and
2) A new Railway Agency, as an EU institution, providing an executive interface between DG Energy and Transport and the industry.

R10 We recommend that the Commission should consider the option of establishing an EU-wide rail accident investigation agency, or regional agencies.

EU promotion of research

R11 We recommend that the Commission should fund research on the following, to lay the foundations for stronger central coordination:
- identification of differences in specific rail safety regulations or procedures which it may be cost effective to remove or reduce, and assessment of the associated costs and benefits and time scales.
- means of developing safety performance and other safety related data.
- use of different risk assessment methodologies (including the comparison of costs and safety benefits) across European regulated industries.

We recommend that the Commission should seek the assistance of the independent national regulators in these tasks.
1. INTRODUCTION

1.1. Background

This study, for DG Energy and Transport of the European Commission, assesses the extent to which current railway safety regulations and practices in the EU have an impact on railway competitiveness, in particular their effects on interoperability and the railway supply market. The study is designed to help the Commission, in consultation with the industry, to assess further steps towards a common approach to safety in European rail transport.

Much of the information for the study was provided by railway operators or regulators. However the project teams, following the Commission’s intention, were independent of these bodies.

An Interim Report was produced in July 1999. That Report provided an initial overview and analysis of the railway safety regulatory regimes in the Member States. This Final Report presents that work again, with some updating1, together with further work which examines in more depth how safety regulation is applied in practice in France, Germany, Italy, the Netherlands, Spain, Sweden and the UK mainland of Great Britain. The Report draws on this information to consider what steps towards a common approach might be desirable and realistic.

This Report is produced in five Volumes, as follows.

Volume I: Main Report
Appendix 1: Project Specification

Volume II: Appendix 2: Summaries of Member State RSRRs
Appendix 3: Summary of Responses to Track Worker Case Study

Volume III: Appendix 4: First Questionnaire

Volume IV: Appendix 5: Responses to First Questionnaire

Volume V: Appendix 6: Case Study Questionnaires
Appendix 7: Responses to Track Worker Questionnaire

Many readers of this Main Report may find it helpful to have to hand also Volume II. Volumes III to V are of more specialised interest: they are provided for the record, for researchers who require access to unedited background data.

1.2. Railway Competitiveness

Railways are an environmentally friendly and safe mode of transport which the European Commission and Member States wish to promote. Nevertheless they are continuing to lose market share in both passenger and freight markets to the roads and airlines.

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1 In particular on insurance and liabilities; and on Greece, which was omitted from the Interim Report.
There are many reasons for the relatively low growth of rail traffic, which are discussed in the Commission’s White Paper "A Strategy for Revitalising the Community’s Railways" (CEC, 1996).

In particular, although many railways were originally private ventures, all the major European railway systems were nationalised as unified, government-owned systems. This provided the benefits of a high level of technical standardisation within countries (but not between them), good "network benefits" within countries, and the use of railways to achieve national governments’ social objectives. On the other hand, the monopoly power enjoyed by the national railways has been a shield against the incentives provided by market forces. This contributed to relatively static structures and cultures. The national railways have faced weaker incentives than their competitors to continually reduce costs, improve quality and develop new services; and the scope for technical or market innovation by suppliers or new operators within the industry has been constrained.

The Treaty on European Union included the broad aim of creating trans-European networks and promoting interoperability, in particular through technical harmonisation. In the context of railways this is being pursued through three more specific objectives.

One of these objectives is to improve administrative procedures, especially for freight. This includes for example the exchange of operational and commercial data, matching of timetables and the procedures applied at international borders, with the medium term intention of freight services crossing borders within the EU without stopping, where this is technically possible.

A second objective is to improve technical interoperability of the conventional rail networks. Railway freight and passenger carriages circulate throughout the Community, but differences in technical and operational standards usually require a change of locomotive and crew at or near the national border.

A third objective is to help create a single market for railway equipment, again by promoting technical harmonisation. Recent years have seen a concentration of the railway supply industry into fewer and larger companies serving increasingly international markets. However costs are increased by having to build to so wide a range of national specifications, and by the extent to which railways are still locked into national suppliers.

These current objectives need to be seen in the context of the earlier EU initiative on restructuring European railways, promoted by Directive 91/440.

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2 A programme for achieving interoperability on high speed lines is provided by reinforced by Directive 96/48 of July 1996. A draft proposal for a broadly corresponding Directive for conventional rail services has now been issued (CEC, 1999).

3 Under the CIV (freight vehicles) and CIR (passenger carriages) frameworks negotiated by the national railway industries within the Union Internationale des Chemins de Fer (UIC).
Restructuring implies, first, the separation of the management of railway infrastructure from train operation and, second, making the infrastructure accessible to new operators, both freight and passenger, on the same terms as incumbent operators.

As this study progressed it became clear that safety was very much in the background, rather than the foreground of these developments, but that the development of safety regulation, for which we conclude there is important potential, is heavily bound up with these wider reforms and developments of European railways.

1.3. Railway Safety

The European railways have a safety record which is good, by comparison in particular with road transport, and has improved considerably over time (UIC, reported in ETSC, 1999). This is achieved through tight control of all aspects of railway activity. Primary responsibility for safety necessarily lies with the train operators (TOs) and infrastructure managers (IMs). These railway operators have suites of standards, rules and regulatory procedures covering all technical equipment and operating practices. The content of these is broadly similar for the different railways, but the details are different, mainly because each national railway has developed on its own.

All railways are also subject to railway safety regulation regimes (RSRRs) administered in part by external bodies, and often to railway-specific safety law.

RSRRs can have strong implications for interoperability, for the institutional aspects of restructuring, for the development of new operators, and for the development of a single market for railway equipment.

4 We mean by this that today’s safety level could be achieved at lower cost and with less restraint on innovation. We do not mean that European railways are less (or more) safe than they ought to be, although the development of a more dynamic industry might be expected, overall, to further improve safety.

5 Rail is the safest transport mode:

<table>
<thead>
<tr>
<th>Fatality Risks</th>
<th>per 100 million person km</th>
<th>per 100 million person hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bus</td>
<td>0.08</td>
<td>2</td>
</tr>
<tr>
<td>Car</td>
<td>0.80</td>
<td>30</td>
</tr>
<tr>
<td>Train</td>
<td>0.04</td>
<td>2</td>
</tr>
<tr>
<td>Ferry</td>
<td>0.33</td>
<td>10.5</td>
</tr>
<tr>
<td>Air</td>
<td>0.08</td>
<td>36.5</td>
</tr>
</tbody>
</table>

(ETSC, 1999)

Rail safety has improved considerably over time:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Staff fatalities, per year</td>
<td>335</td>
<td>40</td>
</tr>
<tr>
<td>Passenger fatalities, per billion km</td>
<td>2.1</td>
<td>0.37</td>
</tr>
</tbody>
</table>

(15 Member States of EU; UIC)

The rail accident rates of most Member States appear to be close to the average. However the statistics and other accident data on EU railway safety are unsatisfactory, in terms of definitions, scope and normalising data. Particularly relevant to restructuring is the problem of national definitions of workforce not including contractors. With the present statistics it is not possible to make useful inter-State comparisons of overall railway safety performance.
Interoperability is directly affected by safety regulation. The effect of different RSRRs, including their standards, rules and procedures, may sometimes be small relative to that of other system differences, such as electric power supplies. However differences between RSRRs in adjoining countries can add substantially to administrative and technical obstacles which discourage cross-border traffic and add to costs.

Restructuring to separate infrastructure from operation means that the systems for ensuring safe operation, and for achieving compatibility between trains and infrastructure, must change from being within a single organisation (the state railway) to systems which fit into contractual relationships between different organisations. This new context for safety regulation can radically effect the relationship between the infrastructure manager (IM) and train operators (TOs). Restructuring into multiple bodies in place of unitary bodies makes efficient safety regulation even more important, to ensure that there is no ambiguity about, or gaps in safety responsibilities.

Access by new operators requires arrangements for new entrants to acquire information; for them to obtain safety approval of their equipment and operations; and for the safety performance of operators to be audited.

Obstacles created by RSRRs to the development of a single market for railway equipment are both the obvious additional manufacturing and administrative costs of satisfying multiple regimes, and the disincentive which this creates to international restructuring of the supply industry itself.

1.4. Objectives and Structure of this Report

Safety regulation can be an important factor in the development of interoperability, new operators and a single supply market. However, there has been little information on which to assess these effects; or to assess what measures might be taken to reduce any avoidable adverse effects of national RSRRs and of differences between them. This study is designed to help fill this gap in information and policy analysis.

The objectives as set out in the project Specification⁶, are to:

1) provide an overview of existing safety regulations for railway operations among the Member States, concentrating on the following questions:

- which organisations/bodies supervise railway safety with regard to traffic operation and with regard to rolling stock?
- to what extent are safety standards - for operation as well as for equipment - set by the railways themselves or by legislation?
- which differences in safety philosophies exist among Member States?
- to what extent are safety regulations based on risk assessment analysis?

⁶ The full Specification is reproduced in Appendix 1 attached.
2) identify those cases where different safety regulations for different types of rail network (e.g. tramways/light rail/main line rail) exist within a Member State;

3) provide an overview of different liability standards for railway operation among Member States (including the identification of cases where railways are subject to strict liability);

4) assess the impact of existing differences in safety regulations and/or practices among Member States on seamless rail traffic operation and on equipment;

5) develop recommendations for a common safety approach to rail transport within the EU, outlining necessary long term steps, considering the links of national safety regulations with general principles of liability; and proposing suitable short and medium term measures to overcome existing divergences between Member States.

Chapter 2 below addresses points (1), (2) and (3), by describing and comparing the national regimes, focusing on the railway operators and regulators.

Chapter 3 summarises the present structures for developing European railway standards.

Chapter 4 addresses point (4), by examining more closely how the national regimes and differences between them operate in practice, drawing on information also from suppliers. It also contributes to point (5).

Chapter 5 develops point (5). It discusses the findings of the study, draws conclusions and develops recommendations.

Chapter 6 summarises the conclusions and recommendations.
2. THE CURRENT NATIONAL REGULATORY REGIMES

2.1. Methodology

The current railway safety regulatory regimes (RSRRs) in Member States were examined for this study mainly by means of a questionnaire, described as the First Questionnaire. This was completed for each Member State by members of the project team, either in their own or in a neighbouring Member State.

This information was collected in the spring of 1999, and has been only very partially updated. Many of concepts being explored are subtle. Most of the responses had to be translated. And judgement was needed in making comparisons between the fifteen Member States. Much of the information therefore is already, in February 2000, slightly out of date and it is bound to include details which yet more research would have amended or refined. However it has been sufficiently well researched and checked for us to be confident of the picture which it portrays.

The information was collected from many sources, generally on a non-attributable basis. We believe that, in this often sensitive field, this was more likely to provide reliable information than formal statements, to which individuals or their organisations could be tied.

2.1.1. Designing the First Questionnaire

The complex and changing national RSRRs have many similarities and differences, but there is no established way of describing or comparing them. Designing the Questionnaire therefore required a framework to categorise the key issues and interpret the answers, over a field which covers many disciplines, is rich in institutional and technical detail and has sometimes unclear boundaries. The study is in this respect exploring virgin territory.7

The Questionnaire did not address the technical content of regulations. It addressed instead how the RSRR is structured. It therefore emphasised regulatory procedure: that is, the nature and source of authority of the organisations imposing regulations, the processes by which regulations are determined and changed, their transparency, and the ease with which new entrants can understand them. The Questionnaire also addressed the decision rules under which regulations are adopted and applied.

Within the Questionnaire, the main classification of regulations, discussed below, was by the nature of their safety function, rather than by the physical operations to which they

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7 The literature on risk and regulation provides little help on the practical comparison of risk regulation regimes. There is a literature on risk and society at a national or international level, based mainly in sociology, discussing issues such as public trust in the authorities. There is a more technical literature based in science and engineering and in psychology on the definition and measurement of risk and on people’s attitudes to different qualities of risk. There is a literature based in economics on the valuation of risks. There is a literature based in management science on risk management. There is however little or no analytical literature on the comparison of regimes across all of their multi-disciplinary dimensions.
apply. Procurement, infrastructure management and train operation, for example, were addressed, but only as vehicles to illustrate the different functions of the regulatory regimes.

Comparing regimes in this way required the development of generic concepts, which proved to be extremely helpful in the analyses of the results. These generic concepts and other terms were defined in a Glossary, which is reproduced at the end of this Main Report.

All the project team partners were invited to comment on a draft design of the First Questionnaire. The Questionnaire also incorporated a number of helpful comments on the draft from members of the UIC.

There are aspects of safety regulation not covered in the Questionnaire which are important, but which are for the most part beyond the scope of the study. These include:

• comparisons of railway safety performance between countries;
• comparisons of the effects of different regulatory regimes on safety performance;
• the effects on safety performance of increased inter-operation;
• the interaction between safety regulation and the financial support provided to the railway, and the constraints placed upon it; and
• the safety regulatory regimes of other modes of transport.

All except the first of these aspects are considered briefly and in general terms in Chapter 5.

2.1.2. Structure and Content of the First Questionnaire

The First Questionnaire is reproduced in Appendix 4, in Volume III of this Report. The Questionnaire had four parts:

Part 1: The formal structure of railway safety regulation.
Part 2: How the safety regulatory regime is applied.
Part 3: The decision rules and principles on which the regulations are based.
Part 4: Overall assessment.

It aimed to provide a map of the structure of internal and external railway safety regulation. It addressed in particular those aspects of safety regulation which might affect the competitiveness of railways.

In Parts 1 and 2 of the Questionnaire regulations were classified by their safety function within the “control cycle” of regulation. In the fullest version of this (in section 1.2.5 of the Questionnaire), thirteen functions are identified, as listed below.

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8 As an example of a generic term, “acceptance procedure” is used to describe any process intended to confirm that a proposed piece of equipment or railway activity is acceptable in safety terms before it is introduced into normal commercial operation. The concept may be applied to anything from equipment, through operating procedures, to new operators or management structures.

9 We were asked in the project specification to note any conspicuous differences of safety performance if these become apparent, but they did not.
Part 1.1 of the Questionnaire sought a factual, dynamic description of the structure of the railway industry, and of its internal and external regulatory regime. Part 1.2 sought information on the bodies with responsibilities for railway safety. Part 1.3 sought a description of the regulations themselves.

However the formal description of a safety regulatory system may give little indication of the way it is actually applied on the ground. For example some regulations may in practice never be enforced; while other important safety functions may be performed with no formal regulations at all. Part 2 of the Questionnaire, on practical application, therefore enquired more closely into how the regulatory regime is applied, with particular reference to the processes for changing requirements and for enforcing them. These processes were again grouped by reference to the cycle of control, as follows:

<table>
<thead>
<tr>
<th>Director function (policymaking and rule setting)</th>
<th>Detector function (policy application and monitoring)</th>
<th>Effector function (response to new developments)</th>
</tr>
</thead>
<tbody>
<tr>
<td>• risk assessment of proposed standards</td>
<td>• acceptance of “safety cases” or similar arrangements</td>
<td>• developing new safety measures</td>
</tr>
<tr>
<td>• standard setting</td>
<td>• acceptance of new works, methods, or equipment</td>
<td>• providing advice</td>
</tr>
<tr>
<td></td>
<td>• setting objectives for safety performance</td>
<td>• investigating railway accidents</td>
</tr>
<tr>
<td></td>
<td>• controlling operations</td>
<td>• recommending changes following accident</td>
</tr>
<tr>
<td></td>
<td>• reporting on safety performance</td>
<td>investigations</td>
</tr>
<tr>
<td></td>
<td>• auditing and/or inspection</td>
<td>• enforcement of the law</td>
</tr>
</tbody>
</table>

Part 3 of the Questionnaire, on decision rules and principles, was concerned with regulatory style and “safety philosophy”. Part 3.1 considered regulatory style - for example whether regulation is centralised, the degree of discretion, whether it is co-operative or punitive, the degree of self-regulation, and the role of experts relative to the influence of the public, the media, or politicians. Part 3.2 asked about the terms in which the law allows safety duties to be qualified by costs. Part 3.3 asked about how safety is measured, and how these measurements are used in the regulatory regime. Part 3.4 asked about decision rules,

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10 There was some difficulty with the term “enforcement”, which is defined in the Glossary as the investigation of violations and imposition of sanctions on an organisation which, through negligence or worse, had failed to apply the safety requirements. Several of the responses interpreted it more in the sense of ensuring compliance - with no reference to failure, negligence, sanctions, or external intervention. This may reflect the “in house” approach to railway safety found in most Member States.
especially about the nature of the implicit or explicit trade-offs between safety and costs. Part 3.5 explored the use of risk assessment.

Finally, Part 4 requested a subjective overall assessment of the safety regime in each Member State, again asking questions about its effect on interoperability and whether it created a significant barrier to new entrants.

The Questionnaire thus contained both factual questions and subjective questions, which asked for judgement about what the facts imply.

2.1.3. Completing the First Questionnaire

Questionnaires for eight Member States (Finland, France, Germany, Great Britain, Italy, the Netherlands, Spain, Sweden) were completed by project partners based there. The rest (for Austria, Belgium, Denmark, Greece, Ireland, Luxembourg, and Portugal) were completed by partners based in neighbouring countries.

Much advice was drawn from railway organisations and regulators, but project partners were encouraged to use a variety of sources, including their own prior knowledge.

In the Member States with resident project partners responses to the Questionnaire were based mainly on interviews with key people in the railway and regulatory bodies. Some partners sent their draft answers to the bodies for comment; some did not, partly for reasons of confidentiality. For the seven Member States without resident project partners relatively more use was made of correspondence.

In preparing their answers to the First Questionnaire project partners generally did not approach the railway equipment supply industry, new entrant operators, or railway users. These sources were held over until later in the study.

In one case (Portugal) the current arrangements are described as so transitional that concepts such as style and philosophy have not clearly developed. For Greece information was obtainable only late in the project and in summary form, rather than as specific responses to the Questionnaire. In the case of the Netherlands, Belgium and Luxembourg, on a point of detail, the concept of “acceptance procedures” was felt to be subsumed in “design requirements”. However the framework and concepts adopted for the Questionnaire were otherwise fully applied to each Member State, to provide a common framework for comparative analysis.

A summary of the formal structures portrayed for each Member State by the Questionnaire responses (supplemented in some cases by other sources) is recorded in Appendix 2, in Volume II of this Report.

The unedited responses to the Questionnaires, to the extent that confidentiality allows, are recorded in Appendix 5, in Volume IV of the Report.
2.2. General Analysis of Railway Structures in Member States

This section examines and compares the railway structures in Member States. Section 2.3 provides a detailed analysis of the railway safety regulatory regimes (RSRRs).

The mainline railways\textsuperscript{11} of the European Union are part way through a journey, from integrated nationalised industries towards systems which are still regulated, but with many players in contestable markets, ideally on level playing fields. Even if they ultimately end in much the same place, Member States are at different stages of the journey and this is one source of wide diversity of railway structures and of RSRRs.

Until recently, all Member States ran the mainline railway on the nationalised industry (NI) model:

- 100% horizontal integration - one mainline operator only
- 100% vertical integration - the same body:
  - owned trains and infrastructure;
  - operated train services;
  - renewed and maintained track, structures and signalling;
  - controlled train movements;
  - maintained the trains.
- Public ownership:
  - no profit motive or take-over threat;
  - capital for investments and deficits from government, not the market.
- Identification with the Member State:
  - obligation to support national suppliers;
  - limited incentive to expand abroad.

In safety regulation, this has been associated with:

- high degree of trust in motives of NI;
- most safety regulation being self-regulation by NI;
- (for larger railways) many design decisions being taken by NI (rather than by supplier);
- management of interfaces between functions being internal to NI;
- safety instructions being part of integrated documents also embodying engineering decisions and procurement detail.

Restructuring to create contestable markets and level playing fields can involve, in contrast:

- Vertical division into infrastructure manager (IM) and train operator (TO), and between operator and maintainer.
- Horizontal division into several TOs.
- Competition between TOs; and more international competition between equipment suppliers.

\textsuperscript{11} “Mainline” is defined in the Glossary.
The Current Railway Safety Regulation Regimes

- New entrants to many railway activities; or at least new combinations of former national companies.
- Requirement to raise capital in the market.
- Profit motive and take-over possibility.

We hypothesise that this restructuring will affect safety regulation in the following ways:
1) More explicit management of the interfaces between the various functions.
2) Provision for certification of new entrants (and existing operators).
3) Greater sensitivity to possible conflicts of interest; including incentives to recognise the costs of safety regulations.
4) Greater emphasis on quantitative targets, including targets for safety risks to individuals and groups, implying more quantitative risk analysis.
5) More emphasis on encouraging innovation, and on managing its safety consequences.

We therefore start our analysis by summarising the progress made by Member States in restructuring the mainline railway, first in terms of implementing the relevant Directives (91/440; 95/19; 96/48); second in terms of adapting their RSRR.12

In Table 2.1 we report on the way in which infrastructure management has been separated from train operation. Table 2.2 describes the broadly corresponding pattern of introduction of new train operators (TOs).

**Table 2.1**

<table>
<thead>
<tr>
<th>Integrated NI continues unchanged</th>
<th>Greece, Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Within NI, but a separate division</td>
<td>Austria (1), Belgium, Italy (2), Luxembourg,</td>
</tr>
<tr>
<td>Within NI, but as a separate division, plus a new autonomous body for new lines</td>
<td>Spain (3)</td>
</tr>
<tr>
<td>A separate organisation, but devolving operating activity back to NI</td>
<td>Finland (4), France,</td>
</tr>
<tr>
<td>A separate organisation, but capacity allocation and train movement control remain with the NI</td>
<td>Portugal (5)</td>
</tr>
<tr>
<td>A separate organisation, exercising its functions directly, within the public sector</td>
<td>Denmark, Germany (6), Sweden (7)</td>
</tr>
<tr>
<td>IM functions split between three separate organisations within the public sector: capacity &amp; safety (IM); maintenance; train movement control.</td>
<td>Netherlands (8)</td>
</tr>
<tr>
<td>Privatised, as regulated monopoly</td>
<td>Great Britain (9)</td>
</tr>
<tr>
<td>Franchised</td>
<td>None</td>
</tr>
</tbody>
</table>

(1) Infrastructure financing and capacity allocation by separate agency. Capacity allocation to revert to NI.
(2) There are proposals to establish IM as separate organisation.

12 The data on which this Chapter is based was collected in the spring of 1999. Only a few details have subsequently been updated.
(3) The new body, GIF (Railways Infrastructure Manager) is under the Ministry of Civil Works and is in charge of the construction and operation of new lines, starting with the new Madrid-Barcelona-French border high speed line. The extension of GIF’s responsibility to the whole Spanish network is under consideration.

(4) It is envisaged that freight and local passenger services will be opened to other operators; private sector share of infrastructure renewal and maintenance will increase; allocation of track capacity will be done by IM; train control will be done by IM or an independent agency.

(5) Capacity allocation is to pass to IM.

(6) This description assumes that the holding company DB AG does not intervene in operations. Consideration is being given to converting IM from publicly-owned company to government department.

(7) There is a separate organisation for train control.

(8) The IM is expected to leave the present holding company within year or so.

(9) This Report deals almost wholly with the railway system of the UK mainland of Great Britain. The safety regulation arrangements for the very small railway system in Northern Ireland, as described in Appendix 2, are different and broadly similar to those of the Republic of Ireland.

Table 2.2
Introduction of new TOs

<table>
<thead>
<tr>
<th>No new train operators</th>
<th>Austria, Belgium (1), Finland(3), Greece, Ireland, Italy(3), Luxembourg, Spain</th>
</tr>
</thead>
<tbody>
<tr>
<td>One private sector operator runs some minor lines on behalf of NI</td>
<td>France (1)</td>
</tr>
<tr>
<td>One new entrant, closely controlled by NI</td>
<td>Portugal</td>
</tr>
<tr>
<td>Some new entrants, running small operations</td>
<td>Netherlands (4), Denmark</td>
</tr>
<tr>
<td>Large scale franchising of highly-subsidised “regional” operations</td>
<td>Germany, Sweden (5)</td>
</tr>
<tr>
<td>Complete fragmentation and privatisation of former NI</td>
<td>Great Britain</td>
</tr>
</tbody>
</table>

(1) Counting international TGV operations such as Eurostar as extension of activity by NI.

(2) Opening of freight and local passenger services is envisaged in next year or so. Considerable further adaptation is then envisaged (see Note to Table 2.1) including establishing NI’s training and staff health checks as independent functions, or obliging NI to provide services to new TOs.

(3) New TOs expected in Italy from 2000 onwards.

(4) Local and regional services to be franchised in the Netherlands by 2003. 33 non-profitable routes are to be auctioned to “new entrants” (which might be a consortium of the NI and a bank).

(5) Freight services and subsidised operations in Sweden are wholly liberalised. 40 percent of mainline traffic franchised from January 2000.

This is a rapidly changing scene. Many of the institutional changes are recent: it will take many years for their full impacts to unfold.

Table 2.3 describes the changes made to safety regulation arrangements as a part of, or as a consequence of, or possibly simply in parallel with, restructuring the industry. In contrast to nearly all the other Tables in this Chapter, many of the rows in Table 2.3 are not mutually exclusive. One Member State may therefore appear in several rows.
### Table 2.3
Adaptations of railway safety regulation regimes to a restructured railway

<table>
<thead>
<tr>
<th>Rationalisation of legislation/regulations/standards</th>
<th>Finland, France (in hand), Great Britain, Netherlands,</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transfer of safety role to Ministry:</strong></td>
<td></td>
</tr>
<tr>
<td>Transfer of high-level Regulations</td>
<td>Belgium, France</td>
</tr>
<tr>
<td><strong>Transfer of safety role to Railway Inspectorate (RI)</strong></td>
<td>Belgium, Germany, Sweden, Denmark</td>
</tr>
<tr>
<td>New railway safety agency established, separate from railway operators</td>
<td></td>
</tr>
<tr>
<td><strong>Transfer of system wide safety role to IM:</strong></td>
<td>Great Britain (1), Sweden</td>
</tr>
<tr>
<td>System-wide safety role, with new formal powers and duties, which prescribe how the IM should carry out that role</td>
<td></td>
</tr>
<tr>
<td>IM role split, with new formal powers and duties, which prescribe how the relevant part should carry out its system-wide safety role</td>
<td>Netherlands (2)</td>
</tr>
<tr>
<td>IM assume responsibility for most regulations (the rest either staying with NI or going to Franchising Regulator)</td>
<td>Portugal</td>
</tr>
<tr>
<td>IM duties restricted to “objectives and principles”</td>
<td>France</td>
</tr>
<tr>
<td><strong>IM safety role vis-à-vis TOs</strong></td>
<td></td>
</tr>
<tr>
<td>All TOs obtain safety certificate from IM</td>
<td>Great Britain, Italy</td>
</tr>
<tr>
<td>“Incoming” TO requires safety certificate from IM</td>
<td>Austria</td>
</tr>
<tr>
<td>Safety role included in negotiation of track access agreement with TO</td>
<td>Sweden</td>
</tr>
<tr>
<td><strong>Involvement of rail regulator</strong></td>
<td></td>
</tr>
<tr>
<td>IM becomes a regulated private sector monopoly</td>
<td>Great Britain (3)</td>
</tr>
<tr>
<td><strong>No change</strong></td>
<td>Greece, Ireland, Luxembourg, Spain</td>
</tr>
</tbody>
</table>

1. UK statutory regulations require the IM to prepare a Rail Safety Case (RSC), with content specified in the regulations, for acceptance by the RI. The TOs and station operators prepare RSCs for acceptance by the IM.

2. Railned is set up with a specific safety role, distinct from design/installation/maintenance of infrastructure, and from the real-time control of train movements. This safety role is soon to be formalised.

3. The Rail Regulator is established to regulate the IM’s monopoly power and has no direct safety role. He is obliged by law creating to take advice on safety from the general safety regulator (HSE). His involvement with safety takes the form of specifying the decision procedure.

4. Because EC91/440 has yet to be implemented.

### 2.3. Detailed Analysis of RSRRs in Member States

This section addresses the first three of the questions posed in the project specification, as set out in section 1.4 above and in the sub-section headings below.
We here identify and categorise the institutional arrangements and how they work. Evaluation of the *impact* of the regimes is covered in Chapter 4.

2.3.1. Which institutions/bodies supervise railway safety?

We interpret “supervising” as *external* supervision of one legally independent organisation by another. This *excludes* the following (important) interactions:

- a railway operator imposing contractual conditions on a supplier in order to fulfil the railway operator’s safety duties;
- one department of an organisation imposing requirements on another department;
- a standards organisation drafting standards to be adopted by an authority able to impose them;
- police investigation of possible criminal acts associated with a railway accident; and
- Trade Unions exercising rights to be consulted or to inspect.

We have however gathered information about the wider safety management system including such interactions, including situations where the national railway is self-regulating and external supervision is light or absent.

The following dimensions have emerged from our study as important for describing the external supervision of railway safety:

1) To what extent are the different regulatory functions (defined below as Specification, Compliance, Investigation and Prosecution) carried out by separate organisations?

2) What is the position of the Infrastructure Manager in the supervision of railway safety?

3) Is the safety regulation of railways separate from that of other transport modes and other industry?

4) Is railway employee safety regulated separately from railway-specific safety (safety of trains, passengers and public)?

5) What is the relationship between institutions regulating safety and government?

6) What is the relationship between institutions regulating safety and the railway operators?

Items (1) to (5) are discussed below, followed by a discussion of the separate implications for the regulation of traffic and of rolling stock. Item (6) is discussed in section 2.3.2.
2.3.1.1. Separation of regulatory functions

We noted in section 2.1.2 a 13-stage cycle of safety management. In considering different patterns of external safety regulation we have reduced these to four core functions:

- **Specification**: Laying down the requirements which are to be fulfilled.
  - This covers the traditional engineering design requirements and operating rule requirements, but can also include processes such as certification processes; insurance requirements; and safety performance requirements.

- **Compliance**: Securing the fulfilment of those requirements.
  - This can involve acceptance procedures (to check compliance before introduction); auditing (checking after introduction); and reporting outturn; as well as requiring introduction or removal directly.

- **Investigation**: Investigating accidents and other incidents.

- **Prosecution**: Initiating legal sanctions for breach of safety requirements.
  - These can apply to specific design requirements or to general requirements to ensure safety. We do not consider the general system of criminal and civil law in Member States, but merely the processes specific to railway safety.

We found four models, as shown in Table 2.4.

<table>
<thead>
<tr>
<th>Model 1</th>
<th>Specification, Compliance, Investigation and Prosecution all carried out by the same body</th>
<th>Austria, Belgium, Germany, Great Britain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Model 2</td>
<td>Specification and Compliance carried out by one body; Investigation and Prosecution by a second body</td>
<td>France (1), Italy, Ireland, Luxembourg (2)</td>
</tr>
<tr>
<td>Model 3</td>
<td>Specification, Compliance and Investigation carried out by the same body; Prosecutions by others</td>
<td>Greece (3), Spain (4)</td>
</tr>
<tr>
<td>Model 4</td>
<td>Specification, Compliance and Prosecution carried out by one body; Investigations by a second body</td>
<td>Denmark (5), Finland, Netherlands, Sweden (5)</td>
</tr>
</tbody>
</table>

(1) Largely self-regulatory, so external specification and compliance functions are light.
(2) Self-regulatory to the point where the prosecuting authority does not have an accident investigation capability.
(3) Firm information not available on responsibility for prosecution in Greece.

13 Bodies which supervise industrial safety are generally outside the industry in question. However in the environment of the restructured railway, instances are found where the IM supervises safety (for example, Railtrack in GB promulgates Railway Group Standards, which TOs are legally obliged to observe). The various roles of IMs are discussed in section 2.3.1.2 below. They never include prosecution, and there is almost always a body outside the industry which oversees, at a higher level, any supervisory functions undertaken by the IM (for example, the IM may investigate accidents but the external body will investigate the most serious accidents).
Spanish prosecutions may be initiated by the criminal justice authorities (police, charged by judges) or by action by injured parties.

Individual operators will investigate the accidents in which they are involved, and prosecuting authorities will investigate where an offence is believed to have been committed. Any accident with one or more victims killed or seriously injured is immediately reported to the RI. It will then normally be investigated by the RI unless there are more than five deaths or serious injuries, or the damage exceeds 20 million kronor, in which case it is normally investigated by the independent State Commission for accident investigation.

(Information not available on accident investigation or prosecution in Portugal.)

Different approaches to safety regulation - as discussed in section 2.3.3 below - place different emphasis on the different functions. A “high trust” regime may be confined to specifying requirements in broad terms and investigating accidents, assuming that all requirements will be fulfilled and that punitive measures are superfluous or counter-productive. One very different approach would be pure deterrence, relying on severe sanctions for failure to secure safety, and leaving it to operators to decide the most effective measures to minimise this risk. A low trust regime would specify in detail, and check compliance before and after implementation.

2.3.1.2. The position of the Infrastructure Manager

Table 2.1 reported on the evolution of IM functions in broad terms, as an index of the extent to which the industry has been restructured.

Table 2.3 summarised the adaptation of railway safety regulatory regimes, often involving the IM.

Table 2.1 showed the IM in five Member States (Denmark, Germany, Sweden, the Netherlands and GB) as a legally distinct organisation, which has not devolved its operating functions back to the NI whence it came. Such an organisation has the safety responsibilities which follow from those operating functions, which are typically as follows (although not all IMs undertake all these functions).

- Design and installation of track, structures and equipment;
- Maintenance of track, structures and equipment;
- Allocation of capacity and time-tabling;
- Real-time control of train movements.

The safety responsibilities of all of these functions involve trains and the staff of train operators (TOs). Typically, this involvement of TOs arises because the need for compatibility. The track, structures and equipment of the IM must be compatible with the trains, and vice-versa. The interfaces include gauging and envelopes, wheels and rails, signalling and control systems including braking, and communication systems. Operating procedures must be compatible. Much depends on the competence of TO staff at all levels. Provision must be made for deviations from plan, including accidents. Much of this would fundamental to a commercially viable railway even if there were no issue of safety.
There is therefore an important question raised by Directive 91/440, of the responsibility for ensuring this compatibility of systems once the unified NI structure has been split.

Two broad approaches can be seen in the railway safety regulatory regimes (RSRRs) created by Member States in response to the restructuring Directives. A third is found in other transport modes.

- One approach is to leave IM operating functions with the NI railway operator, or to devolve them from the IM, back to the NI where they originated. Responsibility for compatibility of technical and human systems is then with the NI.

- The second approach is to put responsibility for compatibility of technical and human systems onto the IM, with the IM having authority to impose solutions on TOs.

- The third approach is to give the IM and TO equal status. Compatibility issues would then be resolved either by consensus or by a third party. This approach is not however found in any Member State’s RSRR. It may not be appropriate to railways, because trains and track are so closely coupled.

The second approach makes the IM responsible in safety terms for the great bulk of the design of the railway, and for its successful translation into a safe operation. (The TOs and suppliers also have their own safety responsibilities, which then overlap substantially with those of the IM.)

This design and safety role of the IM could be achieved through the normal commercial contract between IM and TO. This would not constitute external safety regulation, any more than the contract between TO and train builder, or between train builder and component supplier.

However, in some regimes the role of the IM is given a status, and powers and duties, beyond that of the normal business enterprise responsible for the safety of activities under its control. In Great Britain, these additional powers and duties of the IM are stated (by the relevant Regulations) to relate solely to safety. They lay down how the IM is to ensure compatibility and competence: they do not determine what the IM is to ensure. Sweden and the Netherlands also have highly articulated roles for the IM, as noted in Table 2.3.

These procedural arrangements bring the IM within our working definition of “an institution supervising railway safety”.

It is noteworthy that analogous arrangements do not, in general, apply in road and air transport, where the coupling between vehicle and infrastructure is less strong than is the case with railways. The highway authority does not lay down the standards of braking of road vehicles or the test to be taken by drivers. The body owning and operating airports does not regulate the safety of aircraft. Other modes are discussed later, in section 5.2.5.
The powers and culture of the IM are central to the incentive structures of the industry. True contestability and level playing fields require regulation which has no reason to favour incumbent operators over potential new operators.

2.3.1.3. **Overlaps with safety regulation of other transport modes and other industries**

2.3.1.3.1. Overlaps with other transport modes

No Member State has a specialist agency covering the specification or compliance functions for both rail and other transport modes (although this is identified as an option in the Consultation Document issued by the British Government’s current Transport Safety Review, (DETR, 1999, paragraphs 2.05 to 2.15). All Member States have a central government ministry dealing with all transport modes. However, where this ministry is closely involved in railway safety regulation, the staff concerned are not closely linked with the safety regulation of other modes.

Where Member States have accident investigation bodies separate from other regulatory functions these do cover other transport modes, and in some cases, other forms of accident, as shown in Table 2.5.

<table>
<thead>
<tr>
<th>Accident investigation bodies</th>
<th>Netherlands(1)</th>
<th>Denmark,(2)</th>
<th>Finland, Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covering all transport modes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Covering transport and other accidents</td>
<td></td>
<td>Denmark,</td>
<td>Finland, Sweden</td>
</tr>
<tr>
<td>No separate accident investigation body</td>
<td></td>
<td>Austria,</td>
<td>Belgium, France,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Belgium, Germany, Great</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Britain,(3)</td>
<td>Greece, Ireland,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Italy, Luxembourg,(4)</td>
<td>Portugal, Spain</td>
</tr>
</tbody>
</table>

(1) From 1999.
(2) Denmark has no permanent body, but according to the Lov om Jernbanesikkerhed (Railway Safety Law) the minister shall appoint a commission if there is an accident with a special character or heavy consequences.
(3) Separate body under consideration as part of Transport Safety Review.
(4) Proposal that Ministry appoints investigators.

2.3.1.3.2. Overlaps with regulation of other industries

In only one Member State, Great Britain, is railway safety regulated by the body - the Health and Safety Executive (HSE) - which regulates safety in most other industries (although the HSE does not regulate other transport modes).

2.3.1.4. **Employee safety regulation**

All Member States appear to recognise the specific dangers of railways to employees by some form of railway-specific safety regulation.

In most, but not all the Member States for which we have information, the safety regulator for railway employees is the same body as for employees in other industries. However in most, but not all the Member States, the regulator for railway safety of the public (including
passengers) is different from the regulator for safety of railway employees. These diverse arrangements are set out in Table 2.6.

<table>
<thead>
<tr>
<th>Regulation of safety of rail employees</th>
<th>Same as other industries</th>
<th>Different from other industries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Same regulation for safety of public as for safety of rail employees</td>
<td>Great Britain</td>
<td>Belgium, Germany, Ireland (2), Italy (3), Netherlands</td>
</tr>
<tr>
<td>Different regulation for safety of public as for safety of rail employees</td>
<td>Denmark (5), Sweden (5)</td>
<td>Austria (4), Finland (5)</td>
</tr>
</tbody>
</table>

(1) Railway-specific risks such as train collision, which affect employees as well as passengers, are regulated in all cases by the regulator for safety of the public.

(2) Some overlap in responsibility for employees: lack of acceptance of responsibility for safety of public.

(3) By inference from response.

(4) Inspectorate for rail employee safety is subordinate both to Ministry of Transport which deals with rail safety in general and to Ministry of Labour which deals with employee safety in general.

(5) Railway employees are covered by same laws as other employees, but also by additional regulations. (Information not available for France, Greece, Spain, or Portugal.)

2.3.1.5. **Relationship of the Railway Inspectorate with government**

Most Member States have a government body with the specific task of regulating railway safety - a Railway Inspectorate (RI). Its relationship to central government varies, as shown in Table 2.7.

<table>
<thead>
<tr>
<th>Function within Ministry</th>
<th>Austria, Belgium, France, Ireland (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Identifiable separate body within government</td>
<td>Italy</td>
</tr>
<tr>
<td>Independent public sector agency (2)</td>
<td>Denmark, Germany, Netherlands (3), Sweden</td>
</tr>
<tr>
<td>Within general employment-related safety regulatory agency</td>
<td>Great Britain (4)</td>
</tr>
<tr>
<td>No RI function distinct from railway industry</td>
<td>Finland, Greece, Luxembourg, Portugal, Spain</td>
</tr>
</tbody>
</table>

(1) Within Ministry for nationalised industries.

(2) As defined in the First Questionnaire.

(3) Main weight of regulation is with the IM (Railned), rather than the RI (RVI).

(4) Until 1990 the RI was within Ministry of Transport. It was then transferred to the general employment-related safety regulator (the HSE), which was then a responsibility of the Ministry of Employment. The HSE, including the RI, was later transferred to the Ministry of Environment. It is now the responsibility of a combined Ministry of Environment and Transport.
Our information about the scale of the RI in terms of resources is incomplete, but it seems reasonable to infer that in most cases, the RI’s resources are modest. On that basis, it seems reasonable to conclude that the RI is a substantial body in about one-third of Member States:

Table 2.8
Size of the RI function

<table>
<thead>
<tr>
<th>Substantial</th>
<th>Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>15 – 20 full time equivalent staff (FTE)</td>
</tr>
<tr>
<td>Germany</td>
<td>&gt;100 FTE in EBA</td>
</tr>
<tr>
<td>Great Britain</td>
<td>93 FTE staff in RI and HSE Railway Safety Policy</td>
</tr>
<tr>
<td>Netherlands</td>
<td>50 FTE; budget 4 million euro</td>
</tr>
<tr>
<td>Sweden</td>
<td>About 30 FTE</td>
</tr>
<tr>
<td>Modest</td>
<td>(inferred)</td>
</tr>
<tr>
<td>Austria</td>
<td>(inferred)</td>
</tr>
<tr>
<td>France</td>
<td>3½ FTE professionals + 2 support; budget 75k – 100k euro</td>
</tr>
<tr>
<td>Ireland</td>
<td>1 professional, 3 proposed, + support</td>
</tr>
<tr>
<td>Italy</td>
<td>(inferred)</td>
</tr>
<tr>
<td>No RI</td>
<td>Luxembourg, Spain</td>
</tr>
<tr>
<td>Not quantified</td>
<td>Belgium, Portugal</td>
</tr>
</tbody>
</table>

(Information not available for Denmark or Greece.)

2.3.1.6. Application to safety regulation of traffic operation and of rolling stock

2.3.1.6.1. Traffic operation

Traffic operation has two facets:
- Real-time control of timetabled train movements on the running line.
  - This is a command function, operating within a given signalling system. In the liberalised railway, there are two questions: first, where is it located? second, how is it safety-regulated?
- Rules for other traffic operations.
  - This deals with functions such as train despatch, train marshalling, and emergency movements. It is more a communications function. It is partly a matter of prescribing what is to be done in a given situation, and partly communications protocol.

As real time control is exercised by those operating the signalling system, the initiative inherently lies with the infrastructure operator, not the train operator. However there are still several options for locating the safety regulation of real-time control, as shown in Table 2.9.

All railways have a “Rule Book” which governs manually-controlled train movements. This is an important part of the “glue” which holds the system together. It often involves the interface between IM and TO (e.g. communication between signal operator and train driver in the event of signal failures). Because it consists largely of protocols governing communication between operative staff, it has to be managed conservatively. The
arrangement in a post 91/440 environment which has been adopted so far is for the Rule Book to be the property of the IM. Sometimes it is managed on a consensus basis jointly with the TOs. Sometimes some high level rules are promulgated by the external safety regulator. The arrangements in different Member States are shown in Table 2.10.

Table 2.9
Safety regulation of real-time control of train movements

| Function executed by IM. Safety regulation integral with that of IM | Germany (1), Great Britain, Sweden (2) |
| Function devolved back to NI train operator. Safety regulation integral with that of NI train operator | Finland (3), France |
| Function remains with NI train operator. Safety regulation integral with that of the NI train operator | Portugal |
| All IM functions continue within NI. Safety regulation integral with that of NI train operator | Austria, Belgium, Denmark (4), Greece, Ireland, Italy, Luxembourg, Spain |
| Function established as independent public sector agency. No explicit safety regulation | Netherlands |

(1) Inferred.
(2) Function established as independent authority within IM.
(3) Envisaged that when new TOs enter, function will be undertaken by IM or independent agency.
(4) However the 13 private railways in Denmark are their own IM and have their own real time control and safety regulation.

Differences in practical application are probably less than is implied by the differences in formal responsibilities shown in Table 2.10. We feel however that a significant message emerging from Table 2.9 and Table 2.10, and others like them, is the split between the RSRRs which aiming to conserve the benefits of the integrated NI and those which are moving to a traffic operation system based on the IM, or a separate agency.

Table 2.10
Safety regulation of the Rule Book

<table>
<thead>
<tr>
<th>Drawn up and decided by IM</th>
<th>Germany, Portugal (1), Spain (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formally the property of the IM, but managed on a consensus basis jointly with the TOs</td>
<td>Great Britain (2), Netherlands (2)</td>
</tr>
<tr>
<td>Drawn up by IM, accepted by RI</td>
<td>Sweden</td>
</tr>
<tr>
<td>Drawn up by IM, endorsed by Ministry</td>
<td>Austria</td>
</tr>
<tr>
<td>All relevant IM functions devolved back to, or remain with, NI. Rule Book managed within NI</td>
<td>Belgium (3), Denmark, France, Greece, Ireland, Italy (3), Luxembourg</td>
</tr>
<tr>
<td>Managed on a consensus basis between IM and NI</td>
<td>Finland</td>
</tr>
<tr>
<td>Remains with NI train operator</td>
<td>none</td>
</tr>
</tbody>
</table>

(1) In Portugal and Spain the IM is a division within the NI. In both countries approval is also required from the Ministry of Civil Works, directly or, in the case of Portugal, in the near future, from the INTF (Rail Transport National Institute), which is responsible to the Ministry.
(2) Some high-level rules promulgated by the external safety regulator.
2.3.1.6.2. Rolling Stock

Responsibilities for the safety regulation of rolling stock are shown in Table 2.11. Where there is still effectively an integrated NI this is carried out (within the NI) by the TO. However where there is not an integrated NI it is generally carried out by the IM or another agency (with the apparent exception of Portugal, where the NI TO undertakes functions which elsewhere are IM functions).

Table 2.11
Safety regulation of rolling stock

<table>
<thead>
<tr>
<th>IM and RI, in parallel</th>
<th>Finland, Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>RI</td>
<td>Denmark</td>
</tr>
<tr>
<td>Ministry and RI</td>
<td>Germany</td>
</tr>
<tr>
<td>NI</td>
<td>France, Greece, Luxembourg, Portugal, Spain</td>
</tr>
<tr>
<td>NI, subject to high-level requirements promulgated by RI/Ministry</td>
<td>Italy (1), Belgium</td>
</tr>
</tbody>
</table>

(1) Technical safety requirements are established by the rail operator and by National Standards bodies, such as UNIFER and CEI.

(Information not available for Ireland.)

2.3.2. To what extent are safety standards set by the railways themselves or by legislation?

The Project Specification contrasts safety standards set by “the railways themselves” with ones set by “legislation”. While many Member States have considerable railway-specific safety legislation, it seems that most of it is either so general or so obsolete as not to be a binding constraint. We therefore focus on the contrast between regulation applied by the industry and regulation applied by any agency or authority external to the railway.

For several decades until the 1990s the typical pattern in European countries was of a high degree of self-regulation by the nationalised mainline railway. This was a natural, perhaps inevitable, consequence of the nationalised industry form:

- Public service ethos, no profit motive, no threat of take-over: engendered trust in motives of the NI;
- Statutory monopoly: limited expertise elsewhere;
- Vertical and horizontal integration: led to “single document” approach, whereby engineering, commercial, procurement and safety requirements were combined in a single instruction.

In many cases - Belgium, Sweden, Netherlands, France, Finland, Germany, and Ireland, - there seems not to have been any substantial external resource for railway safety regulation prior to the restructuring of recent years. There will have been some posts in the Ministry,
but not with sufficient numbers or skills to be able to set safety standards in other than very
general ways.

In other cases (Denmark, Great Britain, Italy) the Ministry contained a more substantial
railway safety unit. But even in these cases, the great bulk of safety standards were
prepared and decided within the NI.

Throughout Europe, the safety arrangements now in place are still largely set by standards
drawn up by the industry, in its nationalised form, because substantial change in the
content of such a corpus of standards cannot be made quickly.\footnote{14} However for safety
standards now being drawn up or amended, the typical pattern is for general standards to
be set externally and detailed standards to be set internally. Without detailed study, it is not
possible to know how far the general standards represent a constraint on operators.
Detailed standards are typically set on a national consensual basis between the various
industry parties. Both of these points apply irrespective of the extent of industry
restructuring.

There is a considerable difference in some Member States between the treatment of the
mainline IM and the TOs. Several Member States do not provide for safety regulation of the
IM, presumably on the basis that it will remain in the public sector with a public service
rather than a commercial remit. Table 2.12 sets this out, for those Member States in a post
91/440 regulatory environment.

\begin{table}[h]
\centering
\begin{tabular}{|c|c|}
\hline
\textbf{Safety regulation of infrastructure operation} & \textbf{Safety regulation of train operation} \\
\hline
\textbf{Self-regulating} & \\
\hline
Portugal\footnote{1} & Regulated by RI \\
\hline
Austria\footnote{2}, Finland, Netherlands\footnote{2} & Regulated by IM \\
\hline
Germany, Great Britain & Regulated by both IM and RI \\
\hline
\end{tabular}
\caption{Extent of self-regulation}
\end{table}

\footnote{1}{Equating Franchising Regulator to RI for the purposes of this Table. This system is not yet effective,
and in practice self-regulation largely applies.}
\footnote{2}{High-level regulation from Ministry.}

Belgium, France, Greece, Ireland, Italy, Spain and Luxembourg are classified in this context
as not in a post 91/440 environment. These Member States are characterised mainly by self-
regulating NIs (although in Belgium there is high level regulation from the Ministry).

\footnote{14}{In Great Britain, considerable effort has been put into creating suitable standards which are concerned solely with
safety; reflect the changed pattern of responsibilities; and are not needlessly detailed and constraining. However,
this work is not yet complete after more than five years, even though it has not attempted any fundamental
review; and where standards have been revised substantially they are frequently applied only to new equipment,
with no retrospective effect.}
2.3.3. What differences in safety philosophy exist among the Member States?

We consider safety philosophy on the following dimensions:

1) Punitiveness.
2) Acceptance of cost as a legitimate consideration.
3) Treatment of issues affecting IM.
4) Attitude to separation of functions.
5) Due process in deciding safety requirements.
6) Decision rules in practice.

2.3.3.1. Punitiveness

Responses indicated four different stances on the way in which, and extent to which, legal sanctions were applied in railway safety regulation, as shown in Table 2.13.

Table 2.13
Stances on punitiveness

<table>
<thead>
<tr>
<th>Punitiveness on the company (1) and on staff</th>
<th>Great Britain</th>
</tr>
</thead>
<tbody>
<tr>
<td>Punitiveness on staff, not the company</td>
<td>Austria (2), Italy, Belgium</td>
</tr>
<tr>
<td>Formal proceedings only, nominal penalties</td>
<td>France, Finland, Germany, Ireland, Spain</td>
</tr>
<tr>
<td>Legal sanctions not used (3)</td>
<td>Denmark, Luxembourg, Netherlands, Sweden</td>
</tr>
</tbody>
</table>

(1) e.g. prosecution of companies for manslaughter; fines of 800 000 euro for accidents not involving injury.
(2) Rate of prosecutions and penalties not known, but inferred to be low.
(3) Except in rare cases of criminality or gross negligence.
(Information not available for Portugal.)

Punitiveness on companies is much greater in Great Britain than in other Member States. However punitiveness against individual staff is sometimes much more severe in other Member States than is found in Great Britain.

It is natural to ask whether any correlation should be expected between restructuring and punitiveness. It is sometimes argued that competing railway operators will seek to avoid safety obligations. In this case a punitive regime might be necessary to redress the balance of incentives.\(^{15}\) However under the nationalised industry model there was a variety of approaches across Member States. Overall, we see little reason to suppose that stronger market incentives will, or should be associated with a more punitive safety regulatory regime.\(^{16}\)

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\(^{15}\) The issue of the profit motive and safety incentives is discussed in section 5.1.3.3.

\(^{16}\) It is true that the GB mainline railway is both the most commercialised and subject to the most punitive regime. However in Britain the penalties inflicted by the courts for safety offences have increased substantially following a 1998 Court of Appeal judgement which had nothing directly to do with railways or with privatisation. Moreover, to the extent that there is a trend specific to the railway (as is widely believed), this began before privatisation. The Inquiry into a serious fire at Kings Cross Underground (metro) station in 1987 criticised the RI for a lack of “creative tension” with the (public sector) railway operator, and an insufficiently vigorous use of enforcement
2.3.3.2. Acceptance of cost as a legitimate consideration

No regime implements all possible safety measures, because of the cost (relative to the benefit). For example, no Member State has replaced all level crossings with bridges or underpasses, nor proposes to.\(^\text{17}\) Platform doors which physically prevent passengers from entering the envelope of train movement are found, but only where a combination of topography, new investment and intensive use make this rational. A regime which genuinely implemented all safety measures regardless of cost would install these everywhere. Similarly, single track lines are used for two-way traffic.

However rhetoric about how “considerations of cost must not be allowed to influence decisions about human life” is commonplace. There are safety regimes which formally adopt this stance as the legal obligation.

One factor at the root of this apparent paradox is a basic difference between legal systems. In the UK, and to a large extent in Ireland, statute law is interpreted literally; whereas in the systems in other Member States laws are to varying degrees applied “purposively”, and a principle of “proportionality” is applied. This principle of proportionality has a similar practical effect to the literal phrase in UK safety legislation “so far as reasonably practicable”, namely that the obligation to ensure safety is tempered by reference to other factors.

The degree of acceptance of cost\(^\text{18}\) as an explicit consideration is a central issue for this study. Its formal admissibility in the legal obligation to ensure safety varies as shown in Table 2.14.

In Britain there has been a long running, explicit and sometimes high-profile debate about decision rules for industrial safety generally, and in particular how to take account of cost.\(^\text{19}\) However responses to the Questionnaire indicate that little such debate has taken place elsewhere in Europe in the context of railways.\(^\text{20}\) The presence or absence of public debate is itself an index of safety philosophy.

\(^{17}\) Although Germany has a policy of not allowing level crossings to be constructed on any new lines.

\(^{18}\) Cost in this context includes costs such as delays to services, or speed restrictions, or other indirect costs to passenger or freight customers.

\(^{19}\) This originated from debates about nuclear power at the time of the Public Inquiry into the proposed Sizewell B nuclear power station in 1986. The Health and Safety Executive (HSE) generated a “Tolerability of Risk” doctrine, first published in 1988 and as a second edition in 1992 (HSE, 1988/1992). This endorsed the use of safety cost benefit analysis (CBA) in suitable circumstances. In 1999 the HSE issued a Discussion Document entitled Reducing Risks, Protecting People, known as R2P2 (HSE, 1999), which proposes a more pragmatic approach. These issues are discussed in Chapter 5 (section 5.2.3).

\(^{20}\) As noted in section 5.2.5, there is more European debate of this issue in the context of road safety, although here there are wide national differences, with some countries being unwilling to cost risks of death or injury explicitly.
### Table 2.14
The admissibility of cost in the legal obligation to ensure safety

<table>
<thead>
<tr>
<th>Cost formally inadmissible</th>
<th>Austria (1), Germany (2), Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law neither admits nor precludes</td>
<td>Luxembourg</td>
</tr>
<tr>
<td>Cost is permitted to be taken into account. How this is done is not settled in law</td>
<td>Finland, France, Great Britain (courts and HSE), Ireland, Netherlands, Spain</td>
</tr>
<tr>
<td>Cost benefit analysis using explicit values of preventing fatality sometimes (3) a major input into decision making</td>
<td>Denmark, Great Britain (Railtrack RSC), Sweden (4)</td>
</tr>
<tr>
<td>Incomplete response</td>
<td>Belgium (5)</td>
</tr>
</tbody>
</table>

(1) If a safety measure approved by the Ministry is revealed to be inadequate, liability is limited by law and no criminal offence has been committed.

(2) It is informally acknowledged that costs are taken into account to a certain degree.

(3) For example where large expenditures are being considered for perhaps questionable benefits.

(4) Use of Cost Benefit Analysis becoming more common with handbooks on methodology produced by the IM and courses held by the RI.

(5) The costs of safety measures may be included in the negotiations every 5 years between the Belgium railway NIT and the government; it is not clear how these costs are compared with the associated safety benefits.

(Information not available for Denmark or Portugal.)

#### 2.3.3.3. Treatment of issues affecting Infrastructure Management

Some consequences of restructuring for IMs in some Member States are shown in Table 2.15. (In this Table, as in Table 2.3, the rows are not mutually exclusive, and the same Member State may appear in several rows.)

In most other Member States the issues in Table 2.15 have not yet presented themselves. Certification of the IM may not be seen as necessary when the organisation of its functions and the staff running it are the same as in the previous unified NI. Where the IM remains in the public sector external safety regulation of its operations may seem superfluous. Where the NI continues as the dominant train operator, external regulation of its relationship with the IM may seem unnecessary.

As restructuring proceeds more explicit regulation will be needed of the interfaces. The opening of markets to new operators opens up the interface between IM and TO, and that between TO and maintainer (both for trains and for infrastructure), and between different TOs. It may also shift the balance between TO and train builder or other provider. In Great Britain, the ROSCOs (rolling stock companies), which neither build the trains nor operate them, but own and lease them, are in many ways more important players in gaining approval for new train-based safety measures than either TOs or suppliers.
The Current Railway Safety Regulation Regimes

Table 2.15
Issues affecting IMs

<table>
<thead>
<tr>
<th>Explicit regulation of relationship between IM and TOs</th>
<th>Austria, Denmark, Great Britain, Netherlands, Sweden</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recognition of need to regulate IM:</td>
<td></td>
</tr>
<tr>
<td>Certification of IM</td>
<td>Austria, Great Britain, Portugal</td>
</tr>
<tr>
<td>Standards and acceptance procedures for infrastructure equipment</td>
<td>Great Britain</td>
</tr>
<tr>
<td>Control of infrastructure maintenance</td>
<td>Great Britain, Netherlands (1)</td>
</tr>
<tr>
<td>Identification of real-time control of train movements as a sensitive issue</td>
<td>Finland, Netherlands, Sweden</td>
</tr>
<tr>
<td>Safety decisions removed from IM</td>
<td>France</td>
</tr>
</tbody>
</table>

(1) Railned regulate NS RIB.

No single pattern of organisation and regulation of IM functions is implied by the development of contestable markets and level playing fields. This is illustrated by the decision by the Netherlands and Sweden (and proposed by Finland) to organise the IM function of real-time control of train movements separately from the other IM functions. This was never considered in Great Britain, the Member State otherwise furthest down the restructuring road, despite extensive public debates about the privatisation and fragmentation of the NI (BR).

With restructuring, the IM may in some cases move closer to government (relative to its former NI status) and acquire regulatory status. This could be consistent with a minimalist approach to restructuring. In the other direction, if the IM becomes a private company, and particularly if there were several mainline IMs within a jurisdiction, it could be anomalous to give the IM any general responsibilities for system safety.

2.3.3.4. **Attitude to separation of functions**

Table 2.4 above reports the current situation on separation/unification of the core safety regulatory functions. The timing of the separation of transport accident investigation arrangements in the Netherlands, Finland and Sweden is set out in Table 2.16. This has developed independently of restructuring.

These developments appear to have been justified partly by “civil liberties” considerations, for example that the body which lays down standards should not investigate accidents where the standards which are in place, or the lack of them, may be in question. There is also the argument that the priority in most accident investigations is to discover the facts in order to design remedial measures, not to pursue possible criminal charges, and that it may therefore be counter-productive for the enforcement authority also to be the investigating body for normal purposes. “Efficiency” considerations have also been put forward, to do with the peak loads created by accident investigation and the special skills it may require.
### Timing of changes to transport accident investigation arrangements

<table>
<thead>
<tr>
<th>Country</th>
<th>Description</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netherlands</td>
<td>Railway Accident Investigation Board</td>
<td>1956</td>
</tr>
<tr>
<td></td>
<td>Multi-modal Accident Investigation Board</td>
<td>1999</td>
</tr>
<tr>
<td>Finland</td>
<td>All major accidents, not only transport</td>
<td>1985(1)</td>
</tr>
<tr>
<td>Sweden</td>
<td>All craft accident investigation</td>
<td>1978</td>
</tr>
<tr>
<td></td>
<td>All major accidents, not only transport</td>
<td>1990</td>
</tr>
</tbody>
</table>

(1) The Finnish board became fully autonomous in 1995. Before that it carried out investigations at the request of the Parliament; now it makes investigations on its own initiative.

It is, however, possible to envisage that restructuring will increase the demands on the regulatory system, so strengthening both the “civil liberties” and the “efficiency” arguments for separate accident investigation bodies.

#### 2.3.3.5. Due Process

The extent to which national RSRRs follow due process\(^{21}\) is shown in Table 2.17.

Almost all responses to the First Questionnaire claimed that the RSRR in question observed due process. This is encouraging in the sense that it suggests that the principles are ones to which the regimes aspire. However there is evidence that in many cases the requirements of due process are not met. For example:

- It was claimed that procedures’ decision criteria are specified, but the response was unable to state what they criteria are.
- “Affected parties” seemed to be interpreted narrowly, as being confined to those directly involved rather than potentially involved, so excluding for example competitors, trade unions and consumer organisations.
- Reasons were typically given only when the decision is adverse or qualified. This implies the view that the parties to a regulatory decision are only the regulator and the party being regulated. Once the interests of others are recognised, it becomes clear that in principle reasons should be given for decisions which are entirely favourable to the applicant.
- The appeal body was often not stated.

There was also evidence of a paradox, that cultures where openness, consensus and freedom of information were general, and hence where due process would seem likely to be congenial, also seemed to have relatively informal processes - i.e. not documented.

---

\(^{21}\) As defined in section 5.3.1.1 below and in the Glossary.
### Table 2.17
Extent to which national RSRRs follow due process

<table>
<thead>
<tr>
<th>Largely</th>
<th>Denmark, Germany (1), Great Britain, Netherlands, Sweden (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Partly</td>
<td>Austria (3), Finland (4)</td>
</tr>
<tr>
<td>Closed process</td>
<td>France (5), Italy (7), Luxembourg (6), Spain</td>
</tr>
<tr>
<td>Not documented</td>
<td>Finland</td>
</tr>
</tbody>
</table>

(1) But no documentation of, for example, the decision rule or appeal body.
(2) Somewhat informal, but supported by Freedom of Information legislation.
(3) Process for changing company standards not documented. Regulations for employee safety follow due process, except that recognised parties are operator, Trade Unions and Ministry only.
(4) Not documented; no appeal body.
(5) Between NI and Ministry. New procedures not yet issued.
(6) Within NI.
(7) Due process claimed - but process still largely within NI, for example no details given of an appeal procedure, and no distinction made between processes.

(Information not available for Belgium, Greece, or Portugal.)

2.3.3.6. Decision Rules in practice

In only two instances, France and Great Britain, were decision rules identified which were sufficiently specific for a regulated organisation to be able to apply them to its own decisions. In other cases there are presumably “rules of thumb” which are generally understood within the national railway establishment, but these did not emerge from the Questionnaire.

### Table 2.18
Decision Rules in practice

| Cost much debated. Use of explicit “values per fatality avoided” (VPFs). IM bound to comply with outcome of cost benefit analysis (CBA) (but RI and government not bound). | Great Britain |
| Cost much debated. Explicit VPFs used. No clear decision rule | Finland |
| Trade-off between benefit and cost recognised in practice. No explicit decision rule | Netherlands |
| Legal obligation recognises trade-off. Practitioners deny it. CBA not used. Two accepted rules: GAMAB “Overall at least as good as” for new equipment; “No two accidents with same cause” for inquiry recommendations. | France |
| Legal obligation brings in trade-off under “reasonableness”. Accepted rule that new regulations must not reduce safety. | Germany |
| Trade-off denied publicly, but much debated in practice. Application of explicit decision rules not firmly established. | Denmark, Sweden |
| Trade-off denied publicly. No explicit decision rule. Informal consensus on “continuous improvement”. Consensual process involving Trade Unions and Ministry as well as operator | Austria |
| Legal obligation recognises trade-off. Practitioners deny it. CBA not used. Closed process. No explicit decision rule. | Spain |
| Closed process. No explicit decision rule | Belgium, Italy, Luxembourg |
2.3.4. To what extent are safety regulations based on risk assessment?

This question overlaps with the issues discussed above under “philosophy”. However, the use of risk assessment is a major issue in its own right.

In the Questionnaire, risk assessment was defined as the formal analysis of risks and of the consequences of alternative ways of controlling them. A complete risk assessment should:

- be explicit, quantitative, and recorded;
- examine the effects of potential new measures (e.g. alternative forms for a new regulation) on safety, in terms of:
  - the risk(s) being reduced;
  - the people affected;
  - the scale of the effect on safety;
  - any incidental effects, including increases in other risks.
- examine other relevant effects, including:
  - costs in time and other resources to implement and maintain;
  - environment and transport policy impacts.

Risk assessment is more appropriate to regimes which explicitly admit cost as an explicit factor.

The great bulk of railway safety regulations are not recent. Thus even when a regime wishes to review all its safety regulations in the light of modern risk assessment, it is impossible to do this quickly. We have therefore taken the question to be asking: “Is risk assessment the basis for new and revised standards?” This is the basis for Table 2.19.

<table>
<thead>
<tr>
<th>The place of risk assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required for all new and revised requirements</td>
</tr>
<tr>
<td>Required in part: some aspects or some requirements</td>
</tr>
<tr>
<td>Used generally</td>
</tr>
<tr>
<td>Sometimes used</td>
</tr>
<tr>
<td>Not part of regulatory system</td>
</tr>
</tbody>
</table>

(1) By administrative decision, which could be reversed.
(2) Required by law for all safety regulation by and below the RI.
(3) And moving up the table towards Germany.

(Information not available for Denmark, Greece, Ireland, or Portugal.)
Even where formal risk assessment, including assessment of costs, is carried out, it does not of course follow that the decision is determined by a cost-benefit criterion, as discussed in section 5.2.4 below.

2.3.5. Where are there different safety regulations for different types of rail network within a Member State?

The extent to which the safety regulation of secondary railways, such as metros or light railways (tramways), is separate from that of main line railways is summarised in Table 2.20.

<table>
<thead>
<tr>
<th>Separate institutions</th>
<th>Italy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Secondary railways self-regulatory</td>
<td>Finland (1), Greece (2), Spain (3)</td>
</tr>
<tr>
<td>Same institutions; greater devolution to major railways</td>
<td>Denmark, France (4), Great Britain, Netherlands, Sweden</td>
</tr>
<tr>
<td>Unified arrangements</td>
<td>Austria, Germany (5), Portugal,</td>
</tr>
<tr>
<td>Secondary railways negligible</td>
<td>Belgium, Ireland, Luxembourg</td>
</tr>
</tbody>
</table>

(1) It is proposed to bring them into same relationship with the IM as the main line TO.
(2) Inferred.
(3) But modelled on NI’s regulations.
(4) SNCF subcontracts some trains’ operations, retaining safety responsibility. The standards may be less onerous reflecting lower inherent risk.
(5) But with some additional regulation of secondary railways by the Länder, and often higher standards for main line, reflecting higher inherent risk.

The Commission expressed a particular interest in the extent to which the supply market for metros or light railways (tramways) has been affected by differences between the safety regimes for the metro and mainline systems. This is especially relevant where there are proposals to extend the travel of metro trains over mainline track. Project partners have investigated whether differences between metro and mainline safety regulations were considered to be a problem (or explicitly not to be a problem).

In Germany light rail trains have used the same tracks as mainline trains since 1992. This was first carried out in Karlsruhe where tramways connect the town centre and suburbs.

Regulations concerning the construction of tramways and other non-mainline trains are defined in the BOStrab, a different set of regulations from those of mainline trains, which must fulfil the requirements of EBO. Although both sets of regulations require that vehicles be prepared for the worst accident arising from typical operation, safety standards between mainline and metro vehicles are very different.

22 A current example is the Train Safety Regulations which are expected to be promulgated shortly in Great Britain. A risk assessment has been made, which shows that the cost per fatality avoided is substantially greater than the value per fatality avoided (VPF) used in the assessment. Nevertheless, the decision is to impose the requirements in question.
As the BOStrab allows trams to travel at a maximum speed of only 70 km/h, non-mainline vehicles have a lighter construction, with a consequently lower passive safety standard. Therefore, in an accident between a mainline and a tram, tramway passengers could be expected to face much higher risks of injury. However the active safety standard of the trams is higher, because they can reduce their speed quickly, so that trams can more easily avoid collisions with other vehicles. Therefore, as the EBO prescribes that a new type of operation or construction is acceptable if the same or a better level of safety is achieved than with the conventional design, the overall safety standard for the trams is high enough for the EBA to allow them to run on mainline tracks.

There are many instances in Great Britain of interworking between main line and other railways. They include mainline trains on metro track and vice-versa; and “heritage” traction on main line track and possibly vice-versa (understood to be the case but not verified). The interworking of mainline and other railways presents three sets of safety regulation issues. These are safety certification for long-standing operators and services; safety requirements on new interworking arrangements; and consistence of the treatment of new interworking proposals with that of proposals for new mainline services.

When the present Railway Safety Case (RSC) regime was introduced, long-standing operators and services had to prepare RSCs to be accepted for each existing case of interworking. This process involved considerable effort, which some at least applicants felt was disproportionate to the scale of the interworking and the value of the RSC exercise. It may be that this constituted learning how to cope with the new system, and that future such exercises would not be disproportionate, but it is not possible to be confident of this.

Issues arising from the imposition of additional safety requirements on new interworking arrangements can be observed through proposals to extend the running of metro trains over mainline track\(^{23}\) (and vice-versa, which presents similar safety issues). Differences in the regulations as applied to the two sectors have presented real problems, for example:

- light rail trains are designed for relatively low speeds, and for an environment where all the trains are light rail trains (or relatively light “heavy rail” metro trains). When heavier and faster mainline trains are mixed with lighter trains, it is necessary to consider whether additional safety measures are needed;
- metros typically have different train protection systems from the main line: therefore it is necessary to consider whether the train being introduced should install the system on the track.

We have the impression that the general conclusions about the current British RSRR apply to some extent to this situation. These are that the process is novel and therefore unclear and slow; and that there is a tendency by the accepting IM towards a reactive approach.

\(^{23}\) The prime example is the extension of the Tyneside Metro to Sunderland over Railtrack track. The proposal, now apparently abandoned, to run mainline trains on the northern leg of London Underground’s Circle Line represented an example of the issues “in mirror image”.

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with transfer risk and cost to the applicant. However the difficulties with a Tyneside Metro proposal for extended use of mainline track seem not to have been severe.

It is broadly accepted that the same general requirements should give rise to different solutions in the two environments (e.g. lighter trains for the lower speed environment), and that when interworking is subsequently proposed, it may well be appropriate to impose additional safety requirements. Nonetheless, if a main line operator were to apply to run a new service using the same trains as the Metro operator, in the same main line environment (other trains, infrastructure, topography, passenger loading), the application would be rejected out of hand. The applicant would be told that his trains must comply with current Railway Group Standards. This is analogous to the “grandfather rights” situation, where a train which is not compliant with current RGS will be allowed to continue in operation on an existing service, but would not be allowed to be redeployed to another service.

However we do not suggest that this apparent anomaly is necessarily inappropriate. It rather suggests that the safety decisions involved in the interworking of Metro and main line services are, as in the German case, approached with reasonable flexibility.

At the present time, there is no light rail traffic on the Dutch or Finnish heavy rail systems. There has been some discussion about extending some light rail on mainline track, but that is in the distant future and safety regimes are not part of any of those discussions.

In Sweden there is currently no physical connection between light rails (or metros) and main lines (or other lines for heavy traffic); and light rail systems all have their own safety regulations (and rules). However there is an ongoing study on the benefits of light rail operations on mainline tracks (locally described as Duo-Trams).

A recent project was carried out to assess the feasibility of this in Gothenburg (the only Swedish town with a large tram system), drawing on the experience of a number of German cities, with a view to buying German rolling stock and to exploit their experience of this traffic type. However the project is currently postponed as the Gothenburg Tram service is fully occupied with the construction of a new, circular line. There was also a problem with the proposed German build cars on the Gothenburg track.

There are also plans in the Stockholm region to connect their new light rail system with a main line.

Although the safety aspects of the planned mixed traffic projects will be important, they are not expected to introduce any unreasonable costs.

2.3.6. Liability and insurance requirements

2.3.6.1. National liability requirements

The splitting up of monopoly NIs has produced a new framework for liability between these organisations that was previously dealt with internally. For example the TO, if negligent or
non-compliant to rules, will be liable to the Infrastructure Manager. This is a key element in
determining the risks for TOs of operating across different Member States and how the
liability costs are allocated within a Member State.

There are different processes in each Member State for the handling and authorisation of
claims. In the UK the Office of Rail Regulation (the body set up to regulate the private
monopoly IM) has established a Claims Allocation and Handling Agreement (CAHA),
which is a structured set of rules applicable to all "Railway Industry Parties" (including the
IM, TO and infrastructure maintenance contractors). Claims against industry parties are
allocated on a strict liability at fault basis.

The present rules for liability in Member States are shown in Table 2.21.

Although many Railway Operators have "Conditions of Carriage", these are waived for
personal injury, where the organisation wishes to show a "caring attitude" to employees and
customers. However for freight haulage by rail it is normal tradition to apply the
"Conditions of Carriage" with regard to loss or damage to customers’ goods.

<table>
<thead>
<tr>
<th>Liability following fault; damages broadly equivalent to loss</th>
<th>Great Britain, Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liability following fault; damages variable</td>
<td>France, Italy</td>
</tr>
<tr>
<td>Passengers and employees: strict liability. Crossing users and trespassers: liability following fault. In both cases, damages equivalent to loss</td>
<td>Finland</td>
</tr>
<tr>
<td>Passengers and employees: onus on company to show it was not at fault. Crossing users and trespassers: onus on victim to show company was at fault. In both cases, damages equivalent to loss</td>
<td>Sweden</td>
</tr>
<tr>
<td>Qualified liability: Passengers: full compensation except where the accident is deemed non-preventable (caused by third party or animal); Employees: insurance pays compensation, which may be reduced if the victim was partly to blame; Crossing users: full compensation except where it can be shown the victim was responsible for the accident. Damages equivalent to loss, subject to railway-specific limits laid down by law.</td>
<td>Austria, Germany, Ireland</td>
</tr>
<tr>
<td>Civil code with a fault based system of determination by type of environment.</td>
<td>Belgium, Portugal, Spain</td>
</tr>
</tbody>
</table>

(Information not available for Denmark, Greece, or Luxembourg.)

2.3.6.2. **International liability requirements**

The Convention Concerning International Carriage by Rail (COTIF) harmonises the
allocation of liability and responsibility for the international carriage of passengers, goods,
and luggage. The Convention was established to facilitate the development of rail traffic
between the countries concerned, who form the Organisation Concerning International
Carriage by Rail (OTIF).
COTIF codifies the following three main articles. The first two date from 1970 and the third from 1996:

- Article 69, Section 1 of the International Convention Concerning the Carriage of Goods by Rail (CIM);
- Article 64, Section 1 of the International Convention Concerning the Carriage of Passengers and Luggage by Rail (CIV); and
- Article 27 of the additional convention to the CIV, relating to the liability of the railway for death of and personal injury to passengers.

These articles specify minimum requirements for member states, which may be exceeded by national requirements.

The geographical spread of COTIF member states and their accession dates are shown in Table 2.22.

<table>
<thead>
<tr>
<th>Country</th>
<th>Ratification or accession</th>
<th>Entry into force</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Albania</td>
<td>1984</td>
<td>1985</td>
</tr>
<tr>
<td>3. Austria</td>
<td>1983</td>
<td>1985</td>
</tr>
<tr>
<td>5. Bosnia-H’govina</td>
<td>[ - ]</td>
<td>[ - ]</td>
</tr>
<tr>
<td>10. Finland</td>
<td>1984</td>
<td>1985</td>
</tr>
<tr>
<td>11. France</td>
<td>1982</td>
<td>1985</td>
</tr>
<tr>
<td>12. Germany</td>
<td>1985</td>
<td>1985</td>
</tr>
<tr>
<td>15. Iran</td>
<td>1985</td>
<td>1985</td>
</tr>
<tr>
<td>17. Ireland</td>
<td>1986</td>
<td>1986</td>
</tr>
<tr>
<td>18. Italy</td>
<td>1985</td>
<td>1985</td>
</tr>
<tr>
<td>20. Liechtenstein</td>
<td>1985</td>
<td>1985</td>
</tr>
<tr>
<td>22. Luxembourg</td>
<td>1987</td>
<td>1985</td>
</tr>
<tr>
<td>23. Macedonia (FYR)</td>
<td>[ - ]</td>
<td>[ - ]</td>
</tr>
<tr>
<td>27. Norway</td>
<td>1984</td>
<td>1985</td>
</tr>
<tr>
<td>28. Poland</td>
<td>1985</td>
<td>1985</td>
</tr>
<tr>
<td>29. Portugal</td>
<td>1986</td>
<td>1986</td>
</tr>
<tr>
<td>30. Romania</td>
<td>1983</td>
<td>1985</td>
</tr>
<tr>
<td>31. Slovak Republic</td>
<td>1994</td>
<td>1994</td>
</tr>
<tr>
<td>32. Slovenia</td>
<td>1992</td>
<td>1993</td>
</tr>
<tr>
<td>33. Spain</td>
<td>1982</td>
<td>1985</td>
</tr>
<tr>
<td>34. Sweden</td>
<td>1985</td>
<td>1985</td>
</tr>
<tr>
<td>35. Switzerland</td>
<td>1983</td>
<td>1985</td>
</tr>
<tr>
<td>36. Syria</td>
<td>[ - ]</td>
<td>[ - ]</td>
</tr>
<tr>
<td>37. Tunisia</td>
<td>1984</td>
<td>1985</td>
</tr>
<tr>
<td>38. Turkey</td>
<td>1995</td>
<td>1985</td>
</tr>
<tr>
<td>39. United Kingdom</td>
<td>1983</td>
<td>1985</td>
</tr>
<tr>
<td>40. Yugoslavia</td>
<td>1982</td>
<td>1985</td>
</tr>
</tbody>
</table>

Source: COTIF website

Key liability conditions under COTIF are broadly as follows:

- For passengers and luggage the railway is not liable if the railway has taken appropriate care; nor if the accident is the passenger’s or a the third party’s fault. If the railway is not relieved of liability it is liable up to the limits laid down in the uniform rules, but without prejudice to any rights of recourse which the railway may have against a third party.
• Liability is limited for death of, or personal injury to passengers. The upper limit per passenger is 70 000 SDR (Special Drawing Rights) (about 90 000 euro). The limit for damage in relation to articles is 700 SDR (about 900 euro) per passenger.

• For the carriage of goods the railway is not liable for loss or damage arising from the special risks inherent in some circumstances. These generally include carriage in open wagons; failure of packing or loading or unloading where these are the responsibility of the consignor or consignee; or goods inherently liable for breakage or decay.

• Liability for wastage, loss or damage to goods is limited to the market price in the case of total loss and by various formula relating to, for example, minimum levels of wastage below which there is no liability, and limitations on compensation for partial loss and to loss or damage caused by the transit period being exceeded.

We understand that some amendments to COTIF will be made in 2003-4. Typical changes will include new uniform rules governing international wagon usage, infrastructure and a revision of the limit for death or personal injury.

2.3.6.3. National liability insurance regimes

Each Member State has mandatory and non-mandatory insurance applicable to trading companies, but from which railway NIs are often exempt. However many NIs (e.g. BR, SNCF) recognised the potential financial exposure if a major accident occurred and therefore carried liability insurance for high cost risk, funding the uninsured portion from trading revenue. This insurance included third party and employers’ liability. Within the European railway system it continues to be common for there to be high levels of self-insurance, with the insurance market covering high value exposures.

The present formal requirements in EU Member States are shown in Table 2.23.

Table 2.23  Liability insurance requirements

<table>
<thead>
<tr>
<th>Required: cover requirement high</th>
<th>Great Britain (1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required, but cover requirement low</td>
<td>Austria, Germany (2), Netherlands</td>
</tr>
<tr>
<td>Required for private companies, but not for public sector organisations</td>
<td>Denmark, France, Sweden (4)</td>
</tr>
<tr>
<td>Required for TOs (public and private) but not for IM</td>
<td>Finland</td>
</tr>
<tr>
<td>No requirement</td>
<td>Belgium, Luxembourg, Spain (3)</td>
</tr>
</tbody>
</table>

(1) £155 million (~250 million euro) required by the IM and each TO. (The IM and TOs now all private sector.)

(2) Cover requirement not specified in response: inferred to be low.

(3) NI (RENFE) allowed to self-insure. However in practice RENFE has an insurance contract with an external company, including the purchase of legal advice.

(4) Cover is reported to RI, but the necessary amount is not prescribed. In most cases it is around £30 million and for major undertakings this will probably become law. There are special rules for small, industrial IMs.
The differences between national liability insurance regimes will create opportunities and threats as interoperability progresses. Large multinational, integrated rail operators will purchase insurance to protect their pan-European services. Operators based in a single Member States will need to understand the requirements in other countries and ensure compliance. This could be at a higher cost than the cost to a pan-European operator.

Tax is charged on insurance premiums in all but two Member States and ranges between 4% and 35%. This could affect international operators based in some Member States more than others. However the Freedom of Services Directive, being progressively implemented by all Member States, allows companies to purchase financial products (including insurance cover) in any EU country from a global provider. This is leading to harmonisation of cover type available, a closer understanding of the risk and more competitive premiums.

The provision of insurance for international cross-border operations has attracted little comment, seemingly because railway operators are generally satisfied with the COTIF protocols. However these protocols were established in the context of individual operations in different countries, usually by NIs operating trains on their own networks. With increasing harmonisation and entry of new operators the COTIF protocols will be challenged. Insurance also seems likely to replace the present willingness of many governments to bear the risk for their national railways.

With the development of owner-operated railway services across national borders the operators the insurance market is likely to become more flexible and commercially attractive. It is reasonable to expect a competitive market, which will be accessible to all potential operators and is unlikely to be a serious barrier to entry. However there will need to be clear understandings between parties on the continued application of COTIF arrangements. This is an issue for insurers and regulators and for potential pan-European operators, who are not country specific and therefore not committed to the COTIF conditions.

There are examples of where liability and insurance have been tailored to allow interoperability across Member States. One example is the Eurostar operation between London Paris and Brussels. Operators in each of the three countries are responsible and accountable for all liabilities arising from the operation in their county. Each country arranges its own insurance where it is exposed to financial liability, explicitly or implicitly. However these arrangements still require three insurance policies. Eurostar would like to be able to negotiate a single policy, but this is not yet practicable.

2.3.7. The style of regulation

A number of questions in the First Questionnaire were either explicitly about regulatory style or gave the opportunity for answers in those terms. The great majority of replies describe a style of RSRR which is “in the family”, co-operative, consensual, self-regulatory, and left to experts except after major accidents. This style was especially emphasised in the
responses for Austria, Finland, France, Ireland, Italy, Luxembourg, the Netherlands, Spain and Sweden. In these Member States the system itself was also strongly self-regulatory.

This was associated with a generally very high level of professional skill and commitment within the industry - an impression which was to be strongly reinforced in the later stages of the study.

There are however tensions which will become more important if restructuring is to have its intended effect on competition and innovation in the industry such as stability and caution versus incentives for innovation; the interests of ‘outsiders’ new to the national RSRR; or the dangers of diffusion of responsibility versus the dangers of “cosiness”. These were not raised in most responses to questions about the style of the RSRR.

Inconsistency of style was hardly hinted at, except in Great Britain.

2.3.8. Overall assessments

In the overall assessments of the regulatory regimes few criticisms were made.

For several Member States - in particular Austria, France, Ireland, Italy, the Netherlands, and Great Britain - it was reported that safety regulation was seen as a barrier to entry for potential new operators and possibly suppliers, but in most of these cases this was seen by many as a barrier no more demanding than it needed to be. In the case of Ireland, Spain and Finland, with their non-standard track gauges, any barriers caused by safety regulation were felt in any case to be heavily outweighed by other barriers.

In some cases - France, Italy, the Netherlands and Great Britain - and for Finland, there was comment on the high expenditures required of railways, relative to other activities, to achieve a given increment of safety. Responses for the Netherlands and Great Britain noted the high cost of insurance for new entrants.

Only for Ireland were concerns reported of RI resources being (in the past) too low. Substantial, widespread professional debate about the cost of safety regulation was reported only for Great Britain.
3. **RAILWAY SAFETY REGULATION AT THE EUROPEAN LEVEL**

3.1. **The role of safety in European railway regulation**

Safety, broadly defined, is an element in the general development of European railway standards, as illustrated by the acronym RAMS. Safety is similarly an element in the high-speed interoperability Directive 96/48/EC and in the draft conventional interoperability Directive. These documents list safety alongside performance levels, quality of service and cost as key factors, which depend upon compatibility of infrastructure and rolling stock.

However there is no specifically safety regulation of railways at the European level, nor any established European decision rule for safety regulation.

The world of European (and wider international) railway standards is complex, and immense. The focus of these standards is compatibility, to promote railways which work better in engineering terms. While safety is often a factor and sometimes the key factor, the institutional structures and processes of this world are not driven by safety. This Chapter is therefore limited to reporting incidental comment from suppliers and operators about these structures and processes and with questions of how safety might best be considered within these given European standard-setting structures.

To set the scene for later discussion and recommendations we summarise here the roles of the main players at the European level.

3.2. **European railway regulation**

This section draws on comments received from suppliers, operators and safety regulators, including representatives of the UIC, CER and UNIFE. It also draws on advice from DG Energy and Transport and DG Enterprise, and from the websites of institutions involved in the development and approval of European standards.

The activities here described have, as yet, had barely any effect on national RSRRs. There is a general awareness that European (and other international) standards are progressively replacing national standards, but we find little to indicate that this is affecting safety cultures or institutions. We also find remarkably little curiosity about the likely content of the EU level requirements. EU activity does not figure prominently in safety debates in Member States. None of the Member State responses to the study’s First Questionnaire referred to developments in EU or other international processes as having important implications for their safety regulation regimes.

Apart from action by the European Commission, the **Union International des Chemins de Fer (UIC)** have for many years made and continue to make progress in helping co-operation in European railways. It promotes co-operation amongst railway operators, technical harmonisation, interoperability and international rail transport. UIC standards are not mandatory in EU law but are a major component of acceptance criteria throughout Europe. Equally, the UIC’s RIV and RIC codes for the acceptance of international traffic in
non-traction rolling stock and the UIC standard 579 for freight traffic are long established, very widely used and maintaining their authority.

Worldwide, the UIC lists 142 railway enterprises as either affiliated, associate or active members, in 80 countries. It is adapting to the new order by expanding its membership, to represent a wider range of operators. Of a total of 61 active members, 27 are in the EU. Within the UIC the European Rail Research Institute (ERRI) carries out research, studies and tests in fields of common interest. A subsidiary of the ERRI is the European Rail Services BV, which acts as an interface between ERRI and non-UIC organisations, especially in the manufacturing sector of the industry world-wide.

The UIC is involved with a number of important safety initiatives.

One initiative launched in 1999 is the creation with the CER of a think-tank or “Safety Platform” of safety managers from six European railways (Railtrack, DB, FS, RENFE, SBB and SNCF), followed by a seminar on safety and appointment of six discussion groups to develop initiatives and proposals (on human factors, technical interfaces, corridors, institutional evolution, personnel competencies, and UIC databases).

Another initiative is the Man-Machine Interface Project, being carried out by French and British academics and researchers from the Italian Railway, with UIC and Italian finance, on safety and security. The safety research is focused in its first phase on drivers of cross-border, high-speed trains.

The UIC is also sponsoring jointly with DG Energy and Transport the HUSARE project, on “Managing the human factor in multicultural and multilingual rail environments”. The project partners are the UIC, ERRI, SNCF and consultants from Germany, Norway, the Netherlands and the UK.

Further progress in aiding international co-operation has come through the Intergovernmental Organisation for International Carriage by Rail (OTIF) which is made up of countries party to the Convention concerning International Carriage by Rail (COTIF) which addresses railway liabilities. The membership of COTIF and the liabilities conventions are described in section 2.3.6.2 above. An example of a lower profile, but very constructive activity, is OTIF’s encouragement of recognition of testing done in other countries.

There has been discussion of whether the EU body should be party to the COTIF.

Also involved in railway regulation at the European level are the Union of the European Railway Industries (UNIFE), the International Union of Public Transport (UITP), and the Community of European Railways (CER).

UNIFE represents nearly 100 leading European companies in the railway supply industry, and has a further 10 National Organisations as associated members representing another 900 railway supply companies. UNIFE represents its members in dialogue with European
Institutions, industry, operators and other relevant parties to promote the development of the railway supply industries and to promote rail transport initiatives. UNIFE is also involved in the Mass Transit Rail Initiative for Europe (MARIE) project, in partnership with UITP under the auspices of the EU.

The UITP is a worldwide association of urban and regional passenger operators, their authorities and suppliers, with over 2,000 members in 80 countries. It promotes a better understanding of the potential of public transport, by providing information, research and lobbying on behalf of its members with international institutions such as the EC. Within the EU the UITP formed the independent UITP-EU Committee which deals with all aspects of EU policies affecting its European members.

The CER represents the 32 main railway undertakings and rail infrastructure managing bodies of the EU plus Norway, Switzerland and the first wave of candidate countries for EU accession. It promotes the development of railways within Europe and acts as a collective voice for railways with EU-level decision makers.

The European Association for Railway Interoperability (AEIF) - a partnership of the UIC, CER, UNIFE and the UITP - has been formed as the “joint representative body” to develop of standards for high speed interoperability. It has been mandated by the EC to act as a coordinating body to draft TSIs for compatibility of infrastructure, rolling stock and other equipment for the implementation of the high speed Directive.

Mandatory European technical standards set by international bodies are applicable to European railway regulation, although railways are only a small area of the total coverage of these bodies. European specifications come from three main bodies, and in all cases the standards set by these bodies must be implemented by national law.

The European Committee for Standardisation (CEN) develop and vote for the ratification of European Standards. It is responsible for the implementation of voluntary technical harmonisation in Europe in conjunction with world-wide bodies and European partners, and develops procedures for mutual recognition and conformity assessment to standards. The national members of CEN are the national standards bodies of the EU and EFTA countries plus the Czech Republic (19 in all).

The European Committee for Electrotechnical Standardisation (CENELEC)\(^\text{24}\) is officially recognised by the EC as the European Standards organisation in its field. CENELEC works with 40,000 technical experts from all CEN member states to publish standards for the European market. In the railway industry CENELEC management standards CENELEC 50-126, -128 and -129 are especially influential.

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\(^{24}\) We note in passing that it is commonplace in the industry to hear contrasts made between CENELEC, as a broadly flexible organisation, and its big brother CEN, which is seen as a heavy and slow bureaucracy which takes literally years longer on average to approve a standard. Perhaps this reflects institutional age, or size, or the rapid rate of pace of electrotechnical change.
The **European Telecommunications Standards Institute (ETSI)** is an open forum with 696 members from 50 countries, representing administrations, network operators, manufacturers, service providers and users. Any European organisation that can prove an interest in promoting European telecommunication standards may represent that interest in ETSI. ETSI promotes world-wide standardisation and where possible its work programme is co-ordinated with international standardisation bodies, mainly the ITU-T and the ITU-R. Within the ETSI there are more than 3500 experts working in over 200 groups.

A world wide organisation whose objective is to increase international co-operation in aspects of railway and other transport safety is the **International Transportation Safety Association (ITSA)**. ITSA is an association of national independent accident investigation boards whose objective is to improve transport safety through exchange of information on the causes of accidents, safety studies, recommendations, accident data and investigation methodology.

Contributing to the development of European railway freight is the **Union Internationale des Wagons Privés (UIP)**, which is a member of the UIC and represents private wagon associations in most EU Member States and four central European countries. In contrast to the mainly standard wagons owned by railway operators, ‘private wagons’ are mainly specialised wagons, which carry about half of European rail freight, including 95 percent of hazardous goods carried by rail.

Most of these international bodies are involved at some level in processes which establish internationally agreed railway standards.

Two other independent European bodies act as informal networks on railway safety. One is the Rail Safety Working Party of the European Transport Safety Council, which is a network for European railway safety experts. The other is the International Liaison Group of Government Railway Inspectors (ILGGRRI).

Although the UIC and OTIF are vehicles for the international acceptance of standards they are inevitably constrained, as “self-regulators” whose recommendations rely on consensus among their members. Although the national railways have each gained, with little cost, from common UIC standards for, for example, goods wagons and passenger carriages crossing national boundaries, the application of the same principles to locomotives, multiple units, drivers or signalling systems needs more “give and take” than can readily be negotiated in a forum of this kind. And such bodies are in no position to put pressure on the traditional culture of national railways, for example by encouraging new entrants, as operators or suppliers. There is also a need, with globalisation of the supply market, for representation of the suppliers in much of the standards process.

Consequently, while the UIC has a crucial role in the design and implementation of structural reforms through standards based on UIC fiches, new policies have to be driven by policies set largely outside the industry.
The European Union, while still dependent on political support, has a wider agenda. It is acting to promote railway competitiveness by:

- developing contestable markets and level playing fields for potential new operators;
- promoting high quality investment and responsiveness to technical change; and
- encouraging common standards and other steps to harmonise systems, to achieve so far as practicable a seamless European mainline railway.

Amongst these objectives single market and interoperability Directives, especially Directives promoting restructuring and high speed interoperability, are transforming the European railway scene and the creation of the AEIF is a major step.

Table 3.1 shows the two routes by which the EU promotes and approves such standards, and the corresponding mechanisms for OTIF standards. The EU procedures have three layers, with detailed standards development being led by the standards bodies, more general specifications being designed by experts under specific Directives, and approval by higher level committees of Member States and by the European Parliament.

### Table 3.1

**Supra-national railway harmonisation processes**

<table>
<thead>
<tr>
<th>Authorising legislation</th>
<th>EU Single Market policies</th>
<th>EU Interoperability Directives</th>
<th>OTIF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authorising body</td>
<td>Single Market (1)</td>
<td>Specific interoperability Directives (2)</td>
<td>Intergovernmental Convention</td>
</tr>
<tr>
<td>Authorising process</td>
<td>Council of Ministers and Parliament (3)</td>
<td>Qualified majority voting (4)</td>
<td>OTIF</td>
</tr>
<tr>
<td>Document recording the general technical requirements</td>
<td>European Specifications</td>
<td>Technical Standards for Interoperability (TSIs) (6)</td>
<td>Technical Standards</td>
</tr>
<tr>
<td>Supervision of the drafting process</td>
<td>None</td>
<td>AEIF (7)</td>
<td>None</td>
</tr>
<tr>
<td>Drafting the technical standards or specifications</td>
<td>CEN, CENELEC, ETSI</td>
<td>OTIF Technical Committee (8)</td>
<td></td>
</tr>
<tr>
<td>Scope of process</td>
<td>All procurement and operations</td>
<td>TENs lines</td>
<td>International routes and rolling stock</td>
</tr>
<tr>
<td>Status of regulation</td>
<td>Required to be implemented by national law. Override national regulations (national regulations may not set more stringent requirements).</td>
<td>Binding decisions under intergovernmental convention</td>
<td></td>
</tr>
</tbody>
</table>

---

1. In particular 93/38/EEC of 14 June 1993 coordinating the procurement procedures of entities operating in the water, energy, transport and telecommunications sectors.
2. These so far cover only high speed services - in particular EC96/48. A draft conventional interoperability Directive was issued in December 1999.

The Working Time Directive is also applicable to the transport sector, but this is outside the scope of this study.
(3) Approval by the European Parliament has been required since the Maastricht Treaty of 1993. In the case of TSIs, the Council of Ministers role is undertaken by the Article 21 Committee, as specified in that Article of the high speed interoperability Directive.

(4) Formulae as for EU institutions.

(5) OTIF rules: 25 percent blocking minority.

(6) These may include the output of the HEROE project on harmonised operating rules if time scales allow.

(7) These standards are often based in UIC Fiches; they draw heavily on standards agreed through CEN, CENELEC and ETSI.

(8) These are currently based on UIC Fiches.

European institutional initiatives specific to the regulation of railway safety have so far been limited, although a Safety Directive is proposed, which would require each Member State to have - as many do already - an independent national body to supervise railway safety.

We understand that no firm procedures are yet in place for the economic assessment of TSI proposals. However a paper was produced in May 1998 by the AEIF Economic Evaluation Group, in consultation with the Commission, on “Cost/benefit assessment of Technical Specifications for Interoperability”.

The general approach of the Commission to harmonisation is pragmatic, with a long term objective of converting a currently fragmented system into a common system, but accepting practical constraints on the rate of change. For example on power supplies the policy has been adopted of a single standard, but with an exemption of Germany and Austria as a special case.
4. THE IMPACT OF RAILWAY SAFETY REGULATION

4.1. Methodology

4.1.1. General Approach

Chapter 2 compared railway safety regulatory regimes (RSRRs) across all Member States. This Chapter examines more closely the effects of the regimes in seven Member States - France, Germany, Italy, the Netherlands, Spain, Sweden and the UK mainland of Great Britain.

Case studies were selected, covering:
A. train operations - to examine the effects of RSRRs on interoperability between national regimes and on new entrants;
B. design and acceptance of new traction units - to examine the effects of RSRRs on the supply industry; and
C. track workers - to examine, across all the Member States for a single, relatively simple application, how the formal rules of the RSRR were interpreted in practice.

Each Case Study was supported by a Questionnaire, reproduced in Appendix 6, in Volume V of this Report. Other approaches were also made to suppliers and train operators, in support of the Case Studies but not tied to these Questionnaires.

We noted in Chapter 2 that the information there related to the spring of 1999, and had not in any case been double checked for accuracy in every detail, nor for completeness. The information collected for Chapter 4, on the impact of safety regulation, relates to the autumn of 1999 and similarly has not been double checked in every detail; nor can it be more than a small sample of observations across an immense field. However, as with Chapter 2, we believe that the general picture portrayed is sound. The same conditions of confidentiality of interviewees applies.

A problem with the examination of impacts is that the consequences of the Directives for restructuring and the Single Market on the development of new entrants (as train operators or suppliers) are still very limited. This increases the scope for judgement about how a relatively small number of observations of new entrants and their experiences should be interpreted. There is however a clear enough picture to inform judgement, even though observers from different perspectives may draw different conclusions.

26 The unedited responses to Case Study C, to the extent that confidentiality allows, are reported in Appendix 7, which is also in Volume V. An edited summary of these responses is in Appendix 3, in Volume II. We do not include a record, or separate summary, of the unedited responses to the Questionnaires for Case Studies A or B, because all of the data from these responses is included in this Chapter. Case Studies A and B were also heavily supported by many other, confidential discussions with suppliers and operators.
4.1.2. Design of Case Study A: Train operations

Case Study A provided information about the impact of RSRRs on cross-border traffic and on new (or potential new) train operators. It was designed to support an analysis of how any negative impacts might be reduced, without compromising safety.

Project partners in the seven selected Member States chose two or more cross-border and/or new train operations, as listed in Table 4.1 below.

At the request of the Commission, High Speed services were given a lower priority, and the highest priority was given to freight. The operations were chosen for their potential to illustrate important and/or contentious aspects of safety regulation, or differences between regimes in neighbouring states. Each partner chose at least one operation which included freight and one operation which crossed a national border. The latter included some crossings to non-EU member states (Norway, Switzerland and Hungary).

For Case Study A the following organisations were approached27:

- cross-border freight operators;
- passenger train operators;
- infrastructure managers; and
- safety regulators.

The following information was sought from infrastructure managers, safety regulators and those operating or wishing to operate services.

New services:
- What are the formal procedures for safety approval: who requires what information?
- Is it easy for potential operators to obtain this information?
- Is it clear what conditions need to be met?
- How (a) costly, (b) time-consuming, is the approval process?
- Are the costs of the process regarded by train operators as being as low as they reasonably can be?
- To what extent do new train operators face requirements which differ from those required of present or previous NI operators, or which are more costly for new operators to achieve?

Cross-border services:
- To what extent (in fairly general terms) are extra conditions required because a service is cross-border?

27 The questionnaires for suppliers and new operators were designed to invite general views as well as comment on the routes selected for the Case Study. However infrastructure managers and safety regulators were asked to address the particular examples selected, not just the general system. All approaches to purely national bodies such as nationalised industries or ministries were conducted by the corresponding project partner. Whenever an approach was made to international companies it was explained that approaches may be made to other parts of the company by other project partners.
• To what extent (in more detail) are these extra conditions attributable, or attributed, to safety requirements?
• To what extent have national safety requirements entailed modifications to rolling stock or operational procedures, relative to stock or procedures which are acceptable on other routes?

General:
• What changes in safety measures could be taken to make train operations easier and less costly, without compromising safety?
• To what extent, if at all, do safety requirements go beyond what the operator would voluntarily do anyway?

Table 4.1
Train operations chosen for Case Study A

<table>
<thead>
<tr>
<th>Member State</th>
<th>Operations chosen</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>X/e: cross-border service / established operator</td>
</tr>
<tr>
<td></td>
<td>X/n: cross-border service / new operator</td>
</tr>
<tr>
<td></td>
<td>D/n: domestic service / new operator</td>
</tr>
<tr>
<td>France</td>
<td>X/e: New long distance passenger service between Lyon and Turin.</td>
</tr>
<tr>
<td></td>
<td>X/e: Belifret freight traffic (Belgium, Luxembourg, France, Italy and Spain): French/Belgian border.</td>
</tr>
<tr>
<td>Germany</td>
<td>X/e: Cross-border traffic Austria/Hungary operated by ROeEE/GvSEV.</td>
</tr>
<tr>
<td></td>
<td>X/n: Cross-border freight Germany/Netherlands operated by HGK and Shortlines (also studied from the Netherlands).</td>
</tr>
<tr>
<td></td>
<td>D/n: New freight service across Germany between Munich and Lingen operated by KEG.</td>
</tr>
<tr>
<td></td>
<td>D/n: New 200 km freight service between Ludwigshafen and Neuhof (near Kassel) operated by BASF AG.</td>
</tr>
<tr>
<td>Italy</td>
<td>X/e: FS cross-border freight services to France.</td>
</tr>
<tr>
<td></td>
<td>X/e: Cisalpino passenger service between Italy and Switzerland.</td>
</tr>
<tr>
<td>Netherlands</td>
<td>X/n: Cross-border freight Germany/Netherlands operated by HGK and Shortlines (also studied from Germany).</td>
</tr>
<tr>
<td></td>
<td>X/e: NS Cargo.</td>
</tr>
<tr>
<td>Spain</td>
<td>X/e: Talgo passenger services from Spain to France and Italy.</td>
</tr>
<tr>
<td></td>
<td>X/e: Freight services between Spain and France.</td>
</tr>
<tr>
<td></td>
<td>X/e: Services between Spain and Portugal.</td>
</tr>
<tr>
<td>Sweden</td>
<td>X/e: Sweden/Norway traffic (long established).</td>
</tr>
<tr>
<td></td>
<td>X/e: The new Øresund Link, Sweden/Denmark.</td>
</tr>
<tr>
<td></td>
<td>D/n: Arlanda Express: new passenger service to airport.</td>
</tr>
<tr>
<td>UK (GB)</td>
<td>X/n: EWS: Cross-Channel freight service taken over from British Rail.</td>
</tr>
<tr>
<td></td>
<td>D/n: Heathrow Express: new passenger service to airport.</td>
</tr>
</tbody>
</table>
4.1.3. Design of Case Study B: Design and acceptance of new traction

Case Study B provided information on: a) the extent to which differences in safety requirements for rolling stock add to the costs of railway procurement of new and second hand rolling stock; and b) the extent to which analysis is applied to these requirements, to achieve the maximum level of safety for a given expenditure. As with Case Study A, it was designed to provide an insight into what changes might reduce costs, without compromising safety.

Each project partner identified designers/suppliers, owners and operators from within their Member State, with recent experience of the introduction of traction new to their mainline railway system. These were chosen to illustrate the extra costs involved in safety. The cases considered, listed by country in which the approval was sought (rather than the country from which the traction was supplied), are shown in Table 4.2.

Table 4.2
Acceptance applications chosen for Case Study B

<table>
<thead>
<tr>
<th>Regulating Country</th>
<th>Source of information</th>
<th>Supplier</th>
<th>International or domestic service(1)</th>
<th>Other countries in which similar traction operates (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>France</td>
<td>France</td>
<td>Alstom-De Dietrich</td>
<td>Domestic (3)</td>
<td>Germany</td>
</tr>
<tr>
<td>Germany</td>
<td>Germany</td>
<td>Alstom Linke Hoffmann-Busch</td>
<td>Domestic</td>
<td>France</td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>Fiat Ferroviaria</td>
<td>Domestic</td>
<td>Finland, Italy</td>
</tr>
<tr>
<td>UK (GB)(4)</td>
<td>UK</td>
<td>Adtranz</td>
<td>Domestic</td>
<td>Finland, Germany, Italy</td>
</tr>
<tr>
<td></td>
<td>UK</td>
<td>ABB York</td>
<td>Domestic</td>
<td>Spain</td>
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<td>Denmark, Germany</td>
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(1) International services are those which cross the border of the regulating country.
(2) The extent of similarity differs between cases. In some instances, e.g. the Alstom-De Dietrich traction, the original intention was to have one design: at the other extreme, with Fiat Pendolino, it is a matter of a family of designs where the main common feature is proprietary tilt technology.
(3) Although most services using this rolling stock are domestic omnibus services, one local service does cross the border between Alsace and Germany.
(4) Comments from the three rolling stock leasing companies (ROSCOs), and from Railtrack, ORR and HSE were taken into account for the GB case. With Angel Train Contracts and three non-applicant bodies no
specific traction type was examined; the discussion covered general issue of design and acceptance of new traction.

(5) Only used for freight in France.

(6) Additional orders have been received from France and Great Britain (to be delivered in September 2001);

(7) Several other bodies as follows were also interviewed, covering both international and domestic services in general terms, not confined to a particular traction type.

Train operators: Lovers, Syntus, ACTS, Noordned, Shortlines, NS
Rail Authorities: Railned, RVI, CEN/TC256 and UIC
Others: NedTrain Consulting

For Case Study B the following organisations were approached:

• traction suppliers;
• train operators;
• other train owners; and
• authorities responsible for external regulation of traction used by train operators.

The information sought from each group was as follows.

From multi-national designers/suppliers:

• Examples of procurement by different EU Member States of rolling stock procured for similar functions, but with differences in specification because of differences in safety regulations.
• The reason for these differences? Were they necessary because of unavoidable differences in requirements (e.g. climate)?
• Did those differences which appear to be avoidable add materially to production costs?
• Are there significant potential savings from more safety harmonisation of rolling stock requirements? If so, what might be done to achieve this?

From local and multi-national representatives of designers/suppliers:

Design:

• To what extent does the supplier analyse the cost effectiveness of safety standards? Are there examples where you consider that the standards imposed by a national regime add too much (or too little) to production costs?
• What is the role of European Standards in your decisions, and how is this changing?

Approval:

• What have been the formal procedures for approval: who requires what information?
• Is it easy for potential operators to obtain this information?
• What is it that the acceptance procedure is checking:
  - Compliance with determinate standards (e.g. that particular materials are being used)? Where this applies, is it a formality?
  - How a performance standard is being defined (e.g. that the risks do not exceed a certain level)? Where this applies, is it successful in achieving the specified goal assessed?
- How an area of technological uncertainty is being dealt with? Where this applies, what is the supplier required to provide?
- Whether the equipment is compatible with particular local requirements, not documented in detail centrally (e.g. particular track restrictions)? Where this applies, are details of the local requirements available locally?
- Other procedures?

• Is it clear what conditions need to be met for approval?
• How (a) costly, (b) time-consuming, is the safety approval process?
• Are the costs of the approval process regarded as being as low as they reasonably can be?

From operators and owners:
• As for local designers/suppliers, but asking about their operating costs, instead of production costs; and also asking about the impact of any differences on the second hand market for rolling stock.

From external regulators and standards institutions:
• Do differences in safety regulations for rolling stock provide any obstacles to cross-border operation?
• If so, what measures might best be pursued to reduce these obstacles?
• To what extent is the cost effectiveness of safety regulations of traction analysed? Is there an example of how a draft proposal was changed as a result of analysis of cost effectiveness?
• How far is it possible to accept traction which has already been approved by a safety regulator or infrastructure manager in another Member State? What are the areas where acceptance by one Member State is not relevant to acceptance in other Member States?
• Is it an aim to achieve consistency in safety requirements with other Member States?

4.1.4. Design of Case Study C: Track workers

Case Study C provided a picture, for the same application in each of the selected Member States, of how the RSRR is applied and enforced in practice. It was designed to study whether differences in philosophy might be an obstacle to interoperability or common procurement standards. This included an examination of how the regimes make the compromises which have to be made in the real world.

The Case Study focused on the ways in which general legal requirements translate in practice, at different stages, from legislation through to application by railway operators, external regulation and the imposition of penalties. For example, it examined the role of administrative rules, official enforcement practice and informal discretion; and the rationales used for relaxing absolute duties - such as practical inconvenience, “technical” factors, or explicit costs.

Track working close to moving trains was chosen as an activity or situation which is inherently dangerous, but which is allowed to continue in certain circumstances. The study examined the activity from primary legislation, through to the regulations, the application
of these regulations, inspection and monitoring and any response to breaches of the
regulations.

This Case Study was based largely on a centrally designed questionnaire, but with emphasis
on telephone and face to face enquiries. Data was collected from the custodians of the
formal requirements (safety regulator, possibly infrastructure manager) and the following
sources of information:

- train operators;
- infrastructure managers;
- infrastructure contractors;
- Trade Unions;
- safety regulators; and
- partners’ own experience, including a paper by DHV and Kindunos (Kuiken and
  Stoop, 1999) comparing Dutch, British, French and German practice.

Project partners sought to obtain from this case study:

- The present operational rules governing the selected activity/situation.
- The events by which the present rules arose.
- The hierarchy of requirements, starting with the particular rules, and ending with
  the general legal obligation on companies to ensure safety.
- An outline of the nature and extent of any systematic non-compliance with the
  formal rules.
- Explanation of how such non-compliance persists.
- Ways in which the rules could be marginally more stringent, i.e. could reduce the
  remaining risk perceptibly.
- When the present rules were being drawn up, were these marginal changes
  considered? If so, why were they rejected?
- Consequences of an accident which would have been prevented by marginally more
  stringent rules:
  - Would the enforcement authority prosecute?
  - Would the courts convict?
  - Would the operator face civil liability?
- Reaction if an interested party (e.g. regulator, Trade Union) suggested making the
  rules marginally more stringent. Would the operator be obliged to:
  - accept the proposal?
  - give reasons for rejecting the proposal?
- What would be acceptable reasons for rejecting the proposal?

4.2. Findings on the Impact of Safety Regulation in Practice

This section begins with a description of our findings on train operations, followed by
findings on the procurement of railway traction. There is some overlap between these two
as new operators often wish to introduce new types of traction. However the discussion of
train operations, from Case Study A, draws together the perceptions of train operators, while the second, from Case Study B, draws together the perceptions of those who supply the operators with vehicles.

This is followed by an analysis of the responses to Case Study C, on how laws, regulations and procedures are applied in practice, based on the example of track worker safety.

An issue which has proved to more contentious than we expected is the handling of the boundary between “safety” and other aspects of technical compatibility or standardisation.

Some partners in this study would prefer to concentrate heavily on safety rules, perhaps as defined in the Rule Book. There has also been some demand for a clear distinction between safety and other equipment. The Report in the event takes a view of safety as one of a number of important factors which influence many aspects of the railway, including many which are handled mainly through engineering standards with little direct reference to safety. These issues are discussed in Chapter 5 (section 5.1.1).

4.2.1. Case Study A: The perceptions of train operators

The response to Case Study A was encouraging in the sense that there were potential examples of cross-border freight and passenger flows, of improving quality, and some examples of new operators of train services both across borders and within Member States. It also revealed, as would be expected, that most of the obstacles to cross-border traffic are unrelated to safety regulatory regimes, but arise from infrastructure differences such as power supplies, the technical characteristics of signalling systems, and, to a striking degree, the problem of language.

It is also encouraging that the procedures for international acceptance of goods wagons and passenger carriages, as opposed to traction, work well. It is of interest that these procedures, long established through UIC standards under the RIC (goods) and RIV (passenger) frameworks, have no legislative authority, but maintain their authority through the strong historical position of the state railways.

However in the context of safety regulation, the typical arrangement found in this Case Study was that of a dominant role held by a monopoly infrastructure manager (IM).

Where a new entrant wishes to introduce a service the typical response of the IM is to require the applicant to accept all of the responsibility and cost of persuading the IM that the service meets conditions which the IM may define only loosely, and which may depend on information about the infrastructure which the IM cannot provide.

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28 Although to a declining extent, as the distinction between locomotive and train is increasingly blurred, with the development of powered trainsets. The RIC and RIV standards do not cover powered units.

29 One exception being Sweden, where the safety function has been formally separated from other IM functions. It is not clear how much the values and mindsets of the safety regulator have changed from that of the historical domination of the state railway.
Where traction crosses an international border, the norm is for each regime to require all of its conditions to be met, in addition to the conditions required by the neighbouring regime. While some of the differences in conditions are unavoidable consequences of differences in inherited infrastructure, many are not. The approach to train crews crossing national boundaries, other than in the special regimes of TGV routes, or sometimes for very short journeys to the first marshalling yard, contrasts with the attitudes in other transport modes.30

None of the new operators approached suggested that there was any deliberate discrimination against them, but many believed, to varying degrees and in different ways, that the established regulatory regimes were a serious brake on the development of new markets and, sometimes, on technical innovation, to a degree that was not justified by safety concerns.

Some operators quoted differences in dangerous goods regulations as a problem, albeit one not specific to railways. We have not explored this, but record it as another issue which needs attention if the benefits of transport between Member States are to be fully realised.

4.2.1.1. Cross-border services by established operators

4.2.1.1.1. Services by established operators between Italy and France

An example of the addition of conditions from neighbouring regimes is the tilting passenger train service introduced between Lyon and Turin/Milan in 1997. This replaced a previous service in which both the crew and the locomotives hauling conventional trains were changed at the border. For the new train service the crew still change at the border for several reasons: two drivers are required in Italy, one in France; it saves the costs of training, and it avoids the problems of language. However the railcars travel through both countries. For this to be allowed the trains must have an Italian speed control system (RS4 Code). It must also have the French speed control system (KVB) and the French Automatic Vigilance Device, which makes it acceptable to have one driver.

In the event not all of the trains had the French speed control system fully installed by the start of commercial operations. Trains without an operational system were still allowed to operate, but with maximum speed restricted to that allowed without tilting. This derogation shows flexibility, although it was formally inconsistent with SNCF regulations.

The Italian railway, FS, operates a freight service between Piacenza and Villeneuve which is at present hauled in Italy by double, coupled electric locomotives (type E633). These are currently changed at the border because of the change in power supply. It is proposed that from 2001 this service will be hauled by multi-current locomotives. Train crews will still change: no serious consideration appears to have been given to licensing French or Italian freight engine drivers to operate outside their national systems. However the train, which

30 As noted above, language is an important constraint here. Railway staff have not historically been recruited for language skills, but these are much more important for international rail than they are for international road transport, because of the potential need to deal with complex emergencies.
will travel through both systems, will have to incorporate the safety requirements for each national system, added together. This includes for example the installation of a dead man’s handle, to allow single driver operation in France, and a higher standard of braking in Italy.

4.2.1.1.2. Service by established operators between France and Belgium

Similar issues have arisen with the Belifret freight services, where common train composition rules have been agreed for services which have long since operated between Belgium, Luxembourg, France, Italy and Spain. Taking the French/Belgian traffic as an example, common rules have been achieved by SNCF and SNCB by simply applying for each item, such as braking ratios or a braking car at the rear of the train, the most restrictive requirement from each national regime.

In this French/Belgian case the electric locomotives are interoperable (multi-current; multi speed control) and cross-borders; but they change, with the crew, at the first marshalling yards - typically after about 30 km. Under this “limited interpenetration” arrangement the crew apply the regulations of their home country in the penetrated country. This saves training costs and reduces the risk of confusion between different safety regulations.

4.2.1.1.3. Service by established operators between Italy and Switzerland

The Italian (FS) and Swiss (SBB) railways introduced a multi-current, permanently coupled passenger train set (ETR470) to cross the Chiasso/Domodossola border from 1996 (extended two years later for some services to Stuttgart via the Swiss/German border at Singen, with a tilting ETR on the SBB-DB networks). This service follows fairly closely the typical pattern. Train crews change at the border, because of the costs of training in operating regulations, safety systems, route knowledge and language, and “logistic and administrative problems of personnel management”. The train has to incorporate the regulatory requirements, additively, of all the regimes through which it will pass.

This has included some harmonisation of the fault condition rules and procedures, and the development of codes for such conditions to avoid language problems. However the trains have to be designed for the Swiss single driver regime (ZS system, speed control with ZUB system, radio) as well as the CAB-Signal system (continuous repetition on the locomotive) with speed control on automatic block equipped lines, used with the Italian two driver system. The Italian authorities also record “different attitudes to paperwork and excessive quantities of paperwork” as a significant problem for this service.

4.2.1.1.4. Service by established operator between Austria and Hungary

A service between Austria and Hungary was suggested by the Commission as an unusual and potentially interesting example of cross-border rail traffic. It started operation in 1879 as an internal railway within Hungary. After World War I it continued to operate after its western end, in the Burgenland, became Austrian, and after World War II it continued to operate throughout the Soviet Bloc era.
The railway has one Hungarian terminus at Győr, about 100 km west of Budapest, which connects to the Hungarian national railway, MAV. The line travels about 50 km westwards, crossing the Austrian border to connect with the Austrian national railway, ÖBB, at Ebenfurth, about 15 km south of Vienna. About midway between Győr and Ebenfurth a branch line travels north to another border crossing, and on to an Austrian freight terminus at Neusiedl am See. Passenger services are confined to the line between Ebenfurth and Sopron - the first station on the Hungarian side of the border - the crew having driven from Austria, usually from Vienna. The railway's Hungarian name is GySEV (Győr-Sopron-Ebenfurtti Vasut RT). Its German name ROeEE (Raab-Oedenburg-Ebenfurther Eisenbahn AG).

The company headquarters are in Hungary and all the drivers are Hungarian. It carries about 60 freight trains and 50 passenger trains each day. For freight trains, crew and traction change at Sopron, because of customs formalities and the need in any case to change traction because of the stub end freight terminal. Most passenger services are multi-current, permanently coupled trainsets from Vienna. Of less importance are diesel railcar and electric locomotive hauled passenger trains from Ebenfurth. A few passenger trains travel north-south from Austria to Austria across a spur of Hungarian territory through Sopron without change of crew, on ÖBB and MAV track.

ÖBB regulations are applied from Ebenfurth to Sopron, and MAV regulations on all other Hungarian track, except for the branch line to Neusiedl am See which has a system of its own. The company’s signalling systems are very similar to the corresponding ÖBB and MAV systems. The power supply changes at Ebenfurth from the MAV to the ÖBB standard. Trains/wagons are inspected when they move between ROeEE and the ÖBB (at Ebenfurth) or between ROeEE and MAV (at Győr). This creates a delay of about 30 minutes but otherwise operates smoothly. ROeEE comment however on a significant difference between the safety philosophies of Hungary and Austria. The Hungarian philosophy is to exclude any unsafe operation, leading to very expensive systems as every accident leads to higher standards. One consequence is that whereas Austria accepts Hungarian vehicles without problems, Hungary accepts Austrian vehicles only after complicated procedures.

Problems reported by the railway (apart from customs formalities), are language, as not all of the drivers and other staff speak German; the fact that not all locomotives have insurance for both countries; and the difficulties of handling wagons from the countries to the east of Hungary. GySEV is responsible for appropriate checks and inspections of these wagons and they often do not meet the required safety standards. In this case freight is usually transferred to other wagons.

4.2.1.1.5. Services by established operators between Spain and neighbouring Member States

The boundary problems between the mainline railways of Spain and those of France and Italy are dominated by the change in track gauge, which creates costs which are much more important than any safety requirement. The Talgo passenger train service connects Madrid-Paris, Barcelona-Paris and Barcelona-Zurich-Milan. The trains, but not the locomotives,
have an axle system which automatically changes gauge on passing through a fixed installation at a speed of about 10 km/h. Locomotives and crew change.

The vehicles were tested by SNCF and approved before entering service. The train operating company does not regard the additional costs of safety approval as significant.

Freight traffic between Spain and France is achieved by changing axles, which takes about 1½ minutes per axle. At one crossing, Irún-Hendaye, the shipping company Transfesa has installed a system which allows axle change of coupled wagons. This removes the need for a brake test after the axle change. At other crossings, the SNCF brake test is carried out in a specially installed pneumatic installation. On the Spanish side the test is carried out by the engine driver on the track. The safety elements of freight wagons are checked by SNCF in accordance with UIC card 579-2.

The most important contribution to costs of freight transport between Spain and France is the unsatisfactory coordination of train paths, to fit in with the passenger timetables of the two systems. SNCF and RENFE have set up committees to improve this and other aspects of the efficiency of freight transport. However safety issues are felt to be satisfactorily covered already, through UIC 579-2.

We have not sought information on the proposed high speed link between Spain and France, which will also carry freight, on European standard gauge.

There is no change of gauge at the border between Spain and Portugal. However both locomotive and crew change at the border and the border sees very little rail traffic. The change of locomotive and crew is partly because the change of power supply (25kV-50Hz in Portugal and 3kV-DC in Spain), but it is partly because the Spanish railway, RENFE, requires the ASFA safety system, which prevents Portuguese railway (CP) diesel locomotives from running on RENFE track. This barrier is not seen as a matter for concern by the railway authorities, perhaps because there would be further technical problems to resolve to achieve through-running services.

4.2.1.1.6. Services by established operators between Sweden and Norway

Passenger and freight services have for nearly a century travelled between Sweden and Norway at four border crossings. At three of these crossings it is usual for the train to cross with no change of crew. This is achieved by training the staff on safety regulations, with examination in the country in which they are going to drive. For a small company introducing a new service the initial cost of training was high, at a little over 100 000 euro for the first year of operations into Norway. This amounted to about 10 per cent of the turnover of the train service for that year (even though there is no problem with language). However subsequent training costs have been much less, at about 10 000 euro per year. This

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31 In the one case where crews change, this is because of the change of locomotive from electric in Sweden to diesel in Norway, where the system is not electrified.
cost should be further reduced in future by the work of a special Committee on further homogenisation of Norwegian and Swedish Traffic Rules.

The main technical issue raised by the operation is the differences between the signalling systems. There are also differences in the ATC/ATP systems, although these are nearly identical. There are some problems of interfaces between IT systems. Constraints on the traction which BV allow to be used on the Swedish system include strong concerns about lateral forces on the track, which exclude many non-Swedish locomotives; however this is not seen as a safety question.

Passenger and freight services are scheduled to start in 2000 between Sweden and Denmark across the Øresund, connecting Copenhagen to Malmö. There will be no change of train crew. As in the case of the Swedish/Norwegian crossings this will be achieved by training. Danish drivers are trained in Sweden over 5 weeks. This includes three weeks of mainly theory, followed by one week of training on a simulator and one week on the track and finally an examination. Differences between the national systems include signalling systems, ATC and power supply.

4.2.1.2. Cross-border services by new cross-border operators

4.2.1.2.1. Service by new operator between Germany and the Netherlands

The Cologne based company HGK and the Dutch company Shortlines established “Rail Development Partners” in 1997, as a railway logistics related supplier. The new company sees itself as not only as railway operator, but also an innovative service provider, looking for new forms of service.

The new company started operation of a freight service in 1999 between Cologne and the Rotterdam. It complies in the Netherlands with the safety standards V001 and V002, issued by Railned Spoorwegveiligheid. The train crew changes at the border, because of the obstacles of language and route knowledge, but the traction - a permanently coupled, diesel-electric trainset - does not change.

The (mainly German) trains presented no novel technical features, and the operators take the view that the cost and time required to obtain approval by Railned was disproportionate to any safety benefit.

More generally the new operators stress that there should be a mutual learning process and development of trust between national regulators and operators. They report that Railned appears to have no incentive to encourage or reward better quality and lower costs. They regret the still relatively closed culture within the European railway community. They

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32 The company also operates a service between Rotterdam and the inland shipping-rail terminal of Born.
33 They report that a special study, costing about DM 200 000 (100 000 ecu), is required for each engine model, even if a model is exactly equivalent in the safety relevant areas to a model which has already been approved. Approval of the model range 1024 took two years. The operators also believe that in practice, although not as a policy of deliberate discrimination, they are not treated as equals to bigger operators in the allocation of train paths; but this is unrelated to safety.
suggest there should be no competition with respect to safety issues, and that Railned charges for information are imposed to an extent which hinders the exchange of expertise. Within the Netherlands the new operators had to develop their own framework, standards and handbooks to propose for approval by Railned, as there was no existing framework. To obtain a safety certificate it was necessary to hire a safety consultant accredited by Railned.

There is a serious monopoly in the Netherlands in the supply of some safety equipment, in particular ATP, where a monopoly-monopsony relationship exists between the supplier and the national railway. Besides adding to costs, this can lead to years of delay for smaller, new operators, as they are seen by the equipment supplier as a lower priority than the much larger main customer.

Railned Spoorwegveiligheid take the view that serious new entrants have no problems with the Dutch certification process. The costs may be high, but this keeps out only substandard performers. The technical standards are well defined and information readily available. Safety management systems are readily available in the market. Railned information is available on the internet. However, according to Railned, new entrants have little notion of the requirements with respect to rolling stock, admittance certification and maintaining the required safety level, staff training and recertification checks, how to deal with safety-enhancing improvements and how to learn from incidents and accidents.

The certification process is at present administered by Railned without charge, but there are plans to charge these costs to applicants. There is some debate about whether this is a wise decision.

Obtaining safety approval for HGK/Shortlines to operate in the Netherlands was difficult despite the considerable advantage of one partner being Dutch. These companies have considered establishing freight traffic routes between Germany and Antwerp, but this seems unlikely to materialise, because of the nature and extent of Belgian regulatory requirements. To satisfy these requirements without a Belgian partner would be very difficult.

HGK and Shortlines separately express the view that there is great potential for savings in safety regulation without compromising safety. Shortlines recommend:

- an incentive structure which recognises and rewards steps to achieve better quality and lower costs, which the present Railned procedures do not provide;
- procedures established within the regularity authorities, as well as within applicants, to learn from experience of the new certification process. Action by the government to establish its own benchmarks and standards, unconstrained by the national railway historical culture. (A rail safety framework, Kadernota Railveiligheid, issued in February 1999 by the Dutch Ministry of Transport may help to provide this.)
- much improved procedures for learning from incidents and accidents. The national railways are not used to an open culture of learning and sharing experiences in the way that is found in the process industries; and little attention is paid to costs.
Some discussion was also held in the Netherlands with the newly combined German/Dutch enterprise, now renamed Railion, of the previous established NS Cargo and DB Cargo. However this company had no substantial concerns with the safety regulatory system with which it was familiar.

The Dutch company Lovers Rail had problems importing traction and carriages from Belgium for use in the Netherlands. Certification by Railned was not accepted by local NS staff at the border crossing. Although the equipment met Railned’s standards it was were declared unsafe or not compliant with the regulations.

4.2.1.2.2. Service by new operator between Great Britain and France

The previous British Rail freight operation between Great Britain and France was taken over by the company EWS. This service involves some 75 trains per week in each direction. Outward trains start in the UK, typically at Wembley in North London, and run with EWS traction and train crew to Dollands Moor at the British end of the Channel Tunnel, and through the tunnel to Fréthun/Coquelles at the French end. SNCF then take the train on (the final destination can be beyond France).

Train crew change at Dollands Moor where EWS choose to maintain a specialist depot for Channel Tunnel work. However, traction changes at Dollands Moor only when diesel locomotives are used in Britain. Both traction and train crew change (to SNCF) at Coquelles.

Three RSRRs apply: British, French and Channel Tunnel. In operating terms, the differences are minor: special fire, evacuation and dangerous goods requirements in the tunnel; tail lamps, speed limits, braking requirements, and radio between any two of the three. The tunnel requirements arguably reflect its special features. The effects of the other differences on both safety and cost are small.

Severe problems were encountered in obtaining approval from the Channel Tunnel Safety Authority (and from the British authorities for the Class 92 electric locomotive).

The change of train crew at the GB end of the tunnel is a free management choice. The change of train crew and traction at the French end is presented as an unquestioned fact of life. The EWS attitude is that these differences in RSRRs are just facts of life, to be adhered to.

4.2.1.3. New services by new operators within Member States

Only a few examples emerged of truly new operators within Member States. We have not included any of the newly formed train operating companies (TOCs) in Great Britain, because to a large degree they evolved from components of the previous national railway, British Rail. We did however approach international managements of these operating companies for their views on the European railway scene as a whole.
The examples studied are two specialised freight companies in Germany and new passenger services in Sweden and Great Britain, connecting capital cities to their major airport.

4.2.1.3.1. New freight services in Germany

BASF, based in Ludwigshafen, operates a very considerable local railway network on its own industrial sites. It has also recently introduced, in 1999, a freight service covering about 200 kilometres between Ludwigshafen and Neuhof, near Kassel, of permanently coupled trainsets carrying potash. The new service includes no novel technical operational features. Both traction and rolling stock are owned by BASF and the drivers are BASF employees.

The company is content with the procedures for approval of this service. These involved approval as a non-federal railway by the Land authority of Rhineland-Palatinate, on the basis of inspections by EBA which were authorised by the Land. Admittance to the DB Netz network was then granted after approval by the DB Netz supervisory board. BASF however report that an important factor was their employment of many former DB staff, who were familiar with the procedures. They say that “many more problems could expected without these employees’ knowledge”.

BASF has faced unexpected problems in operating the service because of the differing safety systems and variable quality of the DB Netz track. It has had to order special locomotives. Nonetheless it is investigating the potential for operating services from Ludwigshafen to Schwarzheide (Brandenburg) and to Antwerp. For the latter service the company would expect to change locomotive and train crew at the border, with the train then becoming a Belgian train.

It is revealing that BASF has no wish to become a railway operator as such. Its only reason for operating these services is that conventional railway services by themselves are insufficiently competitive. It competes with other railway operators simply to increase competition.

The company KEG (Karsdorfer Eisenbahn-Gesellschaft) has operated train services since well before German Reunification, on the track of the former Deutsche Reichsbahn. In 1999 it introduced a service transporting kerosene between Munich and Lingen, about 1000 km distant in north west Germany. As in the case of BASF, KEG owns the traction and the rolling stock; the drivers are its own employees; and there are no novel technical features. Again, like BASF, it is content with the procedures for approval, conducted in this case by EBA and DB Netz. However it stresses even more strongly how much the handling of such approvals depends upon the employment of former DB workers, who understand the regulations.

KEG feels that in its operations it has excessive inspections by EBA, some of which appear to be on the basis of information provided by DB Cargo, which is a competitor, or by the trade union. Inspections are made, at some cost to the company, which appear to be unjustified.
KEG report difficulties with operating wagon-load services four kilometres into France, to the French cross-border station. A French guide has to join the German engine driver and the locomotives have to be inspected by SNCF, although the infrastructure on these four kilometres appears to be no different from that on the German network. This results in delays and increased inspection costs.

4.2.1.3.2. New airport service in Sweden

The Arlanda Express service has recently started operating between Stockholm and Arlanda Airport. The company is a new operator. However the safety staff have long experience of working with SJ and/or Banverket. About half of the journey is on BV track and the rest on Arlanda Express’s own track. There are no significant new technical features. Safety concerns, related to tunnels and fire detectors on the trains, delayed the opening by at least half a year, but these are seen as technical problems and the operator has not expressed any dissatisfaction with the regulatory process.

The procedures and conditions for obtaining approval from BV for Arlanda Express to use its track were well defined under a standard commercial contract. The conditions for obtaining approval from the Railway Inspectorate to manage track and operate traffic were less well defined and required a number of meetings to establish the criteria for acceptance at each stage, over a two year period. The most costly approval process - perhaps ten times the cost of obtaining Railway Inspectorate approval - has been satisfying the Rescue Authorities on tunnel safety. This is based on risk analysis, but with little documentation to explain what criteria need to be met.

4.2.1.3.3. New airport service in Great Britain

Heathrow Express (HEX) is a new company established by BAA plc, the owner of London Heathrow Airport, to design, procure and operate a new passenger service, providing a 15 minute journey between the Airport and the west London mainline railway terminus of Paddington. This included the construction by HEX of a substantial new spur from the track owned by the British infrastructure manager, Railtrack, to connect to the Airport. However, following construction, HEX transferred ownership of the new track to Railtrack, and acts as Railtrack’s agent for maintaining it. The service was the first electric traction into Paddington.

The approval process was not easy, for several reasons. One reason was the new safety regulation institutions, following the radical restructuring of the British railway, were being used for new operator approval for the very first time. A second reason was that, as a flagship service for the airport, HEX wished to introduce several novel technical features, including unusual platform heights and a new class of traction, made by a manufacturer new to GB, as discussed further in section 4.2.2.7 below. A third reason was that the top management culture of the new company was based in the aviation industry, not the railway industry. However the service began operation in 1998, with most but not all of the new company’s objectives achieved.
The new company’s main complaints were about the approvals process for its trains. They were consistent with other findings on acceptance processes in Great Britain and are discussed under Case Study B below.

As for other safety regulatory processes (acceptance by the IM of the Safety Case for the operating company; acceptance of new infrastructure by the IM and RI; restarting tunnelling work after a Heathrow tunnel collapse), the top management of HEX sees their application as slow-moving, lacking a problem-solving attitude, and excessively risk-averse. Top management impetus from HEX was required to avoid loss of time on the project.

4.2.2. Case Study B: The perceptions of suppliers

This section records the experiences mainly of suppliers, including rolling stock leasing companies (ROSCOs) in GB, in obtaining approval for operation of new traction on national, or multinational networks. The regimes of each of the selected Member States are addressed in turn, drawing on the information collected via the Questionnaire and, in several cases, wider consultations.

4.2.2.1. France

A railcar (X 73 500) for regional express services was ordered in common by SNCF and DG AG from Alstom de Dietrich and Alstom Linke-Hoffmann-Busch. The railway press has reported how the final products for the two railways differed very substantially, but this report is confined to experience in France. Some of the vehicles were procured for services between France (Alsace) and Germany. The French railcars were manufactured in France, except for the bogies which were manufactured in Germany. They came into service in late 1999.

The manufacturer proposed several modifications to reduce costs, the most significant of these being to the design of the axles. These modifications conflicted with the internal rules of SNCF, and therefore required additional tests.

The manufacturer faced two kinds of hurdle. One was the very stringent and rigid rules applied by SNCF and specified in its contract in great detail. This regulated, for example, the materials used for axle boxes, not only their performance. The other was the requirement to met the GAMAB principle (“globally at least as good as”). This principle states only that the level of safety should not be reduced and is thus extremely unspecific. There is considerable freedom for expert judgement in deciding whether it has been met - the opposite extreme of due process.

The manufacturer had particular difficulty with the GAMAB criterion, as there was no incentive on SNCF to help prove that GAMAB had been met. Its incentive was to leave all

34 Specifically: the use of polyamide for the axlebox cage roller bearing, a new metallurgical treatment of bogies, and an axlebox made of GS (spheroidal graphite) cast iron.
the action and expense with the manufacturer to persuade SNCF that a robust enough case had been made for SNCF to approve, with no risk of its subsequently being blamed.

4.2.2.2. Germany

Alstom DHB is producing a diesel car (Dieseltriebwagen 641) for DB Regio and for SNCF, for short distance passenger traffic. It has no significant novel elements.

In Germany, Alstom face two acceptance and certification processes, one managed by EBA, the other by DB Regio. They are satisfied with the EBA standards and processes, although it is important to maintain regular contact with EBA throughout the whole process of development of new traction. Cooperation with DB Regio has been more difficult, because of lack of clarity in specification which often only emerges at the inspection stage.

The SNCF procedures require a different design from EBA for the bogie frames. This appears to have no implications for safety, but the production of two products instead of one adds to costs.

The Italian company, Fiat Ferroviaria, is currently negotiating a contract to supply the Pendolino, a tilting body train, for use in Germany. They too have experienced a lack of clarity in some acceptance requirements. They also believe that some regulations impose a much greater cost on operators than can be justified by the possible benefits.

Further comment on the German procedures is recorded in section 4.2.2.4 below.

4.2.2.3. Italy

Ansaldo Trasporti s.p.a. are producing a locomotive (Type E 402B) for the Italian national railway, FS, for use on Italian Intercity passenger routes and for freight in Italy and in France - where it will be operated by SNCF Cargo. The locomotive contains a number of technological developments, which are adaptations of technology established in previous models. The additive requirements of Italy and France necessitate two different speed sensors, two event recorder systems, two pantographs, two “man-machine interfaces” and two radio telecommunication systems. The manufacturer estimates that these impose an extra cost of about 450 000 euro. The manufacturer also estimates that checking of safety performance in France takes three months and costs about 180 000 euro.

4.2.2.4. The Netherlands

No serious acceptance problems were reported for the supply of traction to NS, nor by the operators Syntus or Noordned, who buy or rent their material from NS. Lovers Rail obtained their equipment from NMBS (Belgium), purchasing the cars and renting the traction; they, similarly, report that they had no acceptance problems.
Shortlines and its German partner HGK have a variety of traction equipment. As noted in section 4.2.1.2 above they have experienced some difficulties.

The manufacturer of the traction - a major supplier - explained that they used to sell traction in Germany and the Netherlands to the train operator, who would carry out the required tests. This changed in Germany some time ago, and more recently in the Netherlands. The current situation is as follows:

1) The train operator and manufacturer tell Railned/EBA that they propose to buy/sell new traction.
2) Railned/EBA provide the manufacturer with the requirements in the form of certification procedures, in terms of Standard M005 on procedures and Standard M001 on contents. Both conform to UIC standards.
3) The traction is built in conformity with the requirements.
4) The manufacturer does the tests.
5) In Germany, EBA examines the test report and decides whether or not to accept the equipment. In the Netherlands, Railned usually sends the report on to a third, independent, party. This is NTC, currently still part of NS. They do this because Railned does not have enough staff.
6) NTC advises Railned on whether or not to accept.

The Dutch procedures 5 and 6 will change: there will be competition. NTC, NS Technisch Onderzoek, Holland Railconsult and TuV (from Germany) have applied to be “notified bodies”. Railned will then only be a co-ordinator.

NTC can have several roles in the present procedure:

1) The builder of the safety file: This is a very active role. NTC gather all necessary information about the requirements and test results.
2) Railned-role: this is a more passive role. The rail company will build the safety file and NTC judges whether this traction is safe and compliant with all the rules. Railned has final responsibility, but NTC does the work.

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35 Shortlines has German locomotives: 3 engines of the 10024 series with ATB on a 3 year admittance basis; two engines of the 10002 series (comparable to NS 6400 series), fitted with ATB. HGK has 16 additional engines of the 10002 series. At DSM facilities, DSM shutters are applied. Two British Class 66 engines are available at Leidschendam and Tilburg, one fitted with the 3 Benelux systems, one with HGK equipment at the Cologne terminal. Freight wagons are hired from AHE, a railway company.

36 In Norway, the equipment is delivered to the national railway, NSB. NSB will then ‘fight’ with their agency about acceptance. This could also be done in other countries, but there has been a trend the other way. Small railway companies do not have the expertise on this subject, and will ask the manufacturer to deliver ‘ready for use’, thus assuming responsibility for testing and acceptance, etc. They will also ask the manufacturer to do the maintenance. All responsibility for the traction equipment is thus transferred from the rail company to the traction supplier.

37 If the report describes all requirements, and Railned accepts the report’s interpretations (which is sometimes subjective), they accept the traction without sending the report to NTC.

38 The Dutch acceptance department is only about 5 people, while EBA has about 200.
Help to the rail company: NTC operates as advisor to Syntus in the process of buying new Lint trains. This is because Syntus does not have enough technical and procedural knowledge.

The trend towards ‘ready for use’ delivery is welcomed by Railned. If the supplier has the traction accepted they can deliver with all acceptance reports to the rail company. This saves a lot of work, leaving the need only for series-acceptance. The supplier generally knows much more about the product than the user-to-be.

NTC agrees that ready for use delivery could be a good thing, but comments that it is not working perfectly in the Netherlands. For the new trains for Syntus the LHF and Railned are co-operating to get the trains accepted. It is, however, unclear to Syntus what Railned expects of them after the trains are delivered. Some time ago Railned sent Syntus a letter telling them that the current acceptance procedure was only for the current requirements, and that these would change in the future. When, what and how much cost may be involved is unclear to Syntus, let alone who will pay.

Traction is accepted in the Netherlands only if satisfactory arrangements have been made for maintenance. A Railned-certified body has to be selected to maintain any traction operating in the Netherlands.

Railned is generally regarded as highly co-operative in providing information. Generally operators are satisfied with the clarity of the Dutch requirements, although it is a problem that some of the regulations are new or not yet available. Some problems were reported to arise from unfamiliarity with regulatory differences between countries.

The Dutch acceptance requirements consist of 52 pages of descriptions. Where possible they are tied to UIC/CENELEC requirements/standards. This is Chapter 1 of the requirements. For many of the UIC standards not only the requirements but also the way to measure or test is prescribed. Chapter 2 of the requirements describes the standards which are specific to the Netherlands. These “supplementary specific requirements” for the Netherlands are very diverse.

In the Netherlands it is possible to accelerate the process if the traction is already accepted elsewhere. For example if traction is accepted in Germany and the reports are still available (this is often not the case), these will be accepted in the Netherlands for the overlapping requirements. In the other direction, EBA (Germany) does not always use all material available from test reports written for Dutch acceptance, and some things are repeated. OTIF is trying to reform this.

Even though acceptance of a specific train in Germany gives rise to partial acceptance in the Netherlands, there are differences in the regulations, and this leads to new tests and new

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39 Technical/type acceptance is normal acceptance procedure. Series acceptance is a check that a particular train conforms to the requirements of the type.

40 Apart from the experience of Lovers rail, noted above, of local NS staff at the border stopping trains as being “unsafe”, even though the train had been approved by NS.
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reports. Most of these differences are ‘unavoidable.’ For example, the regulations about closing of doors are more specific (more requirements) in the Netherlands. Dutch passengers are used to the safety of locked doors. Dutch authorities argue that if this regulation changed, it would be decades before people stopped falling out of the trains because they kept playing with the buttons, or hanging against the doors.

Another example is that a particular kind of tinted driver’s window was not allowed because the signals were said not to be clearly visible. This led to seemingly endless tests, but there were no regulations about the wearing of sunglasses by the drivers.

According to a manufacturer, acceptance costs about 100 000 guilders (about 45 000 euro) in Germany (EBA tariff). In the Netherlands Railned charges about 50 000 guilders, but the review done by NTC can amount to more than 1 million guilders. According to Railned, acceptance procedures cost 6 750 guilders for administrative fees, which it believes are as low as possible. According to NTC, the cost of the acceptance procedures in the Netherlands can amount to 5 million guilders in total, for completely new traction which has not been accepted in other countries.

Costs per unit depend heavily on the size of the series. However we heard of no discussion of smaller companies pooling their acceptance requests.

The time to acceptance can be an issue. Lovers Rail found that acceptance took a long time even though all the vehicles had been used in the Netherlands before. The carriages had even been used by NS, albeit on a temporary basis. To use the carriages ‘only in the Netherlands’ was treated completely differently from transit through the country. For example, the carriages did not strictly fit the required structure gauge because of an extra pipe and the stairs. The main problem was not that Lovers had to take the pipes and stairs off the train, but that Railned Acceptance couldn’t decide whether or not they had to be taken off. The Railned Acceptance authorities would say the proposed arrangement was not acceptable, but they didn’t say either why, or what should be done about it.

The situation has improved, but acceptance still takes several months; it is believed that this time could be shortened to a matter of weeks. A problem is that the requirements are not specific, and opinions about the correct interpretation of the requirements can differ. If a new rail company does something different from NS, the Railned Acceptance authorities would prefer to avoid the responsibility of accepting the new traction or carriages.

An additional problem, as noted earlier, is that the required ATB is for sale/available only from a monopoly supplier. It took Lovers Rail about a year to get five of them, and they would have liked more. The one company that is certified to build is slow and expensive. (The same situation holds for yellow safety vests. NS ordered so many of them that the little orders of the smaller rail companies were delayed; the big order goes first.)

A traction manufacturer said that for completely new traction the whole process of supply takes 18-24 months. If material that has been supplied before is reordered, it can be put into service in about 12 months. The testing and acceptance procedures can be done largely in
parallel, although acceptance is in general several weeks after the last tests have been completed. Testing generally takes about 4 months. NTC say that acceptance can be achieved within half a year if all tests have been done and all documentation is available.

Problems arise with the approval process if a new part is put in an old train. The whole train has to go through acceptance again.

4.2.2.5. Spain

We have no views from suppliers on the cost effectiveness of the Spanish procedures for acceptance of rolling stock, which appears to lean heavily, as in other Member States on UIC and ISO standards.

4.2.2.6. Sweden

Siemens are supplying a freight locomotive (EG) to the Danish railway DSB Gods, for service between Hamburg and Malmö via København, when the new Øresund crossing is open. The locomotive is an adaptation of the DB AG locomotive 152. It has no new technology, but adaptations include a higher traction force, increased weight, increased headlight effect to Swedish standard, and two electric current systems (15kV, 16Hz for Germany and Sweden and 25kV, 50Hz for Denmark).

Safety adaptations include two ATC systems and the German Indusi system and many other equipment details adapted separately to Swedish, Danish and German safety rules. The extra unit cost of this multiple provision is estimated at about 100 000 euro.

There have however been few acceptance problems associated with safety, probably because the Danish and Swedish rules are similar to the German rules, but less detailed.

The biggest extra cost of cross-border traffic in this case will be the cost of training Danish and Swedish drivers.

More problems have arisen with acceptance of the new trainsets supplied by Adtranz for passenger traffic between Denmark and Sweden. Beside the obvious problems with two power supplies, two signal systems and two radio systems, the suppliers are concerned that the lack of concrete rules/regulations has increased the costs. The onus was on the supplier to suggest a solution to see if it was accepted; the process was one of trial and error.

This contrasts with the relatively few problems found with the Swedish DMU Y2 train ferry service between Sweden Copenhagen. One reason for this appears to be that is diesel, and another that it has time to change signal system and radio during the 15 minute ferry journey. It is claimed that the Danish signal system is much more sensitive to electrical disturbances than the system used in Sweden and Norway, among other countries.
4.2.2.7. United Kingdom (GB)

A consortium of Fiat Ferroviaria Spa/Alstom Ltd are producing electric multiple unit Pendolino (Italian designed tilting trains) for Virgin West Coast mainline in GB. There are currently no tilting trains either in operation or authorised for operation for passenger service in the UK. New Railtrack Group Standards are therefore being prepared between Railtrack and the manufacturers’ consortium. Long delays have been experienced in the acceptance procedure. The manufacturers believe these delays arise from excessive requirements in UK safety regulations and from UK-specific requirements which, though reasonable in a national context, are ineffective and costly in a European context. To Fiat Ferroviaria Spa/Alstom Ltd these delays are a significant obstacle to innovation in the British railway.

The company CAF in Spain supplied trains for the Heathrow Express service described in the previous section. Within the Engineering Acceptance process, CAF believe that the obligation to be approved through two consulting companies with Railtrack certification unduly increased the cost of the process. Submissions to be approved by these companies (CCB and VAB) were not clearly defined. There was therefore an incentive for them to exaggerate the process in the knowledge that their approval was essential. The Route Acceptance process carried out by Railtrack was also ill-defined, with little clarity about the supply of necessary technical documents, or regarding who was ultimately responsible for granting approval. Within this process Railtrack was seen as having insufficient knowledge of its network, especially the limits of electromagnetic compatibility of network installations. In such cases, responsibility fell on the manufacturer to carry out the relevant studies and tests on track. In CAF’s opinion, the excessive amount of information required from the manufacturer for acceptance increased the cost of introducing a rolling stock series by approximately 6 million euro, with no corresponding increase in safety.

British comment on the GB processes came from the three train leasing companies (ROSCOs), the two main manufacturers and three train operators (TOCs). They all told the same story.

There are four ways in which regulatory requirements bear on new traction design and acceptance in Britain under the current RSRR:

- Railtrack’s Engineering Acceptance process: This verifies and certifies compliance with the requirements of Railway Group Standards (RGS).
- Railtrack’s Route Acceptance process: This deals with the aspects which are not covered by RGS. These include local issues such as gauging anomalies, and electromagnetic compatibility (EMC).
- The New Works Acceptance process of the Railway Inspectorate (HMRI): This is concerned with aspects of safety which are wholly within the train, and hence not regulated by Railtrack.
- Regulations under the Disability Discrimination Act, administered by HMRI: The Health & Safety Executive have told us that they share many of the concerns expressed to us by
the industry. However this is not strictly a safety issue and it is not further discussed here.

The general message about these processes was clear, consistent and deeply felt. The Route Acceptance process was in respondents’ view a major source of cost and distraction, imposing risks (sometimes realised) of severe delays, with negligible safety benefit and possibly the reverse (because of delays in introducing safer equipment). While there were adverse comments about the other three processes, they were minor in comparison, and respondents were anxious to make this clear.

The main criticisms of the Route Acceptance process which, after consultation with the IM, Railtrack, appear to be (or to have been) well-founded, are:

- **Information**
  - Information about the infrastructure which the IM might reasonably be expected to provide was not available. It had to be obtained by applicants at their own cost.

- **Organisation, approach and ethos**
  - The process was fragmented. IM staff and consultants were concerned only with their technical areas. They did not regard their role as problem-solving.
  - The system made it impracticable to obtain approval for other than the specific routes on which the specific TOC wished to use the train.

- **Decision criteria**
  - Requirements were imposed which the existing system did not meet, with no clear justification either for granting the derogation to the old equipment or for declining to extend it to the new equipment.
  - Requirements were set for individual functional areas (e.g. electromagnetic compatibility), with no consideration of the overall safety impact of introducing the new equipment.
  - The required risk levels in some areas were far lower than justifiable.
  - The cost of extra work required of applicants was excessive, having regard to the likely consequent reduction in expected risk.

The IM, Railtrack broadly accepts the criticisms of lack of infrastructure data, and has work in hand to remedy this. The need to change the decision rules is beginning to be recognised, but the full measure of the deficiencies in the present rules, and the suitable alternative, appear to be less well appreciated. It is not clear how much movement there has been from the ethos of “Prove to me your trains are safe” to an ethos of “Let us work together to develop a safer and more competitive railway”.

The difficulties with the Route Acceptance process have mostly been to do with electromagnetic compatibility (EMC). Such difficulties pre-date Railtrack, having severely affected the new traction for the Channel Tunnel, Eurostar and Class 92 freight locomotives, under BR. Recently, difficulties over gauging have also become serious. All new traction since the fragmentation of the industry has been affected. Least affected were the Class 66...
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diesel freight locomotives imported from the USA. These were to a design of which huge numbers had been made, with little change to the design over decades. There was considerable “political” pressure for rapid acceptance. Even so the operator, EWS, complains that it took much longer than necessary.

The issue has attracted considerable attention over the years, including highly critical comments from the House of Commons Select Committee in 1996 and more recent intervention by the Deputy Prime Minister. Despite this, it has taken until 1999 for substantive progress on the infrastructure information issue, and the decision rule issue is only now being clearly diagnosed.

Despite these major concerns there has been no case, until recently, of the replacement of old trains by new safer trains being materially delayed by the Route Acceptance process, because the delays were matched by others elsewhere. There is also independent evidence that much of the delay can be ascribed to the manufacturers.

4.2.2.8. Summary and review of Case Study B

4.2.2.8.1. Salient issues

The comments received in this Case Study exposed three areas of criticism: lack of clarity; excessive costs; and inappropriate ethos. They also raised two neutral issues: historic differences and shift in onus to manufacturers.

Lack of clarity

This took a number of forms: requirements which were documented but where the documentation was incomplete or obscure (GB); requirements which emerged only at the inspection stage (Germany); requirements which were not documented (Germany); a decision rule which proved to be unduly subjective (France).

Excessive costs

These emerged in a variety of ways: excessively specific requirements inhibiting innovation (France); requirements which demanded unreasonably high standards (GB); incompatible requirements where the differences added no safety value (Germany/France; Italy/France); the cost of the approval process (Italy; GB; NL); the time taken by the approval process (NL; GB); the cost of the extra requirements in the two regimes (Sweden; Italy).

Inappropriate ethos

This referred to the ethos of the accepting body. The main underlying theme was the failure of the accepting body (which in all cases mentioned was an NI or an ex-NI IM) to take a system-wide view of its responsibilities. The specific complaints were: off-loading costs on to applicants (France; GB); unwillingness to take responsibility, and specifically to aversion to the possibility of being blamed for an accident (GB; NL); fragmentation of the decision process (GB); passivity, and failure to take a wide view of the issues (GB; NL); refusal to be pro-active in dealing with problems (France; GB; NL). Unwillingness to accept test results
from another country (Germany); and requirements being drawn up in excessive engineering detail (France) may also be considered under this head.

**Importance of historical differences**

This was implicit or explicit in comments made on France, Italy, Germany, NL, Sweden and Denmark.

**Onus on manufacturers**

Probably the single most common observation (France; Germany; NL; GB) was that the onus for obtaining acceptance was now placed on the manufacturer (not, in particular, the TO). This was explicitly noted as a change from the previous NI regime (NL). It was not expressed critically: in particular, the NL report observed that the supplier generally knows much more about the product than the user-to-be. In Great Britain, although the legal obligation rests with the TO, in no case has the TO actually done the work. Where the product is intended for more than one market (France/Germany; Germany/France; Italy/France; Germany/Denmark/Sweden) it is not practical for other than the manufacturer to be in charge of the negotiation of acceptance processes of any difficulty.

4.2.2.9. Interpretation of case Study B

It is likely that in many cases the authorities involved in accepting new traction would reject the criticisms made, or argue that the costs involved were justified, either by the safety issues or by the failure of the applicants. We are not able to adjudicate between the positions in every case.

In the case of GB, given the intensity of the criticisms, we were at pains to consult the RI (HSE) and the IM (Railtrack) after having collated the comments from manufacturers, TOs, ROSCOs and others. In this particular case, a consensus emerged that the broad thrust of the criticisms of the process was justified; but that many of the delays and some of the costs were attributable to the applicants. On both sides, the lessons are being learnt.

We take broadly the same view Europe-wide. Where a broad criticism has been made from several quarters, we have accepted that there is basis for it, particularly when (as in most cases) it seemed a natural consequence of the restructuring of the railways in Europe. Both new entrants and older organisations, reshaped and in a new environment, have had to go through a learning process, with the costs which that involves.

In terms of recommendations, we take forward from this section the following perceptions.

- There should be some (relatively) immediate benefits from clarifying the requirements placed on operators and suppliers. There can be no safety argument against this - rather the opposite.

- The question of ethos is much deeper. It is remarkable that, although the industry is everywhere so integrated technically and operationally, and the staff have generally “grown up together”, the division into IM and TOs has seemingly led to such a loss of system-orientation.
4.2.3. Case Study C: Application of RSRRs in practice

This section examines national policies and practice on the protection of track workers. This relatively simple application, where the physical circumstances vary little between Member States, is used as a framework for comparing the fundamental characteristics, or philosophies, of the RSRRs.

This is presented first from a legal perspective, providing an overview of the allocation of responsibilities and how they are exercised. This is followed by a more specific analysis from an economic perspective, examining the extent to which costs are recognised, and how they are handled.

4.2.3.1. Overview

To understand how the different laws and procedures of Member State can be brought into a harmonious and efficient grouping we need to see how rules are applied on the ground. Variations may be encountered in legal, drafting, enforcement and regulatory strategies, and in sanctions, institutions, resourcing levels and other factors. An awareness of such variations is essential for assessment of the limits and potential of any proposals for harmonisation.

Even complete harmonisation of formal safety requirements in relation to a particular hazard could still present cross-border operators with high costs in complying with very different ‘on the ground’ requirements.

Member States vary in their regulatory strategies to protect track workers during train operations. In some (e.g. Germany) emphasis is placed upon human observation, with workers having to heed the warnings of safety guards. Others (e.g. the Netherlands) rely more on the replacement of human observers with fail-safe technical systems. In some Member States there is a high emphasis on access controls and segregating operations and maintenance (e.g. the French TGV system and the Netherlands) whereas others stress the qualifications required of human observers and the limitation of time periods for work and observation (e.g. Germany). A general approach to track worker safety is adopted in some Member States, but in others (e.g. Italy) emphasis is placed on relating protection measures specifically to maximum line speeds and the kind of work that has to be done (see also Great Britain).

The source and status of the relevant rules also varies across Member States. In some (e.g. Italy, France and Spain) the infrastructure manager (subject to approval) devises the rules. In others (e.g. Germany) regulations are promulgated by trade co-operative associations or even insurance associations for the relevant employees. Legislation is relied on in Spain, for example, and in Great Britain a role is played by the infrastructure controller’s licence, insofar as this licence demands that the relevant rules are made mandatory.

41 These analyses are based on responses from six of the seven selected Member States. No response is available from Sweden, because the Swedish authorities have found it an unusually difficult issue on which to be explicit.
The nature of the rules may also vary. Highly detailed prescriptions are the norm in some Member States (in e.g. France). In others (e.g. Great Britain and Germany) reference is made to general employers’ duties. The rules in many Member States include no qualification of duties with respect to costs of disruption (e.g. France, Italy and Germany), any judgement about proportionality being left to the courts. In contrast, general obligations of employers in the Netherlands and Great Britain demand such behaviour as is “reasonable” or “reasonably practicable”.

The responsibility for avoiding track worker accidents may also be allocated differently across Europe. The maintenance contractor will be looked to for principal liability in France and Spain, but in Germany the infrastructure controller is responsible for the safety of everybody concerned. In Great Britain both the infrastructure controller and the contractor bear responsibilities.

As for who acts to secure compliance with the relevant rules, government inspectors play a major role in France and Italy and the infrastructure controller also play a key part in those two Member States (as well as in Spain). In Great Britain a dedicated independent Inspectorate is central; France is distinguished by the use, now, of internal auditing by a specialised, independent department of the infrastructure manager.

Turning to the general approach to securing compliance, there is variation in the extent to which officials apply the relevant rules flexibly, so as to allow for economic or operational needs of the industry. Strict application of the rules, without concessions to economic or operational needs, is said to be encountered in France, Italy, Germany and Spain, but a more flexible approach is associated with the Netherlands and Great Britain. Sanctions for breaches of the rules again vary. In France there is emphasis on internal disciplinary measures but in that country, as well as in Italy, Great Britain and Spain, an important sanction is the inspector’s power to suspend operations on the track. Contractually-based sanctions play a part in France, Italy and Great Britain as do criminal sanctions. In Italy emphasis is placed on warnings procedures.

Steps to harmonise and integrate rules need to be linked to harmonisation on all these fronts. There is, however, evidence suggesting that such harmonisation may be achievable, at least in part, by co-operative ventures and networks. Thus the meeting of the Advisory Group on Protection of Labour, Health and Safety in Railways (18-19 March 1999 in Amsterdam) discussed approaches to classifying maintenance projects; to defining responsible actors for track maintenance safety; to designing-out the risks associated with track maintenance; to improving feedback on maintenance accidents and to introducing and developing Quality and Safety Assurance systems. Such work maybe required on all aspects of the rule enforcement process.

4.2.3.2. Decision rules

Case Study C examined an application where some trade-off between risk and cost is de facto accepted in all Member States. Thus:
• If people work on the track when normal train operations continue, they are at risk. Every year people are killed by this activity, and it must be expected that this will continue; but like road travel at 100 km/h, or the supply of mains voltage electricity or potentially explosive gas to people’s homes, the activity is allowed to continue, despite these deaths.

• This risk can be eliminated, very simply, by ceasing normal train operations when people are at work on the track. This is done where the risks are unusually great, for example where the speed of trains is very high.

• However in no Member State is this done in all circumstances.

• The reasons for not taking such measures in all circumstances are economic (excessive loss of capacity/excessive cost of providing track with low maintenance requirements/excessive cost of doing work at night and weekends).

The Questionnaire for Case Study C (reproduced in Appendix 6, in Volume V of this Report) sought information about:

• the extent to which the different railway safety regulatory regimes (RSRRs) recognise that there are choices, or options, as to what rules should govern this area of work, which involve different levels of safety; and

• given such options, how the RSRRs handle the problems they present, including making the choices between them?

In the Questionnaire six questions42 were to do with the existence of options.

The pattern of responses was clear-cut. Three RSRRs recognised the existence of options explicitly: Netherlands, Spain and Great Britain. Three recognised the existence of options only indirectly and reluctantly: France, Germany and Italy.

Six of the questions43 were to do with the handling of options.

Several strategies emerged for the administration of the rules once promulgated.

• The most detailed rules should have only contractual status, hence greater flexibility: GB, Italy, Netherlands.

• Observation of the rules determines enforcement (in the sense of criminal prosecution), except in the Netherlands, where there is no enforcement, and in Spain, where enforcement takes account only of the consequences of accident.

There were also several formal strategies for taking the decision on what the rules should be:

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42 Questions 2.2 (About flexible application, to allow for economic or operational needs), 3.1 (Does the railway set out to be 100% compliant?), 3.2 (If less than 100% sometimes accepted, when and to what extent?), 4.1 (Recent history of present rules), 4.2 (Ways in which rules could be more stringent) and 4.3 (Were these or other possibilities considered?).

43 Questions 1.5 (Are there non-mandatory rules which differ from or add to the mandatory rules?), 1.6 (Is principle of proportionality applied?), 2.2, 3.1, 4.1 and 4.3.
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- Decision by specialists: France (and probably others).
- Formulae which legitimise other than the maximum safety solution\footnote{For example, adverse effect on train service; or possible adverse safety effect elsewhere in the system.}: France, Italy, Spain.
- A “reasonableness” criterion: GB (formerly), Netherlands.
- Cost/benefit analysis: GB (currently)

Kuiken and Stoop (1999) argue persuasively that the practical implications of this trade-off for track worker safety, as technology advances and incomes increase, is a progressive shift away from procedures based on human lookouts towards more use of technical warning systems; and measures, such as mechanised inspections and reduced maintenance needs, to reduce the need for workers to be on the track. They also stress the special importance of clear allocation of responsibilities in a period of institutional change, and the importance of information exchange between all types of railway.

4.3. Analysis of the Impact of National RSRRs

This section first summarises the impacts of safety regulation in any industry, which have to be set against the safety benefits. This is followed by a summary of the views of the European railways on the impact of safety regulation in their industry. The section concludes with a preliminary analysis, which is developed more fully in section 5.2, of whether safety regulation is, or is not, a significant problem in the development of European railways.

4.3.1. The costs and benefits of industrial safety regulation

Industrial and transport safety hazards are widely regulated. Some of the principal reasons are the following.

- \textit{The regulator as informed buyer}: the technology may be complex, and consumers or passengers need an ‘informed buyer’ to influence safety standards on their behalf; the safety regulator fills that role.
- \textit{Externalities}: much of the risk of accidents may be borne by third parties or employees, and without regulation the operators might not take these risks sufficiently into account.
- \textit{Economies of scale}: Centrally-set standards and procedures may achieve economies of scale in supply and operation.
- \textit{Expertise}: small or new operators may not have sufficient resources to develop their own standards, and rely instead on the safety expertise embodied in regulations.

On the other hand, regulation also imposes costs, to be set against these benefits. These include:

- \textit{Direct costs}: the costs of regulatory staff, which may be fairly easy to identify and measure.
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• **Indirect costs:** the costs imposed on those being regulated, such as design and manufacturing costs, and the management demands of operating within an often complex and changing regime.

Regulation also has less obvious effects, which are possibly more important than the obvious ones, because they mostly affect the industry's capacity for change and development; although some of these, as noted where appropriate below, are simply the negative side of a necessary or desirable feature of safety regulation.

• **Inflexibility, delay and uncertainty:** Safety regulation tends to either resist change, other than change wholly devoted to safety, or to extract a safety price from it. New equipment is often required, as a regulatory principle, to meet higher safety standards than that of existing equipment. Another common principle is that a safety measure may not be removed, even if overtaken by new circumstances. Once a safety measure has been approved for future installation, regulators are likely to resist a change in plan. Safety regulators can also lack resources to assess particular situations or to police local discretion. They then tend to favour uniform “one-size-fits-all” solutions, and, understandably, solutions which deliver fully adequate safety at the riskier end of the spectrum. Regulation often introduces additional steps and uncertainty into business processes, so adding to costs - especially the costs of innovation. Even if there is provision for impartial arbitration or appeal, resort to that provision may involve costly delays. On the other hand caution about change is a crucial contribution to safety. So too is clarity, which can be obscured if flexibility requires complexity. The challenge is to find the right balance.

• **Protectionism against competition and against managerial reform:** An “insider” operator may recognise a safety measure as not cost-effective, but accept it because it is a barrier to the entry of competitors. Employees (who of course have a legitimate interest in safety measures) may defend practices such as double-manning as safety measures when they may not be.

• **Strategic game play:** Regulatory bodies may see their duty as pressing for safety, relying on others to put forward other considerations. A safety regulator is in any case much more exposed to criticism for under-regulation, if an accident occurs, than for over-regulation which “merely” imposes excessive costs. However the more the regulator departs from objective analysis those being regulated will tip their arguments the other way. To some extent this is inevitable. And those being regulated may have their own adverse incentives. However the more the process is driven by strategic game play away from open information and objective analysis, the further away the outcome is likely to be from the social optimum.

Safety regimes can also have adverse effects on safety. For example increasing the costs of the industry, and in particular the costs of change, reduces the rate at which assets are renewed. Most improvements in safety are embodied in new assets (new trains, new track, 

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45 An example would be a uniform requirement for a very high standard of automatic train protection, even on lightly used lines where much less expensive techniques would deliver a very high and quite acceptable level of safety.
new signalling). The rate of railway asset renewal is much slower than in most other industries, including the main competing transport modes; and any excessive cost of railways will lead to a higher share of traffic on other, sometimes more accident prone modes.

The further costs imposed by multiple regimes are discussed in section 4.4.

4.3.2. Views of suppliers and the railway industry on national RSRRs

Most railway industry respondents approached in this study did not feel that safety regulation was a material obstacle to innovation, in terms for example of developing new markets, or exploiting new (or second hand) equipment.

It is widely accepted that more harmonisation of standards would reduce the costs of supply. This perception however is given more weight by suppliers, to whom the extra costs are evident, than by national authorities, who are faced more directly with the substantial short term costs (and sometimes political difficulty) of changing national standards.

However few suppliers emphasised the opportunities offered by more harmonisation. Some may be constrained by the need to avoid conflict with their major customers. Some may be content, provided that the costs weigh as much, or more, on their competitors.

Challenges to the status quo came mostly from “outsiders”: such as train operators from another country or another industry, and from suppliers enthusiastic to develop European-wide markets. These respondents:

• reported what they considered to be undue obstacles to new developments;
• characterised the safety regulatory system as (at best) passive and excessively resistant to change, or even (at worst) concerned with paper processes rather than safety performance, and using safety as a cloak for protectionism.

Outsiders typically find that, in the course of introducing a new product or service, the costs of pursuing a challenge to the system are more or less certain, while the chances of success are speculative. Often, even if ultimate success would be almost certain, the delay is commercially unacceptable: a slow ‘yes’ would be even more costly than a quick ‘no’.

4.3.3. Some lessons from experience

4.3.3.1. Role of the infrastructure manager

The following lessons flow most strongly from experience in Great Britain, where there has been much more development than elsewhere of new contractual relationships between the IM and other parts of the industry. However they are not inconsistent with experience in other Member States.
1) The Infrastructure Manager (IM) should accept the obligation to provide information about its infrastructure known to be needed by actual and potential operators and suppliers for safety design and acceptance purposes.

This should extend to: providing such information when the applicant needs it; accepting any costs involved in providing such information when needed; accepting liability for the accuracy of the information provided; setting in hand a programme to obtain comprehensive information about its system within a reasonable timescale; keeping this comprehensive information up-to-date; and providing information about the safety-relevant response of the infrastructure to input from the systems of other operators and suppliers e.g. acceptable limits.

Where certain information about the environment\textsuperscript{46}, or about the equipment and operations of existing users of the infrastructure\textsuperscript{47} is needed by the IM for its commercial purposes or safety duties, and where that information is known to be needed by other actual and potential operators or suppliers, the IM should retain this information and make it available, in the same way as information about the infrastructure itself.

The mechanics of bringing all this about are for debate.

There will be cases where technical change, or new information about risks, mean that information is needed for safety acceptance purposes, which was not previously known to be needed. Responsibility for this is a separate question.

2) The IM should accept any costs resulting from its infrastructure falling below the standards laid down in the safety and other requirements, whether promulgated by external authorities or by the IM. This includes the direct costs of remedying deficiencies and also indirect costs imposed on others.

This should be subject (like all other safety obligations) to the requirement being open to challenge by the IM, on the grounds of the costs being not justifiable in relation to the benefits.

3) The ethos of acceptance process(es) for new equipment should be welcoming to new investment, system-oriented and problem solving:

- \textit{Welcoming to new investment}: New equipment or services should not be discriminated against in safety terms relative to existing equipment or services.\textsuperscript{48}

\textsuperscript{46} e.g. electromagnetic emissions from national electricity grid overhead lines.

\textsuperscript{47} e.g. electromagnetic emissions from existing train services.

\textsuperscript{48} Suppose that a service runs with 20 trains per day, and someone applies to run an extra service with a train of a new design. Suppose two safety measures are available; either would cost 1 million euro. One would apply only to the new train and would bring a total safety benefit of 2 units. The other would apply to all the trains and would bring total safety benefits of 1 unit in the new trains and 2 units in the old trains. On our proposal, the second measure would have priority over the first.
• **System-oriented**: Both applicant and acceptor should consider the costs and benefits falling on the railway as a whole.

• **Problem-solving**: Both applicant and acceptor should actively seek to overcome the obstacles to introducing new investment to the railway.

4) Decision criteria for accepting new equipment to the railways should be concerned with the **overall balance of costs and benefits**. This includes having regard to the balance of probabilities; considering all feasible options; recognising the strengths and weaknesses of different sorts of evidence, in particular modelling as compared with checking the actual performance of the system; and the IM being proactive in facilitating the testing of new technology under operational conditions.

5) There should be no presumption that existing equipment is exempt from changes in safety requirements. If retrofitting a safety measure would have benefits no less than its costs, it should proceed. Generally, the costs of retrofitting will be much greater than the costs of installing as part of new build, so there will be measures which are justifiable for new build, but not for retrofitting. However “grandfather rights” should extend only to the extent that there are no reasonably practicable measures available to reduce the risk.

Technology improves between one generation of equipment and another, and improved safety performance may normally be expected. However there should be no general requirement that new equipment should attain safety standards higher than existing equipment, either in particular areas or overall.

4.3.3.2. **Independent accident investigation**

In the Netherlands, Sweden and Finland, rail accidents are investigated by independent bodies (Transport Safety Boards) constituted for that purpose. These bodies are by charter independent of the transport sectors they investigate and also independent of the transport ministries and other regulatory bodies. Their mission is to promote safety and prevent future accidents by investigation of previous accidents and incidents. This is achieved by issuing of recommendations, which may be addressed to any relevant parties. In all three countries, the Transport Safety Boards are multi-modal, combining the general expertise in systems safety with the specific expertise needed for each transport modality. (Modality-specific boards, with varying degrees of independence, exist in some of the other EU countries, but not for rail transport.)

The experience of countries with Transport Safety Boards (the United States, Canada, New Zealand and to some extent Russia and India in addition to the European boards) has been positive. Increasingly, it has become recognised that such boards must focus on the identification of systemic safety deficiencies, to the exclusion of placing blame for accidents. Achieving this requires the independence of the board, the ability to call on expertise as needed, and protection from court proceedings determining blame and punishment. Different countries approach this independence in different ways, and the Independent
Transport Safety Association (ITSA) which includes all of the countries mentioned in this subsection, helps each country to learn from the experiences of others.

Although most attention to Transport Safety Boards in the media has come from aviation accidents or major maritime accidents, rail accidents are coming increasingly into the public eye, and the ITSA members are devoting increasing resources to rail accident investigation.

A wider issue is whether such Boards should have a more comprehensive transport safety role, at the national or regional or EU level. This wider concept of a Safety Board is a complex issue, examined for example in Kahan et al (1999) and Bouchard (1999). We do not develop the issue in this Report. We do however recommend the concept of independent accident investigation.

4.3.4. Overview of national RSRRs

The implementation of railway safety regulation in Europe, despite restructuring, still lies heavily with the principal national operators. The majority view within the industry, on the evidence of the level of satisfaction found in this study, appears to be that this is right. However responses to our enquiries are based mainly on the views of representatives of the NI, or of the RL, or of the monopoly, usually still-publicly-owned IM, all of whom have an interest in the status quo.49 The view of others within the industry is usually that this structure generates excessive obstacles to innovation, in markets and in equipment.

One interpretation of satisfaction with present RSRRs is that the present IM based regimes are fundamentally sound, and dealing satisfactorily with the proposed new world of a fast changing, market based, international industry. This is an interpretation which is, we suspect, widely held.

Another interpretation is that the satisfaction is a measure of the railways’ problems of a culture of defensiveness towards economic threats or opportunities, development of new markets, or restructuring, and of valuing consensus for its own sake.

These issues are developed in section 5.2. In this section we simply note that an inflexibly regulated environment would be expected to show, besides a high level of safety:

- higher costs of safety at the margin, in some areas, than in more dynamic and politically less exposed industries;
- considerable uniformity of technology and practices within regimes, but not between them;

49 Widespread critical debate was reported only in Great Britain. This could be related to the GB system being the most punitive, or one where a formal economic approach to safety decisions has been more overt; or perhaps the range of ethical values in GB is wider, and/or conflict resolution mechanisms less effective, than elsewhere; or perhaps there is in the GB system more to complain about. However, although some of these factors may contribute to the higher level of reported critical debate in GB, we believe that the main reason is the current nature of its railway industry. Overt disagreement seems likely to be found where there are many players, new, undeveloped relationships and sharp economic incentives. Only in Great Britain do all of these apply. A number of project partners in other Member States suggested that, if competition develops, stresses will emerge from barriers to entry and other conflicts of interest. In effect, a dynamic system will lead to stresses.
limited innovation, and delays in bringing it about;
• little effective criticism of safety regulation.

RSRRs within Member States show these characteristics, and some developments at the European level are showing similar signs.

4.4. Analysis of the Impact of a Diversity of RSRRs

Multiple, differing regimes create many costs. This section briefly reviews these costs. It then examines the origins of this diversity within European railways; considers some examples; and examines potential policy responses.

4.4.1. The costs of diversity

One cost of diversity in regulatory regimes is loss of economies of scale in production. Diversity maintains both a separation of products and the division of company operations into separate national markets.

A second cost is that of “redundancy” of approval processes. Unnecessary costs are incurred if, for no reason other than bureaucratic diversity, a company has to submit its product to different tests for different markets.

A further cost stems from the scope for exploiting diversity as a weapon for protectionism. National suppliers and operators can be protected by regulatory procedures which are less onerous for them than for potential competitors from other countries, because of information requirements, or because of (perhaps unintended) bias in subjective approval processes, or because national companies are better informed about impending changes, or simply because they are unique to that country.

Diversity not only adds to costs. It can also directly reduce safety. An example from railways is where individuals have to respond to different operating rules and signals as they cross-borders, as where train drivers have to learn different platform despatch procedures, and road vehicle drivers have to make the best of different level crossing signals and procedures.

4.4.2. The origins of diversity

Regulatory diversity in European railway regulation stems from a number of sources. Variety is thus encountered inter alia in the legal systems, procedures, constitutions, traditions and institutions of Member States; in the division of governmental and regulatory functions across institutions and areas of law; in standards of proof; in conceptions of due process and transparency; in enforcement procedures, cultures and traditions; in the types of sanctions applied to those who break the rules and in the levels of resourcing made available to regulators.50

50 For general reviews of regulatory diversity see Baldwin and Daintith (1992), Chapter 8; and Sykes (1996).
The set of problems to be regulated, or the decision criteria by which they should be assessed, may also vary in nature across different Member States so that differences in tastes, incomes and geographical factors, such as climate, may in principle be quite proper constraints on harmonisation.

Income differences between Member States span a range of about 2:1, and the willingness-to-pay\(^{51}\) of their citizens might vary similarly. These differences, however, have diminished and seem likely to continue to do so. In the context of railway safety, these national differences are in any case less relevant to the extent that passengers, goods and trains cross borders. Other differences in tastes across Member States could also affect people's willingness-to-pay for safety. Differences in social tastes may contribute, together with accidents of history, and differences in culture and legal and political tradition. However, tastes across Member States, in terms of social attitudes to railway safety, appear to be very similar.

Overall, differences in income and taste seem unlikely to justify regulatory diversity, given its costs.

There are more enduring differences across the EU in topography and climate. But these differences do not correspond with national borders. Spain has problems of heat, and Sweden of cold, which the other does not experience in any general way. But it seems reasonable to assume that issues of cold also arise in Finland and Scotland, and high areas; and that issues of heat arise in Portugal, Italy, Greece and Southern France. Indeed, it seems plausible that countries like France and Italy encounter most of the special problems of topography and temperature found in the EU.

Even within a Member State, diversities that reflect geographical factors are efficient. But diversity within or between regimes with respect to the same geographical factors is inefficient. It adds to cost without benefiting safety. Railway regulations for Alpine conditions, for example should ideally be the same in Austria, Italy, France and – to the extent that the issues are the same in other high steep cold areas – in the relevant parts of Spain and Sweden. The issue then is how far the pursuit of uniformity is worthwhile in practice, given a starting point of such diversity.

However topography and climate are not seen (except in extreme cases) as issues which should influence safety regimes, nor even standards which are seen as “safety” standards.

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\(^{51}\) The “willingness-to-pay” concept is a measure of social preferences which, despite being difficult to measure, is widely applied in transport. It is a measure of the informed preferences of those who are exposed to the risks and who pay the costs of safety measures, which in some regimes, including the ALARP principle in the UK, is seen as the appropriate conceptual basis for safety regulation, with qualifications as discussed in section 5.2.3 below. However other regimes may use other conceptual bases. (Willingness-to-pay does not mean that public transport passengers necessarily expect to be able to pay more or less for a more or less safe air, rail, sea, or coach service. In practice they rarely have such an option, and passenger transport companies, in contrast to car manufacturers, for example, generally choose not to compete explicitly in this way.)
Most European diversity in railway safety regulation is not a consequence of economic or physical differences, but an inheritance of its long, nation-based history. This history has bequeathed many, often arbitrary differences in technology and operational methods\(^{52}\) and differences in institutions and traditions. National or other sectional interests (even aspects of ‘regulatory capture’\(^{53}\)) may also impinge on regulation in different ways across Member States. Regulatory convergence will not come quickly or easily in the face of these divergences.

4.4.3. Examples of diversity

This section first presents some practical examples of diversity. This is followed by a discussion of the boundary between safety standards and engineering, where we suggest that the isolation of safety can be a serious obstacle to change. The section concludes with a discussion of why diversities persist, even when they appear to bring more cost than benefit.

4.4.3.1. Some practical examples

A major manufacturer suggested to us, in the context of the Netherlands, an illustrative set of differences as follows, between the requirements of different national railways, especially between those of the Netherlands and Germany.\(^{54}\)

The list is here reproduced in a slightly generalised form, and divided into three Groups.

4.4.3.1.1. Group 1: Differences which physically prevent interoperation, and where harmonisation is so costly as to be out of the question in the foreseeable future

1) **Power supply:** Many types of electrical power supply are used in EU mainline railways. This would be extraordinarily costly to harmonise. However the technology for designing traction to handle multiple power systems has advanced in recent years. The ICE 3 train, for example, can handle four types of power supply, although clearly this increases the cost.

52 Many of these are very simple differences on which agreement on standardisation can be extremely difficult. The difference between Dutch and German conventions on passenger door locks was noted earlier. In Great Britain the safety device in cabs to remind drivers to check the signal aspect before moving away is applied to the traction power and illuminates a red light in the cab. In France and Belgium it is applied to the brakes and illuminates a blue light.

53 There may or may not be instances in Europe’s railways of regulatory capture (i.e. a formally independent regulatory colluding with the regulated body, in the perhaps genuine but mistaken belief that this is in the public interest). Given the pressures for NIs to follow nationalistic purchasing policies, and the influence of Trade Unions in Europe’s railways, it would be surprising if instances did not exist. We have not however sought evidence in this potentially contentious field. The case for action to reduce the costs of diversity does not depend on it.

54 We believe that a full list of requirements which present obstacles to interoperability with the EU, and which arise wholly or partly from safety considerations, would be very much longer than the list considered here. Some respondents were unaware of the differences between national systems (because they operated entirely within a single RSR). Others were reluctant to document differences, possibly because they saw no prospect of changing them, and perhaps sometimes they had little incentive to change them.
2) **Track gauge:** Countries west of France and north and east of Poland have wider track gauges than the European standard.

3) **Space around the train (structure gauge/kinetic envelope)**\(^{55}\): In the Netherlands the structure gauge is large, but in countries with more tunnels it is considerably smaller. The Dutch rail companies are not likely to be happy with reducing the gauge for rolling stock used only in the Netherlands.

4) **Train Detection:** Every country has different specifications for detection, so that the track ‘knows’ where the train is. This is done with track circuits in the Netherlands, although this system may fail if there is poor conductivity, for example because of leaves on the track, this problem being greater on diesel trains. In Germany a special detection device hangs from the train and touches a contact next to the track.

These Group 1 differences are for the most part a burden which the industry has to accept and carry as best it can.

4.4.3.1.2. **Group 2: Differences where the appropriate degree and nature of harmonisation may not be clear cut**

These Group 2 differences are more complex than those on Group 1 above or in Group 3 below. Even more than those in Group 3, they need clear, generally accepted decision rules if they are to be resolved efficiently. They cannot be settled satisfactorily by simple decision processes which avoid explicitly trading-off safety against other factors.

5) **Platform height:** Platform heights vary widely around Europe. The Netherlands is reasonably consistent with heights ranging between 760 and 840 mm. In Germany, there are larger differences, with four different platform heights: 100-200 mm, 560 mm, 760-840 mm and 930 mm (Regiobahn). Small differences can handled by steps, but larger differences require a different design.

The relationship between train design and platform height may preclude operation (because the train fouls the platform); or it may permit the passage of trains but present unworkable difficulties to passengers (e.g. because the lowest step is too high above platform level). Both of these cases belong in Group 1 (corresponding to a structure gauge issue, since altering either platform or train is generally very costly). However as the height difference reduces the consequences move from commercial impracticability, through different levels of inconvenience and risk, until they merge with the background risks of “slipping, tripping and falling”.

Platform height discrepancies cause interoperability problems, and debates about what changes are justified and who should pay for them. Within the GB mainline system this was one of the arguments between a new operator (HEX) and the IM

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\(^{55}\) There are instances where structure gauge incompatibilities are acceptable on some views but not others, so even here the implications can be a matter of degree and fall into Group 2.
(Railtrack), with the IM wanting interoperability and the new operator wanting a special platform height.

5) **Weight of traction and track curvature:** Traction puts forces on the track. If the engine is heavy or if the track is very curved these forces are higher. The track in the Netherlands is more curved than in Germany; thus the heaviest engines are not allowed on every part of the Dutch track.

Train weight and track curvature raise similar issues to platform height, in the sense that the adverse consequences vary with the degree of discrepancy. For a small departure from the ideal, the adverse consequence will be a small increase in the rate of wear of the track and a small increase in overturning risk.

The issues differ from platform height however in that there is an operational measure available, which could reduce the risk as much as required. This measure is to reduce the speed of the heavier trains. This will have a cost, in terms of driver route knowledge, signing, and route capacity. But it can reduce the extra risk of heavier trains to any level, including zero, while maintaining a service.

5) **Automatic train safety systems**[^56]: Countries have different specifications for their automatic train safety systems - ATB in Netherlands, Indusi in Germany, etc. The ICE 3 train, at extra cost, has the four different safety systems which apply in Germany, the Netherlands, Belgium and France.

Differences in train safety systems may present no physical or operating obstacles to interoperability. Operating without an automatic system involves risk: duplication on the train is likely to involve considerable cost.

Assessing the costs and the benefits of train protection systems is relatively straightforward. The work which has been done shows that in some circumstances even retrofitting can appear worthwhile - for example where it permits elimination of a second driver; while in other circumstances the costs may be inordinately high relative to the safety benefit, even when the track is already equipped with the system in question.

Train protection is a test case. Often the magnitudes of the costs and the safety benefits are not materially in dispute. However the view frequently prevails that, even if the costs are extraordinarily high relative to the benefits, such that safety could be improved much more by spending the money in other ways, this is irrelevant to the policy decision.^[57]

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[^56]: This belongs in Group 2 when the train protection system is not integrated with the signalling and control system. When it is integrated it may belong in Group 1.

[^57]: In one example a minor Swedish line was closed down for this reason, with a consequent increase in road traffic and, probably, an increase in transport deaths and injuries. The railway safety regulator would not be held in any effective way accountable for such a reduction in transport safety.
5) **Crash resistance:** Some operators (for example in the USA) require their trains to be extremely strong. Or crash resistance can be improved by crumple zones, which may take up potentially valuable space. There are of course other aspects of design to reduce injuries in the event of a crash.\textsuperscript{58} A balance has to be struck, but different Member States may choose different standards.

Differences in crash resistance, like differences in train protection systems, present no physical or operating obstacles to interoperability, and involve added risk where a train is of lower specification. However for crash resistance:

- the risk reduction is not a step function, but much more a matter of degree;
- the scope for retrofitting extra crash resistance is very limited.

Crash resistance has recently been an issue in Great Britain, where again there was no real dispute that the proposed requirement represented poor value for money, but other considerations prevailed. These GB regulations would apply to rolling stock coming from elsewhere in the EU. They may illustrate one reason why an international supplier told us that to apply the GB standards to all of their products would make them hopelessly uncompetitive in other EU markets.

The appropriate response to differences of this Group 2 kind, in terms of permitting or not permitting interoperation and in terms of required risk reduction measures, will depend on:

- the degree of the discrepancy;
- the risks of interoperation without taking additional measures;
- the net cost and the risk reduction of available measures;
- the decision rule.

Examples such as those in Group 2 therefore represent serious test cases for any proposed approaches to reducing the obstacles to interoperability.

4.4.3.1.3. **Group 3: Differences which seem hard to justify**

9) **Wheel size:** At points (or switches) there are gaps in the rails and if the wheels are too small there is a chance of derailment. The small wheels which Talbot design for some German trains are for this reason not accepted by Railned. However DB has tested and accepts the wheels on these trains on equally wide gaps in their points. Railned has the DB report (provided by Talbot), but still considers the wheels too small for the Netherlands.

10) **Maintenance schedules:** Railned prescribes maintenance or checks every 8 weeks for some parts, and every 10 years for other parts. This is based on advice from the supplier and on experience over the years. In Germany a ‘\textit{hauptundersuchung}’ (complete stripping the engine) is required every 6 years. This leads to discussions

\textsuperscript{58} One minor crash resistance feature peculiar to the Netherlands is that some Dutch trains are still required to carry a “koeienvanger” (cowcatcher). Some diversity of this kind is cost-effective.
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when Dutch trains go into Germany. (Railned claim that they always allow trains whose maintenance is accepted in Germany.)

11) **Cab design:** The admittance of rolling stock is regulated by a UIC fiche with regard to a second driver, and this causes some differences in Dutch-Belgian operations. Due to minor technical differences in the position of the drivers’ cab of the 6400 series and the vision lines during left track occupancy, Shortlines (using Belgian equipment) is allowed to drive single-handed, while NS Cargo may not.

12) **Fire safety:** There are three classes of fire safety (defining how fast a fire will or could develop). Some countries require the highest class while others allow the lowest (which is also very safe). Sometimes the upgrade of class can be achieved by a change of material, but it is sometimes necessary to change the design.

13) **Emergency escape routes:** Regulations in all Member States require at least two escape routes per compartment. However some require a hammer to break a window, while others require the window to come out if the rubber around it is torn out. (For example the Dutch authorities claim that hammers would be stolen.) Because the current design of trains has the windows glued in, ‘tearing out of the rubber’ requires a new design and production process.

14) **Door locks:** Certification criteria for door locks differ between Belgium and the Netherlands: old Belgian rolling stock may be used abroad, while new Dutch stock may not.

15) **Front window shield impact protection:** Formal certification of equipment with respect to this has to be repeated, to admit rolling stock to adjacent national networks.

16) **Asbestos:** Differences in asbestos insulation between facilities in German and Dutch coaches prevent the mutual use of these coaches. Coaches acceptable to the Dutch safety authorities are not acceptable to the German safety authorities. Thus German coaches are used for most passenger services between Germany and the Netherlands.

These Group 3 differences appear prima facie to:
- not involve deeper incompatibilities between national railway systems;
- be avoidable with little or no cost;
- be avoidable with little or no adverse effect on safety.

None of these Group 3 examples implies any criticism any of the national RSRRs in isolation. It may well be that every national decision involved was informed, legitimate and reasonable. However, given the competence and proper concern for safety of the authorities and suppliers concerned, which we believe in this case are beyond dispute, it follows that either national solution gives a satisfactory level of safety. From this it follows that any loss
of safety in moving from one to other is most unlikely to be enough to justify the admitted adverse effect on interoperability and single market objectives.

The Group 3 list is itself considerable, and we have mentioned other such differences. They are evidence that diversity in RSRRs can detract from interoperability without any sufficient benefit to safety.

The differences arise from accidents of history, including very minor differences in the technical judgements of different authorities, should be swept away as soon as Member States can agree to timescales for introducing common standards, because this would yield continuing future savings for a trivial initial cost. We note however that obtaining agreement can be difficult, as discussed in section 4.4.3.2, even for cases of this kind.

4.4.3.2. Why differences persist

Very few of the illustrative list of differences in section 4.4.3.1 are desirable in the terms discussed in section 4.4.2, for reasons such as differences in topography or climate. However all these differences, and very many others, nonetheless persist.

Those in Group 1 persist because the cost of eliminating the difference would be very high, in terms of the direct cost, the disruption while making the change, and the time required.

In Group 3 cases, differences persist even though it seems doubtful that any material differences in safety are in question, and the costs of at least moving towards convergence would be modest.

There are however several factors, besides cost, which might prevent beneficial harmonisation taking place.

One factor is that the benefits and costs are skewed between Member States. For example, harmonisation will often take the form of one railway adopting the arrangements of another, where the costs all fall on the first and the benefits are shared. It may be difficult to negotiate a mutually acceptable sharing of the benefits, which are long term and hard to quantify with any precision.

Possibly more important is the skew distribution of costs and benefits within Member States. The incumbent institutions may perceive the costs of change as falling on them (e.g. in terms of reduced size and employment opportunities) and the benefits as accruing to others (e.g. national Treasuries, incoming competitors).

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59 Mountainous territory might be expected to be associated with sharper curvature, although the tighter curves in the example in section 4.4.3.1 are in the Netherlands!

60 In some cases the cost would however be much less if it applied to only a part of the system. In some cases, the cost might be very low if the change was introduced only when equipment was replaced, but then the time scale could be very long indeed.
Another factor is that a safety regulatory authority might refuse to consider relaxing a safety measure to a level accepted in a neighbouring Member State, even if large non-safety benefits resulted. We believe that such attitudes are common, but we see no reason why, overall, harmonisation and interoperability should not be safety-positive.

However the evidence on these factors, even after this study, remains largely anecdotal and impressionistic. Indeed it would seem to be still an act of faith (albeit a faith which we share) to believe even that the benefits from railway harmonisation in general outweigh the very large costs.

Some differences may interact with other characteristics of the system. For example, it has been suggested that one reason for automatic train safety systems (e.g. Indusi, Automatic Train Protection) being used more on the Continental mainland than in GB has been the greater emphasis in Britain on crash resistance or crashworthiness. It has also been suggested that the balance between design of bogies and quality of track is different between GB and the Continent, where track quality is said to be higher. In such cases it may not be realistic to change one characteristic without changing in the other.

We suspect that there are changes which would improve interoperability materially and have no material effect on safety. However we do not believe that a simple request to a national safety regulator to relax a requirement (in isolation, without at least proposing an improvement elsewhere) will obtain a quick and positive response. We believe that the conditions for cutting through Group 3 issues, and for working out the best balanced solutions to Group 2 issues, require the following.

- Changes to the legal framework, requiring
  - due process including an obligation on authorities to justify rejecting equipment or methods approved by another Member State;
  - clear decision rules which oblige authorities to take into account all the costs and all the benefits accruing to society (not just safety, and not just within the individual Member State).

- Changes in ethos, to include
  - a European rather than a national focus;
  - recognition of the need to balance safety against other good things;
  - a problem-solving and system-oriented approach.

- Changes in structures, to include
  - bringing national authorities together to address these issues of interoperability.

4.4.4. Potential policy responses to regulatory and language diversity

There are many potential responses to diverse regulatory regimes (see generally: Baldwin and Daintith, 1992; Snyder, 1993; Dehousse, 1993; Sykes, 1996; Majone, 1996; Baldwin and Cave, 1999). These responses are constantly evolving in European government and they can overlap, but they can be classified as listed below. This list of responses followed by a discussion of the specific problem of language.
4.4.4.1. A list of policy responses to regulatory diversity

- **Common standards**, or “strict harmonisation” applied by law in all Member States.
- **Mutual recognition** (also known as cross-acceptance), where the regulators accept approvals granted by the regulatory authorities in any other Member State and where central legislation defines performance standards, but generally not detailed specifications. (See Pelkmans, 1986; Baldwin and Daintith, 1992, chapter 8.)
- **Policed decentralisation**, where Member States regulate services that enter from other Member States, but do so subject to centrally policed rules of ‘fair play’ (e.g. as to transparency and due process in procedures for approval – see Sykes, 1996).
- **Co-ordinated or networked regulation**, where authorities at the European, Member State and possibly industry or professional levels coordinate to achieve consistent controls. (Elements are seen in the banking and competition fields – see Majone, 1996; Baldwin and Cave, 1999: 163.)
- **Industry self-regulation**, where standards are set and applied by professional or industry-based bodies, under delegation and supervision from the European centre. This may be a sub-set of ‘Common standards’ if industry determined standards are given legal authority.
- **Agency-informed regulation**, where agencies are established at the European level, not to regulate directly, but to inform and co-ordinate Member State level regulators and to encourage consistency of approaches. (as seen, for instance, in the environmental, working conditions, drugs and medical products fields – see Baldwin and Cave, 1999: 163-4; Shapiro, 1997; Kreher, 1997; Majone, 1996: 274; Harding and Swart, 1996; Everson, 1995; Lenaerts, 1993; Dehousse, 1993). Several of these processes may be supported by **Soft Law harmonisation**, where rules that are not legally binding (such as recommendations, communications and codes of practice) are used to coordinate regulatory practices and procedures. (See Baldwin, 1995: chapter 8; Snyder, 1993; Wellens and Borchardt, 1989.) Consistency can also be achieved by **Indirect harmonisation**, where consistency of standards in one field (e.g. safety) is achieved through action on another front (e.g. on operational technical standards).

In European railway safety regulation there is a potential place for most of these strategies for diversity. No single response to diversity can be appropriate across the board. Different strategies and combinations of response will be appropriate to different safety issues and to different areas of rail activity. This is developed in section 5.3.5 below.

4.4.4.2. The problem of language

One substantial problem for European railway interoperability is that of language. This is not an issue on which we feel competent to make recommendations - beyond the fact that it
an issue which the industry should consider at the European level. However we record here some observations of our own and of train operators.

We see no reason to suppose that undue weight is placed on language by train operators. Whereas truck coach or car drivers can travel through road networks in countries of whose language they know little, this not true of train drivers.61

Aviation faces the same problem, but even more severely since, apart from electronic beacons, voice is usually the only form of contact between the air traffic controller and the pilot. Aviation resolves the problem by agreeing to a common, worldwide language and there is some support for a similar approach for European railways. Partners from two non-English-speaking Member States suggested that the use of English for international European railway traffic, where it crosses language boundaries, should be seriously considered.

The arguments for and against a common language, and for against a particular choices of language, seem clear in principle even if the balance between them is arguable. Historically the “railway languages” of Continental Europe have been French and German. They are for example the official languages of COTIF. English has become more widely used in recent years, partly because there is now a link between the GB and Continental railway systems; but the two native English speaking Member States remain geographically very peripheral. English is more widely spoken than other foreign languages in most Member States and in prospective new Member States. On the other hand, for any proposed common language, there would be understandable objections from some adjoining Member States, where the common language was not widely spoken, to using a third language rather than their own.

A common language would offer advantages in terms of European language training and safety and other training. It would generally help communication within the industry and help to build the idea of a “European industry”. However it appears to be at most a long term prospect.

In the absence of a common language there are several measures which the industry might consider.

There is a need for a continually updated glossary of railway terminally – at least in French, German and English and preferably in all the EU languages. Even in this, non-technical study we have found terms which have not been easy to translate. We understand that the UIC already provide a glossary of this kind. It would be helpful to give this a higher profile, for example on the UIC website, and to encourage wider contribution to its content.

There may be scope for developing some common language training at a European level, or for developing and evaluating the effectiveness of different types and levels of language training.

61 Nor, sometimes, of other staff. Safety may require some multilingual ability of those who would use the public address system of an international service in an emergency. Language skills are expected anyway as part of the quality of service of high profile international passenger services.
There may also be scope for examining the extent to which recruitment should give priority to language skills. For a post which requires a second language, it is presumably much less costly to recruit someone with that language skill that to train him or her after recruitment. However, much recruitment will be for staff in whom language skills may be of very uncertain future value. Some common analysis of the minimum level of language skill which is appropriate to particular tasks in particular circumstances - on trains, stations and infrastructure - could be of value.
5. DISCUSSION

In this Chapter we first discuss, in section 5.1, the scope of safety regulation and the institutional context of today’s developments in European railway safety.

Section 5.2 sets out some principles which, in the light of our findings, we see as key to for the development of good safety regulation of European railways.

In section 5.3 these principles are applied to draw practical conclusions and develop recommendations.

5.1. The European Railway Context

5.1.1. The scope of safety regulation

Some differences between the regulations of national railways are concerned purely with reducing the risk of personal harm (e.g. crash resistance of passenger vehicles, emergency escape routes); while others, in contrast, are a part of running any railway, and would be needed even if there were no risks of personal harm (e.g. train detection, maintenance schedules). Some risk-reducing design features are additional (e.g. automatic speed control, crash resistance); while other design features are constraints, managed so as to reduce risk to a chosen level (e.g. structure gauge, weight of traction/track curvature).

Many within the industry would like to see a clearer definition of what is a safety issue.

One suggestion put to us is that safety equipment can be defined as that for which a malfunction creates a hazard. Thus, for example, the axles, wheels and axleboxes of a train are in this sense safety equipment, whereas the engine might not be. However although this is a useful distinction, almost all equipment has some safety dimension. Even the engine for example is a fire hazard; security of its mountings may be crucial; and in some environments even engine failure could be dangerous.

An alternative suggestion made to us is that safety equipment, if it needs to be defined, is equipment which would not be present were it not for safety considerations. Thus, axles and wheels in this sense are not safety equipment, but door locks and automatic train safety systems are.

Another suggested alternative is to think not in terms of equipment, but in terms of safety functions, in preventing accidents or injuries and in responding to safety threats. This reflects the reality of safety regulation.

However any definition of some acceptance or design issues as being “safety”, and others not, faces the problem that issues which at first sight appear to involve simply engineering compatibility, with negligible safety connotations, are rarely like that.

In practice, as illustrated by the examples in section 4.4.3.1, railway procedural and standards issues are scattered along a spectrum, between one extreme where the issue (as
perhaps with track gauge) is concerned only with operational need, with little or no safety dimension, and the other extreme where the issue (as perhaps with emergency escape routes or emergency lighting) is wholly safety with no other issue of operational need. Most lie some way from either extreme.

It so happens that issues which are often seen as “safety” (for example front windshield protection) tend to be less costly to harmonise than issues which are more often seen as “engineering” (for example structure gauge). But such a distinction seems misleading in the context of the Commission’s concerns. In any case imposing one party’s views on “safety” on other parties is likely to be more difficult than dealing with less emotive issues of engineering, performance and cost.

There is certainly a need for clear and well publicised definitions where terms such as “safety equipment” are used in legislation. However dividing issues sharply into “safety” and “non-safety” conceals the nature of these decisions - in particular decisions about how the balance is struck between safety and other aspects of a good railway service. We believe that in most standards and procedural contexts safety should be considered as one, albeit crucial, issue among others, as in the RAMS acronym, and not as a separate issue.

5.1.2. The drivers of change

Such rapid and sweeping change in the European railways, as portrayed in Chapter 2, has been unknown since the beginning of the railway age 150 years ago. This change is driven mainly by three factors.

The main driver of this change is the moves towards contestability and level playing fields brought about by EC Directives.

A second driver is technical change and trans-national investment. Conspicuous examples are cross-border TGV lines and services, and the fixed links across the Channel and the Baltic. Developments such as ERTMS and “globalisation” of the supply market might also be expected to exert an influence, although their effects are not yet visible. (The supply market faces some special difficulties, given the historical structure of national railways as their main customers. 63)

A third driver, relevant specifically to safety regulation, is concern about regulatory effectiveness, both in public opinion and in government. This shows itself in several ways:

• A long term trend, as incomes increase, to more popular concern with safety combined sometimes with weakening of trust in authority.

62 Since actions need to be prioritised not by cost, but in terms of the relationship between cost and the associated benefit.

63 As noted in the following comment: “While the [four dominant] groups became global their structures remained national, each acting largely independently. That hindered harmonisation, as even the big national contracts were insufficient to allow the economies of scale required to generate long term profitability. Serious reform was further impeded by political constraints: as most customers were state owned, few manufacturers dared antagonise national governments by announcing big plant closures or job loses.” Financial Times, 15 November 1999.
• The movement towards separating the investigation of major accidents from other safety regulatory functions, and unifying the investigation of railway accidents with that of other transport modes.

• A long term tendency among safety professionals towards acceptance of more analytical and more explicit approaches to risk, including more use of risk assessment techniques, and sometimes the valuation of prospective risk reductions in financial terms.

• In one Member State, a movement towards more public and more punitive enforcement.

5.1.3. Implications of restructuring and commercial incentives within Member States

5.1.3.1. Stages of restructuring

The effect on RSRRs of restructuring can be related to the differing ways in which restructuring has been approached in Member States. Three stages have emerged and a fourth is on the horizon. Multinational restructuring is a further prospect.

Stage 1: Minimal restructuring

Even with this minimal restructuring, formal compliance with Directive 91/440 has in most cases brought far-reaching rationalisation of laws and regulations. However, the integrated nationalised industry (NI) remains the centrepiece of the railway. Infrastructure manager (IM) operating functions are devolved back to the NI. Any franchising of train services is done by the NI. Safety regulation lies formally with the RI or the Ministry, but the resources and the initiative remain with the NI.

*This is found in Austria, Belgium, France, Greece, Italy, Ireland, Luxembourg, Spain and Portugal.*

Stage 2: Contestable markets for train operation; IM and/or RI as regulator

In this stage, contestable markets in train services are actively encouraged. This may be extended to infrastructure renewal and maintenance. The IM is often perceived as having an inherent system safety role, including management of the interaction with the train operators (TOs). However there are many variants in the IM role. The IM may be drawn closer to government than when it was integrated in the NI. The Railway Inspectorate (RI) and IM may be merged; or the IM’s original functions of traffic management, safety regulation and infrastructure management may be separated. There may be an increase in the number of smaller IMs independent of the dominant mainline IM.

*Variants on this are found in Denmark, Finland, Germany, the Netherlands and Sweden.*

Stage 3: Contestable markets for train operation; privatisation of infrastructure

In this stage the IM becomes a regulated private sector monopoly. Train services are operated on a wholly competitive basis, albeit in terms of medium to long term franchises
for routes, rather than open on-rail competition. However, the self-regulation responsibilities of the IM for its own activities, or those of TOs, become a deliberate decision, rather than taken as axiomatic from its public sector status. There is no evidence that the tension between any system safety role of the IM and its business incentives might compromise safety; but it has in GB created an incentive to shift costs and accountability to others in the industry.

_This stage is found only in Great Britain, for the main lines._

**Stage 4: Contestable markets for train operation and infrastructure**

The fourth stage still accepts the infrastructure as a natural monopoly, but may divide it differently from the way it has been, and on the basis of a concession to run it for a limited period.

_This is not yet found in practice, but is in hand in Great Britain for London Underground and the Channel Tunnel Rail Link to London. It might be considered more widely, and in other Member States, in the longer term._

**Multinational restructuring**

In some cases it would seem attractive in the longer term to reorganise infrastructure management to transcend national boundaries, although we have seen no enthusiasm for this. Multinational restructuring of train operators will develop of its own accord, as access to national networks is opened up.

5.1.3.2. _The role of the infrastructure manager_

Many railway risks involve interaction between infrastructure and train (collisions, derailments, running into obstructions, boarding and alighting). Many central engineering and operational systems of the railway also involve this interaction: signalling, communications, many operating procedures, gauging and loading issues. Often the interactions involve unplanned consequences: for example between track and wheel affecting ride and fatigue performance, or electromagnetic interference. These interactions make control of these risks more complex.

When train services are divided from infrastructure management, safety responsibilities for these interacting systems typically remain with the infrastructure manager (IM). This is associated with the IM remaining a unity and generally remaining in the public sector; while train services to a greater or lesser extent become contestable, fragmented, and often partially privatised.

Separating off the train services has not resulted in more competitive and innovative IMs, but rather the reverse: the IM has incentives to use its monopoly position and its safety regulatory status to shift risk and cost to the rest of the industry.

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64 In the UK, only limited scope is now seen for open competition for rail passenger services in the ways which are found in, for example, the coach or airline markets. However franchised routes often overlap routes covered by other franchises.
The problems are structural. The discrepancy in size between IMs and TOs, especially new TOs, is often very great. Train operators often have franchises of limited duration. The IM is a monopoly, while much of the rest of the industry, train service providers and equipment suppliers, face Europe-wide competition. Suppliers also have to be wary of offending IMs, who are major customers.

Great Britain illustrates developments where restructuring of the railway has been pushed fastest and furthest. The role of the IM (Railtrack), as safety regulator has been under challenge from an early stage. One challenge has been the argument that safety decisions should not be allowed to be distorted by the profit motive. Another has been criticism from the rest of the industry that the IM was shifting costs onto them. Following the Ladbroke Grove accident in October 1999, the UK Government has said that it is “minded to transfer the main functions of the Safety and Standards Directorate out of Railtrack in order to ensure public confidence that there is no conflict between safety standards and commercial interest”.

A challenge for safety regulation in the restructured railway is to separate functions to provide incentive structures which support rather than discourage innovation.

5.1.3.3. Commercial incentives and safety incentives

5.1.3.3.1. “Profits versus social responsibility”

In popular debate in many Member States it is often argued that if an enterprise is driven by commercial incentives its objectives will be to reduce costs and increase profits, rather than serve social objectives; and that it will therefore give a lower priority to the safety of employees and the public than would a body running a non-commercial public service. In some circumstances this can be true. In other circumstances stronger commercial incentives can increase safety. In the case of railways in Europe, in regulatory regimes which are managed with integrity, the limited evidence suggests that stronger commercial incentives are as likely to increase as to reduce safety overall.

Commercial incentives lead to socially bad decisions when companies face no effective market or legal penalties for irresponsible safety policies. Examples are easy to find. They include for example non-observance of building regulations revealed by the Turkish earthquake of 1999; dumping of dangerous waste by small firms offering cheap rates; and suppression by the (unregulated) tobacco industry of research which revealed health risks of their product. An example from transport was the case of the Ford Motor Company and a dangerous feature of the Pinto car, which was discovered but initially concealed.

On the other hand the absence of commercial incentives provides no natural incentive for safety. Some of the worst disasters of all time have been within state owned enterprises with no commercial incentive. Chernobyl is an extreme case. The Challenger disaster is one Western example. Within the state owned, and heavily subsidised European railway

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65 It is a popular view in some of the media in the UK, and elsewhere, that privatisation of the railway increased the risk of accidents, but as noted in the next section this does not appear to be supported by the data.
industry there have been many fatal accidents, many of which have also been attributable to management failures.

Commercial pressures can be a powerful reinforcement to safety regulation where reputation is at stake. One conspicuous example, especially in recent years, is aviation. Airlines in Western economies know that any hint that they are giving a lower priority to safety than their competitors could destroy their company. The market pressures on the chemical industry and oil industry are less direct but, again, major companies - especially with the now greatly increased profile of environmental concerns - have a strong market incentive to have good safety record.

Outside transport there are relatively few situations in which people put themselves into a mobile environment controlled by others, but where they do - for example lifts in buildings, cable cars, fairgrounds and theme parks, private ownership is at least as common as public ownership. All are strongly and generally well regulated. Although the safety of these activities is sometimes publicly debated, it is rarely if ever suggested that public (or private) ownership of such facilities in the EU would increase safety.

Positive market incentives for safety are especially effective when the hazards are fairly evident and their impact immediate, as for example with explosions, fires, or physical impacts. They are less effective when the impacts are less easy to observe and perhaps delayed in time, as for example with health hazards, perhaps as serious as cancer or as mild as slight sickness, where the cause of the symptoms of a particular victim is rarely certain. The hazards of railways are overwhelmingly evident and immediate.

The only empirical evidence which we have found on the effects of commercial incentives on safety in major regulated industries is a study, using data mainly from the safety regulator, of the consequences of the large UK privatisation programme which peaked around 1990 (NERA, 1997). The evidence could not be conclusive, because of the many random influences on accident data and the significant (improving) underlying movements in industries and sectors throughout the period studied. However the evidence gave more support to the thesis that the safety of employees and the public was increased by privatisation than that it was decreased.66

The data on railway accidents and fatalities are too sparse to draw firm conclusions on the effect of British railway privatisation on safety. However, they suggest that any impact has so far been small, with no suggestion that the new Railway Safety Case regime has either strengthened or weakened the previous improving trend (Evans and Horbury, 1999).67

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66 It is unlikely that safety would ever be used as an argument in support of privatisation of a European railway; nor do we make such an argument. However it is of passing interest to note that the previous Government of the Philippines deregulated domestic shipping, in the hope that ferry operators would compete to offer safer travel. (Economist, 2000)

67 The accident at Ladbroke Grove in October 1999 was exceptionally severe, but its severity was not related to privatisation. Until Inquiries are completed, no conclusions can be drawn about whether its cause was in any way related to privatisation. However we do know that the frequency of fatal train accidents post-privatisation has not been higher than pre-privatisation, even including that accident.
In an open, competitive, competently regulated industry, commercial incentives might be expected on balance to increase rather than to decrease European railway safety - possibly in day to day operation and probably through more rapid innovation. However this depends crucially upon there being a structure which distributes responsibilities clearly and efficiently, both within the industry and between the industry and external regulators.

It is interesting that concern is now sometimes voiced within the industry about standards being imposed on railway safety which unfairly discriminate against that mode, relative to road transport. We see this as an encouraging development. We note elsewhere (section 5.2.3) that society’s preferences are probably for a higher standard of safety on rail than on roads. However more analysis and open public debate of such issues this could greatly help safety policymaking in the long term.

5.1.3.3.2. Financial incentives for European railways

Railways are widely subsidised by national governments, usually from general taxation. This may sometimes be explained in terms of helping to divert traffic from environmentally less friendly modes. It may sometimes reflect the political unpopularity of reducing or closing down rail services. It may sometimes reflect a strategic political decision to develop or maintain a railway link. It is possible that this willingness to subsidise railways will increase, as roads become more congested, or it may decrease, if attitudes to public spending change, railway operation becomes more efficient and roads become more commercial. In either case, national governments are likely to remain concerned about the efficiency with which these subsidies are spent.

The typical pattern of subsidy in Member States is to support the infrastructure, by for example grants, cheap capital and capital write offs. Whatever the merits of this, it provides an incentive to the industry to favour capital investment. In the context of safety this can reinforce cost-ineffective solutions, since new capital technology has obvious and understandable attractions to system operators, by comparison with solutions such as modification, maintenance, or training.

Safety arguments are only peripheral to the choice of subsidy regime. However subsidies place a difficult but important responsibility on national governments for the promotion of efficiency in railway safety expenditure, by examining carefully the case for proposals for substantial expenditure where safety arguments are used.

5.1.4. Developments at the European level

Our terms of reference require us not only to give an overview of the existing safety regulations for railway operations among Member States, but also to develop recommendations for a common safety approach to rail transport within the EU. This would cover analysis of the necessary long-term steps, as well as suitable short and medium-term measures in order to overcome existent divergences among the Member states.

In order to achieve such a common safety approach within the EU it is widely accepted that:
Discussion

• there is a role for the EU in promoting aspects of RSRRs within Member States which support European objectives;

• even in a world where every European national RSRR was optimal in isolation, differences between them would still lead to avoidable inefficiencies and there is an EU role in overcoming these differences.

More generally, unification of the major technical requirements on the railway (e.g. gauging and loading, signalling and control, communications) inherently involves unifying the main safety requirements concerning train accidents.68

To date, the primary focus for EU harmonisation activity has been the high speed interoperability directive, EC 96/48, which will be made operational through the series of TSIs currently in preparation. We note that the process of achieving full technical harmonisation in respect of high speed operations is facilitated because such ventures typically require major upgrading of existing track and signalling systems or the construction of entirely new infrastructure. Common standards and procedures can then be built in ab initio, rather than having to be bolted on to existing equipment, possibly at relatively high cost.

Our discussions with Commission officials and rail and supply industry representatives indicate that, in many respects, the EU level procedures involved in implementing the Directive follow due process with rigour, with well-defined conventions and voting rules. We also welcome the proposals by the AEIF Economic Evaluation Group, in a paper dated May 1998, for introducing cost-benefit assessments into the process of developing interoperability TSIs. The Commission has an important role to play in monitoring their application in practice.

Our discussions with industry representatives at Member State level, however, indicate a lack of awareness of potentially far-reaching developments within the AEIF process, stemming in part from the inaccessibility of some key documents emerging from that process. We think more could be done by EU institutions to promote awareness of the AEIF process.

EU policy on conventional interoperability is still being formulated. Here, we think that the range of technical options that need to be addressed is wider than in relation to high speed operations, because of the need for more widespread adaptation of existing assets and operating procedures. Striking a balance between the potential benefits of a higher degree of harmonisation, and the higher costs that may be incurred, will involve complex judgements. In developing policies in this area to secure the interests of rail users and taxpayers, we think it will be particularly important to ensure that cost effectiveness tests are applied at all stages of the process of developing and evaluating options.

68 Some safety measures, such as crash worthiness of passenger carriages, are designed primarily to reduce personal harm in train accidents; but these are probably in aggregate less important than the measures which would be applied to a railway operation even if there were no risk of personal harm.
5.1.5. The total costs and benefits of safety regulation and harmonisation

We emphasise in this Report the importance of estimating the costs and benefits of specific proposals for changes such as new standards; of comparing these with alternative proposals; and basing decisions on such analysis. However it would be helpful in promoting the general case for harmonisation to be able to derive some broad \textit{ex ante} estimates of the "total cost of safety regulation" and of the "total benefits which harmonisation could yield".

We have considered this carefully, but conclude that these are not issues which can be quantified reliably at such a general level.

General observations can be made, which have some policy value. For example differences between national RSRRs of the “Group 3” category, as discussed in section 4.4.3 above, could over time yield large savings at negligible cost, other than the costs of negotiating agreements between Member States. And the gross costs of regulation are undoubtedly very high. Sections 4.2.1 and 4.2.2 noted some specific costs incurred by the train operators. The cost incurred by applicants for certification of new trains in Britain has been in recent years about £100 million (170 million euro) per year.

Reliable analytical quantification of the \textit{total} costs of regulation or the benefits of harmonisation is not however possible, \textit{ex ante}, for several reasons.

One reason is that there is no clearly definable aggregate set of alternatives to compare. No “harmonised” world can usefully be defined in the abstract. ‘Harmonisation of signalling systems’ for example looks implausible in the foreseeable future, but some degrees of harmonisation between some Member States will no doubt be achieved. It will be possible, and important, to assess the costs and benefits of \textit{individual} measures to this end, but no reliable aggregate estimate can be made in advance.

Another reason is that the benefits of harmonisation can be measured only very partially in engineering terms. The main benefits will probably be in terms of greater flexibility and more competition, leading to a generally more dynamic and efficient railway. But this cannot be reliably quantified. Many years ago some calculations were made by the European Commission to estimate the benefits of a Single Market. Even these calculations were regarded by many as so uncertain as to be more of a presentational than a technical exercise, but at least they were based on substantial and consistent macroeconomic data. There is no comparable data which could be used for such a calculation for a single industrial sector, especially railways, where data is so seriously incomplete.

Another, lesser problem, if such an exercise were confined to ‘safety’, is that we see no useful way to distinguish in such a context between safety and more general operational harmonisation. To take again the harmonisation of signalling, the operational/safety distinction is essentially arbitrary. Distinctions would have to be made on many fronts.

A more practical difficulty is that the net benefits of any change in this field are the difference between often very large costs in the early years and less certain benefits in the
later years. For individual measures this problem of estimating the difference between two large quantities has to be faced. For an aggregate calculation of thousands of extraordinarily diverse and uncertain measures such estimates would become unrealistic.

5.2. Some Principles of Good Regulation

5.2.1. Objectives

We assume that the Commission’s objective is that railway safety regulation should be as effective and efficient as practicable, in the following terms.

Effective
- secures high levels of safety, not merely on paper but on the ground;

Efficient
- achieves high safety levels without undue costs of rule-making, compliance and, enforcement;
- is conducive to healthy competition and to cross-border activity;
- is conducive to the introduction of new, safer technologies; and
- reflects, so far as it is practicable, the preferences of those facing the risks and other costs, by finding the best balance, as opposed to any solution which is politically acceptable;
- is sufficiently certain to allow efficient investment decision-making.

Effectiveness and efficiency can be achieved within the current policy of opening up the European railway only if it is also fair, transparent and accountable. These further characteristics can be expanded as follows:

Fair
- imposes safety requirements that are even-handed across Member States and between suppliers; and
- is implemented by processes which are unbiased and open and which heed concerns by affected parties about the fairness of decisions or policies.

Transparent and accountable
- operates with processes which allow involved parties, and the public more generally to understand and debate policy choices; and
- allocates responsibilities clearly; offers effective methods of holding policy and decision-makers to account; and is consistent with the principles of subsidiarity.

5.2.2. Characteristics of safety regulation regimes

As we considered the safety regulation regimes there emerged a picture, which we believe is broadly uncontentious, of what would constitute good practice. In this picture a regulator takes into account safety and operational considerations, seeking the best balance on the basis of expert analysis and the interests of all those concerned - in the industry, its customers and wider society. The decision process is open, subject to privacy concerns and the safety interests of confidentiality, follows due process for all parties and makes
Discussion

appropriate use of expertise. Although there are times when the regulator presses for safety, to the extent that operators have incentives to under-provide safety rather than over-provide, the regulator’s job is to ensure that operators strike the right balance between safety and other factors.

To sharpen discussion of the institutional structure and style of safety regulation regimes we find it helpful to consider two contrasting, stylised sets of characteristics, which we describe as type A and type B, as listed in Table 5.1. The characteristics of practical regimes, for railway safety or in other industries, lie between the extremes set out in Table 5.1; and different balances may be found in different functions of the regime, such as standard setting, approval, or accident investigation. However we believe this provides a useful framework for identifying the issues which the Commission needs to address, in clarifying its strategy for railway safety regulation.

<table>
<thead>
<tr>
<th>Institutional role of safety</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some decisions are safety decisions, to which safety calculus applies. Avoidable risk generally denied. Other decisions are non-safety, to which an explicit economic calculus is appropriate.</td>
<td></td>
<td>Most engineering and operational decisions involve mix of safety and non-safety factors. Balance is struck by explicit trade-off.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Approach to risk assessment</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Looks at small range of options. Emphasis on technical feasibility more than cost. No valuation of safety benefits. Political judgement typically merged with technical judgement.</td>
<td></td>
<td>Looks at wide range of options. Analysis of all cost and benefits, including safety. Weight of political and other judgemental factors explicitly justified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clarity of the policy process and substantive decision rules</th>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trust in specialists; technical “rules of the game” for decision making not stated, or stated in non-operational terms.</td>
<td></td>
<td>Due process: formal procedures; openness to negotiation and appeal; explicit, rational decision rules.</td>
</tr>
</tbody>
</table>

Both approaches have presentational difficulties, so each will claim features of the other when it is expedient to do so. For example, even strongly type B regimes will often flinch from admitting giving a monetary value to safety benefit; while even strongly type A regimes will often claim to operate due process.

Both approaches recognise the dangers of safety being overridden by commercial incentives. Type A characteristics seek to make this impossible by separating safety and commercial considerations. Type B characteristics seek to control the danger by due process, transparency and explicit decision rules.

Type A characteristics fitted well with many aspects of the regulation of the traditional national industries and Case Study C suggested that there are inhibitions in many RSRRs
against type B characteristics. We discuss below the practical implications of these characteristics for RSRRs and the reasons for moving more towards those of type B.

5.2.2.1. Type A characteristics

In a regime which has strongly type A characteristics certain issues are regarded as safety issues and typically delegated to a specialist function within the organisation. That function has a clear mandate to maintain or improve safety, and is not subject to explicit pressures from other considerations, which are for others to argue. The outcome then depends on intra- and inter-organisational negotiation. It depends upon trust by all other parties that this provides an outcome reasonably close to what is best for society. Publicly, all parties commit to the rule that there should be no avoidable risk.

In such a regime certain risks are deemed to be “avoidable” by specific measures. This is typically accepted without argument; safety regulators tend to press for them; and they are often adopted. The result is a high level of safety with regard to that kind of risk.

On the other hand some risks are so small in relation to the costs or disruption of avoiding them that it is judged to be not worth adopting the counter-measures. For example almost all level crossings pose some risk to train occupants as well as road users; all such risk is in principle avoidable by grade-separating the road from the railway. This is sometimes done, but often the level crossing is retained. Other examples of the trade-off were noted in the illustrative list in section 4.4.3.1. While grossly excessive cost is one criterion in practice, the judgement depends heavily on perceptions and on the interest of participants in the process.

Any approach to safety needs a mechanism for deciding which avoidable risks actually are avoided, and which are not. In the type A approach this mechanism is usually private deliberation or negotiation by specialists, drawn from the NI, the RI and typically the supply industry. Safety measures with a “constituency”, such as influential suppliers, and with a high public profile, are more likely to be adopted than others. In that sense, a strongly type A regime has a positive bias towards high-cost measures. The precise reasons for decisions may not be explicit even to the participants, and no admission is made of the acceptance of avoidable risk. To summarise, in this type of regime:

- Decision-making is left to specialists.
- Decisions are divided publicly into “safety decisions”, where safety is represented as an absolute, and “non-safety decisions”, which are a matter of engineering.

“Avoidable” in this sense involves more than “an effective safety measure is available”. For example, in Britain for many years passenger falls from trains while running were not regarded as meriting investment, even though a variety of effective safety measures were available. Other examples are given elsewhere in this report. An important element in the type A approach is whether someone outside the railway can be blamed, especially (but not only) the victim. The perception of “avoidable” in the type A approach is not a technical concept, but is the outcome of an implicit negotiation between railway engineers and regulators, influenced by the media.

Safety measures which involve interesting new technology and heavy investment are more attractive to many participants (and to the media) than those which involve human factors actions such as training and supervision, or which involve reducing speed.
• There is heavy emphasis on the risks which are avoidable by “technical fixes” and which cause conspicuous accidents. Risks which can be blamed on the victim receive relatively much less attention.

The type A approach appears to reflect in part a concern that safety issues may release uncontrollable public reactions which would be profoundly disruptive. "Public confidence" is regarded as crucial, and the public must believe that no avoidable risk is incurred. This is felt to justify very high expenditure in addressing high profile risks; but since it is impracticable to eliminate all genuinely avoidable risk, the decision process must be kept private.

This approach fits well with the nationalised industry pattern of organisation (monopoly, politicised). But it is also common in other industries. Indeed conflict between type A and type B characteristics is a widespread feature of safety regulation industry-wide and worldwide. In the chemical industry for example there is ongoing debate, with each style sometimes prevailing over the other. In aviation some of the safety regulation functions are strongly type B and standard setting fairly strongly type A.71

5.2.2.2. Type B characteristics

With strongly type B characteristics, there will be a safety management function, but safety management is more integrated with the management of the enterprise a whole, and follows due process, including openness to criticism and appeal against expert decisions, and explicit trade-offs between safety and other considerations. The job of the regulator in this style of regulation is to see that safety is properly managed.

In such a regime, safety is seen as one important aspect among others of managing a railway (or other system). The primary responsibility for making safety decisions rests with the operators concerned. The role of the regulator is to ensure that the operators are competent, and that their decisions properly reflect all affected interests, including those of passengers and third parties.

The type B approach explicitly recognises that not all risks can be eliminated, and therefore focuses on the procedures used to determine the extent to which risks should be reduced. This leads to emphasis on due process, and on the transparency and accountability of the processes leading to risk decisions. Safety decisions are made in public, and are open to challenge by any interested party. Because of its transparency, the admission that operators accept avoidable risk is inescapable.

Because the type B approach uses explicit decision rules, it is capable of combining consistency with decentralisation. This is important where economic efficiency is a priority.

Because its emphasis is on transparency and decision rules, the type B approach is likely to lead to a more equal treatment of high-profile and low-profile risks than the traditional one. On the other hand, when high-profile avoidable accidents occur, it is not clear whether transparency in the decision processes is of much help in controlling the public reaction.

71 Aviation and other transport modes are discussed in section 5.2.5.
5.2.2.3. Application to European railways

5.2.2.3.1. The choice of regulatory style

The present study is to do with the choices which involve safety, in the context of:

- strong EU led moves towards a more competitive and a more interoperable railway;
- a complex, changing environment with many players, including several operators in each of 15 Member States; with multinational suppliers; and with the main technical decisions being taken at EU level.

We recommend that, in this context, the Commission should consider the balance between type A and type B characteristics for railway safety regulation at the European level. Both have costs and risks.

Type A characteristics have been dominant hitherto. However closed decision processes are less compatible with a multi-organisational, dynamic railway than they are with the traditional NI. Indeed, as discussed below, it is hard to see how they can be effective at the European level. Other arguments against the type A approach are that low-profile but important risks are likely to be downplayed relative to high-profile risks; and that sometimes very high expenditure on avoiding high-profile risks may be much higher than the EU’s citizens, away from the emotion of particular accidents, wish to pay.  

Arguments in favour of the type B approach are that these characteristics:

- integrate safety with mainstream decision making;
- lead to more cost effective expenditure on safety;
- provide an explicit justification for decisions;
- promote even-handedness between the increasing number of players;
- provide a framework for European regulation which, being explicit, can be applied through existing national institutions, with minimal requirement for new EU-level bureaucracies.

Arguments against the type B approach is that:

- it is counter to that prevailing in most of the established industry;
- the greater formality of due process requires more explicit records to be kept and more information to be available to more people (i.e. more bureaucracy for individual decisions).

5.2.2.3.2. European level structures

Long term policy options for European level structures of railway safety regulation appear to be as follows.

(1) Reliance on the national regulatory agencies, with no safety-regulatory action at the European level, apart from the extension of European standards.

(2) A safety regulatory body at EU level, based on the broadly familiar Type A approach.

The issues of whose interests should be served by safety regulation, how individual preferences can be measured and the relevance of other social factors are discussed in section 5.2.3.
European structures to support a delegated structure of regulation.

Option (1) offers the attraction of minimal change. The high speed and proposed conventional interoperability Directives are moving technical decisions to the European level, so leaving safety regulation at the national level would clearly separate technical from safety regulation. This would be seen as an advantage by some within the industry.

However this option would leave structures at the national level, which have been slow to resolve differences that inhibit interoperability or new entrants, unchanged. It would also be imprudent for technical and operational decisions to be taken at the European level without having any European safety regulatory capability. If and when a major accident occurs on a railway designed to European standards, the European institutions would be exposed if there had been no corresponding European-level safety oversight, because almost all operational and technical decisions have a safety dimension.

Option (2) - a European safety regulator - would provide European-level safety oversight, but it would bring serious problems of its own. A new major institution is time consuming to establish and costly to run; and even if an EU-level regulator could be established it would either be in constant conflict with the national railway safety regulators, or it would be ineffective at dealing with the existing differences. It would in any case require new law, which Member States would be most unlikely to accept.

Option (3) would meet the difficulties of option (2), by applying a lighter touch. However it would face the difficulties of:

- a need for some new structures to provide pressure for reform;
- serious problems of introducing, probably over a long period, a new approach with the type B characteristics which are needed to support a dynamic and innovative railway.

Some more technical aspects of type B characteristics are discussed in sections 5.2.3 and 5.2.4. Section 5.2.5 looks at other transport modes.

5.2.3. Analytical techniques

5.2.3.1. Social costs and social benefits

All decisions entail choice. If one option is better in every way than all the others the choice is trivial. However most decisions required of safety regulators and managers are not trivial. They require a balance between social benefits - in particular greater safety - and social costs, such as lower speeds, more maintenance, higher capital or operating costs, or longer approval delays.

In industrial safety regulation, whether of the type A or the type B style, this balance is usually made on the basis of judgement by staff, or committees, with considerable expertise and experience in the relevant field. Although the judgement is usually informed by quantitative data and analysis, which may be complex, the trade-off between costs and benefits is usually made subjectively. This is sometimes because a more exhaustive analysis would not be worth the effort; and usually because these judgements often need to reflect
managerial or political elements which cannot be sensibly included in a formal, quantitative calculation.

However any regime concerned to provide the best possible service will wish to define its objectives and, as far as is practicable, to quantify and value costs and benefits.

In safety regulation the explicit recognition of a trade-off between safety and any other factor presents difficulties for industries, for regulators and for government ministers. However although there are some situations where, with good reason, any such analysis would be unacceptable - notably where someone needs to be rescued, where the only constraints allowed are usually the availability of equipment, and risks to rescuers or other people - regulatory decisions are very rarely of this kind. Recognition, quantification and valuation of costs and benefits contributes to an efficient distribution of spending. It is a necessary step to achieving the greatest overall levels of safety and of service quality for any given resources.

Quantification and valuation of most costs and benefits, such as capital and operating costs, service quality, and the probabilities of specific hazards, while often very complex and sometimes technically contentious, are beyond the scope of this report. However the most difficult area, where practice varies and there are many misunderstandings, is in the handling of personal harm. If it can be shown that some specific expenditure or sacrifice of service quality would produce a predictable increase in safety, what analysis can be done to help inform the decision about what to do?

A preliminary issue is the question of what industrial safety regulation is for. It is obviously to require enterprises to take proper account of the hazards to which they expose people, but regulatory decisions in the real world clearly affect several parties. Whose interests count in practice? Whose interests should count?

The consequences of railway safety regulation affect, among others, governments, regulators, the supply industry (including suppliers of equipment, and the acceptance approval services, such as Notified Bodies, required by the regulations), railway operators, railway users (as people at risk and as fare payers), railway employees, third parties (such as level crossing users), trespassers, taxpayers (if the industry is subsidised) and users of other transport modes (if railway safety standards redistribute traffic).

Some of these interests are institutional rather than social. For example government ministers usually prefer not to be involved in safety issues, beyond being reassured that competent regulators are appointed. It is a technical minefield with few political rewards. Regulators know this. Regulators also have their professional pride in pursuing their mission, however defined, and an interest (like other parties) in avoiding blame. Suppliers have a special interest in regulations which either advantage or disadvantage them relative to their competitors.

73 Although regulators may occasionally face the issue of ethical upper limits to individual risk, as noted in section 5.2.3.2 below.
However the costs and benefits which are most relevant to social welfare are the ultimate impacts on people, such as risks of injury or death on the one hand, or extra costs, or loss of service quality on the other.

The rest of section 5.2.3 and section 5.2.4 are mainly about how risks of injury or death can be handled. The discussion focuses on the approach which broadly underlines the “ALARP” concept as developed over the years in the UK for safety regulation generally, but the approach as presented below would be fairly widely recognised internationally and across industries. It would be supported by some and rejected by others and we note objections of which we are aware.

It is an approach which tries to take quantification and valuation as far as is possible, given the many important ethical, political and data constraints. This would be consistent with the principles of due process and clear, democratic decision rules, which we advocate for railway safety regulation.

5.2.3.2. ‘Zero risk’, Acceptable risk’ and ‘Acceptable risk plus ALARP’

A common approach to railway safety is that risk should be eliminated or minimised, with no qualification. This “zero risk approach” is attractively simple. It is also in many operational contexts the best policy. It is the mindset which rail users, and others, would hope pervades those who operate trains or command and control systems. However as a regulatory principle for defining and applying standards it is unworkable if taken literally. It provides no guidance on the handling of the trade-offs which in practice are made in all regulatory regimes. These trade-offs are sometimes extremely important - because they may determine the distribution of large expenditures in ways which may diverge seriously from the preferences and interests of those who face the risks and pay the bills.

A modest variant on the “zero risk” approach is that of “acceptable risk”, in which the regulator, perhaps with ministerial endorsement, defines a low level of acceptable risk, which is used to guide engineering specifications. This is also attractively simple. It avoids any case by case assessment of the trade-off between risk and other factors. It requires only a demonstration that the risk is no more than the “acceptable” limit. Whether this is workable depends on the chosen limit.

However the “acceptable risk” approach, by itself, provides no incentive to reduce risks below the limit, nor any guidance on the extent to which this may be worthwhile. Depending upon how the limit is derived and how widely it is applied, it may either impose measures whose cost is seriously disproportionate to the particular case; or impose risks which could be cost-effectively reduced.

74 One misrepresentation sometimes used in this field, and which is sometimes politically popular, is to claim that extra expenditure is not a cost but a benefit, because it ‘creates employment’. This is in most circumstances wholly mistaken, as we would expect DG Economic and Financial Affairs to broadly confirm.

75 The acronyms ALARP and ALARA are both used in the UK. They are used in different contexts, but there is no clear, systematic difference between their meanings.
The “acceptable risk” approach as a single number does however satisfy the requirement, which is generally accepted, that no individual should be subject to more than a very low level of risk from industrial activities, however large the benefits which this might bring to others. There is therefore a sound equity argument for a limit of this kind.

An extension of the idea of an acceptable limit for individual risk is that there should also be a limit to the frequencies of accidents of specified sizes: for example, an accident with 10 fatalities should not occur more than once in, say 100,000 years. Such limits are sometimes expressed as criterion lines on so-called FN-graphs, which plot the estimated frequency of accidents with N or more fatalities against N. They are widely invoked. However the justification for such criteria is much weaker than for individual risk limits, because there is no equity argument for them. FN-criteria also have technical flaws (see Evans and Verlander, 1997).

The equity case for an upper limit to individual risk was a central concern in a British nuclear power station Public Inquiry in 1986 (Layfield, 1987), which led to the current ALARP-based approached adopted by the Health and Safety Executive for safety regulation generally, across all industries.

The major innovation achieved by that Inquiry was the introduction of both a ‘tolerability limit’ for individual risk and also, at levels below this limit, a comparison of the costs and benefits of reducing risks to ever lower levels. An approach of this kind is both equitable, in that it does not load risk very heavily onto any individual, and efficient, in that it requires risks to be reduced as far as it is efficient, or proportionate, to do so.

5.2.3.3. The valuation of risk of personal harm

It is sometimes argued that it is unethical ever to put an explicit monetary value on the risk of death or injury. However whatever is or is not done explicitly, monetary values are placed on such risks implicitly. Few people believe that every branch line level crossing of a road or a path should be eliminated, that impenetrable fences should be erected around every line, or that single lines should never be used for two way traffic. It is better to know what values of risk are being implied than not to know. In practice the concept of valuing such risks has long been established, notably in road safety, with no significant public criticism of the principle. However ethical judgements are ultimately subjective; and this is an issue on which the balance of political opinion varies between Member States.

The empirical measurement of public preferences is however far from straightforward.

Psychologists have provided extensive evidence that perceptions, and attitudes towards risk vary widely over different hazards. A useful source of papers is Glickman and Gough

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76 These graphs are conventionally plotted as straight lines against logarithmic scales, often with a gradient of minus one. The real risk distribution, to be acceptable, must at all points lie below this line.

77 The extent to which they apply in practice is questionable. It is impossible to observe the fulfilment of criteria which depend on the frequency of accidents which occur once every decade or even less frequently. Any application of such criteria is thus by means of mathematical models. The builders of such models admit that they are liable to errors of two orders of magnitude.
(1990), and a widely quoted, seminal paper is Slovic et al (1981). This work shows that people’s perceptions of risks are strongly influenced by factors other than the probability and the direct pain and suffering associated with the risk.

Major factors are the extent to which a person is in control of the risk; familiarity; the extent of ‘dread’ associated with, for example, nuclear radiation, or more generally with risks of cancer; the degree of control by other institutions as opposed to natural forces; the level of trust in those responsible for regulating or managing the risk; and whether the person benefits from the activity which imposes the risk. People tend to strongly overestimate the magnitudes of small risks, such as death from storms or floods, and strongly underestimate much larger risks, such as death from disease. Important also is the direction of change: people show more displeasure at a small increase in risk than they do pleasure at an equal reduction in risk. It is also very evident that some accidents, such as a train collision causing many deaths, generate much more public and political concern than other accidents, on the roads or elsewhere, which in total cause the same amount of personal injury.

Some of these factors influence people’s \textit{individual} aversion to risks of different kinds of hazards. For example people might be expected to be more averse to a small increase in risk which they could not control, or was imposed on them by someone else, or was especially unpleasant, than a similar increase in a controllable, voluntary, or less unpleasant risk. Some of these factors are also relevant to what is often called \textit{societal risk}, or, more sensibly, societal concerns,\textsuperscript{78} which may lead management or governments to give extra weight to some hazards, to reflect wider costs to society.

More recently, another strand of empirical work has sought to investigate the way in which differences of this kind might affect people’s “willingness-to-pay”,\textsuperscript{79} \textit{ex ante}, for small reductions on \textit{individual} risk.

In one such study, Mendeloff and Kaplan (1990) investigated willingness to pay to reduce the risk of death by each of several causes, such as workplace exposure to cancer-inducing chemicals with long delayed effects, bicycle and automobile accidents, and fatal crib-slat accidents to young children, and found a variation of a factor of two. McDaniels et al (1992) considered ten different technological hazards. Five were relatively familiar and well-defined, such as automobile and aviation accidents. The other five were less familiar and less well-defined, such as nuclear energy and electromagnetic fields. For more familiar hazards, individual willingness-to-pay to reduce risk was most influenced by the extent of respondents’ perceived personal exposure to the particular hazard. For less familiar hazards the most important influences were levels of "dread" and the perceived severity of adverse consequences. Savage (1993) reports substantial differences between willingness-to-pay to reduce the risks from four different kinds of hazard - specifically, road and aviation accidents, domestic fires, and stomach cancer – and shows, again, that willingness-

\textsuperscript{78} “Societal concern” has been used by the UK Health and Safety Executive since 1995, in preference to societal risk.

\textsuperscript{79} And people’s willingness to accept compensation for a small increase in risk. This is larger than people’s willingness to pay for an equal reduction in risk, because, as noted above, people show more displeasure at a small increase in risk than they do pleasure at an equal reduction in risk.
to-pay may be significantly affected by psychological factors including perceptions of the “dread” and “unknown” attributes of the hazards concerned.

It would seem hard to justify giving more weight to railway risks than to, say, road risks, on account of unfamiliarity or lack of understanding of the nature of the hazards. However there is a “duty of care” dimension to public transport. When people entrust their safety wholly to a commercial organisation they expect the risks to held as low as is reasonably possible - to an extent which may be greater than they expect of, for example, the provision of warning signs, or lighting, or crash barriers, to reduce the risks which they face on the road.

5.2.3.4. Societal concerns: The relevance of accident size

Societal concerns are factors which may justify giving more weight to some risks than would be implied by the preferences of those directly affected. The most common such factor discussed in safety debate is accident size.

It is often argued by safety professionals that the loss of, say, 30 lives in a single large scale accident is much worse than the loss of 30 lives in separate small scale accidents. One convention widely quoted as a descriptive “rule of thumb” for safety policy is that the weight given to the risk of an accident causing n deaths should be proportional not to n but to n^2. This implies that the weight given to the risk of, say, one passenger falling out of door is about 3 percent of that given to the risk of the passenger being killed in accident with 30 fatalities. Another variant in the literature is that the weight given to the risk of an accident causing n deaths, if n>1, should be proportional to n+(n-2)^a, where a is some value between 1.2 and 2.0. This gives relatively less weigh than n^2 to deaths in accidents in which more than one but only a few people are killed. Formulae are sometimes used with “risk aversion factors” (for example Bohnenblust, 1998) which give more weight to accidents which, because of their size or for other reasons, affect especially strongly the responsible company or institution, or the industry as a whole.

Given the nature of media attention and political reaction, operators and regulators have a strong incentive to apply a premium to risks with the potential for accidents with a high media and political profile, including those which cause many deaths.

One reason for this is the incentives placed by the media process on institutions and their senior management\(^\text{80}\), not always related to the care and efficiency with which their decisions have been made. These internal blame avoidance incentives are inevitable, but it seems hard to justify importing managerial concerns of this kind into a public policy decision rule. It is a factor for management to consider in their interpretation and application of the formal analysis, in balancing the allocation of resources between high profile and less high profile hazards.

\(^{80}\) For example during the 1980s two Presidents of SNCF resigned after serious accidents. So too did the Chairmen of London Underground and London Transport after a metro (escalator) fire in which 31 people died in 1987.
It is also sometimes suggested that accidents with many fatalities tend to be associated with more than proportionate physical damage. However this is not a persuasive argument for a general “scale premium” on fatality risks. It is better handled case by case, as a separate issue from personal harm.

A wider argument sometimes made is that a scale premium should be applied to reflect “damage to the social fabric” which may result from a large-scale accident. The argument expressed in these dramatic terms seems implausible for any but totally exceptional public transport accidents. Nonetheless some passengers are observed to be unsettled in the weeks following a serious rail accident. These effects appear eventually to disappear, but they can be large enough to have a substantial commercial impact, and a significant social cost.

It seems implausible that the relationship between this effect and numbers of fatalities is strong. The nature of the incident and the degree of media coverage would be expected to be more important. This is however clearly a legitimate factor to consider in the distribution of safety expenditure.

Another argument which justifies extra concern about high profile accidents is the pragmatic observation that the media attention creates social and political pressures to bias spending away from other hazards into preventing even the remotest possibility of repeating the particular accident which occurred. Again, the criterion is essentially one of whether an incident will or will not become a focus for media interest. The number of fatalities is incidental. However it is a societal concern, justifying some extra concern to prevent high profile accidents, on top of any premium which might be included in people’s individual aversion to such accidents.

There are therefore some persuasive reasons for committing more than proportionate resources to preventing accidents which will attract media coverage and political attention. They are pragmatic, managerial concerns, which are best kept separate from any formal numerical analysis.

5.2.3.5. Estimating people’s willingness-to-pay to reduce individual risk from railway hazards

This section outlines an empirical approach to valuing ex ante, individual preferences for safety, which are distinct from the societal concerns discussed in 5.2.3.4.

81 This is the main rationale for the British Health and Safety Executive’s perception that the “societal” concerns associated with large-scale accidents are a social cost additional to “individual” risk - see for example Health and Safety Executive (1989).

82 For example after the escalator fire noted above, London Underground appears to have lost 6 percent of its traffic in the immediately following year and 4 percent in the subsequent year.

83 For example the report following the 1988 Gare de Lyon accident in Paris, in which 59 people died, included recommendations which went ‘well beyond what might be considered reasonable’ (Semmens, 1994). There is also widespread acceptance, years later, that the safety countermeasures recommended by British transport accident Inquiry reports in the late 1980s would, if implemented in full, have entailed a serious misallocation of resources (Hope, 1992).

84 Another Three Mile Island type incident at a nuclear reactor could be fatal to that industry in that country and perhaps worldwide, even if, as in the original incident, there were no fatalities or serious injuries. The railway industry is less exposed to catastrophic loss of confidence, but media interest in fatal passenger train accidents is only weakly linked to numbers of fatalities.
Empirical studies of willingness-to-pay for safety can be classified, broadly speaking, into two types. "Revealed preference" studies essentially derive willingness-to-pay values from data about actual choices involving trade-offs of wealth for risk. In contrast, "stated preference" studies ask members of a representative sample more or less directly about their willingness-to-pay for hypothetical small improvements in their own (and possibly other people's) safety. However it is doubtful that either of these approaches is directly workable for railway safety.

The revealed preference approach would require that railway passengers should face a choice from a range of different safety levels and a corresponding fare structure (for example, "very safe and expensive" versus "less safe but cheap"), but this is not the case. For any given mode of public transport, passengers do not face choices of this kind.

The problems with stated preference are more subtle. One difficulty is that railway risks are so small that respondents in a direct study would be asked about their willingness to pay for reductions in risk which are not only small but minuscule. Experience shows that such data is generally unsuitable for estimating willingness-to-pay to reduce accident risks. A related difficulty is the misperception of risk. Given the relative rarity of fatal railway accidents compared with, say, road accidents, it is possible that, in line with the findings of Slovic et al. (1981), respondents would overestimate the risks concerned. A further difficulty is that railway customers are fare-paying. This means that, if asked about their willingness to pay for improved safety, they might believe that their answers could influence future fare levels, and so adopt a downward strategic bias.

Because of these difficulties, an empirical estimation of the willingness-to-pay valuation of individual risk reduction for London Underground adopted an indirect approach (Jones-Lee and Loomes, 1995). This involved: a) estimating the scale premium of people's aversion to large scale Underground accidents relative to single fatality Underground accidents; and b) estimating a context premium for single fatality Underground accidents relative to single fatality road accidents. This could then be applied to the UK Department of Transport's well established, willingness-to-pay based roads valuation of risk, to arrive at a value to be used in the appraisal of Underground safety projects.

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85 See, for example, Violette and Chestnut (1983), Miller et al. (1984), Jones-lee (1989), or Viscusi (1993). This reference and much of this sub-section are taken from Jones-Lee and Loomes (1995). A quite different valuation approach still used in some Member State in the context of road safety is the value of the income which a dead person would have earned if he or she had stayed alive. This is conceptually deeply flawed as a measure of the social value of the risk of death, but it has the advantages of being easy to calculate and explain.

86 The use of stated preference techniques to derive monetary values is often described as "contingent valuation".

87 For a discussion of strategic bias, see for example Cummings et al. (1986).

88 This was in 1999 equivalent to a value per prevented fatality of about £1 million (1.7 million euro). The EU suggests a value in the context of road safety, which is at present 1 million euro. Other values are used by other DGs in other contexts (for example 3 million euro by DG Environment). Roads values have been discussed among Member States in the context of COST. Public sector agencies in the US use values ranging from about 2.5 million dollars (2.5 million euro) for roadway workers to about 5 million dollars (5 million euro) for some medical scanning and some environmental impacts (Office of Management and Budget, 2000).

89 These values are derived by investigating people's considered willingness-to-pay to reduce risks by a small amount. For practical application this is then scaled up to give an ex ante "value per prevented fatality".
It is not clear *prima facie* whether people are more averse to the risks of large accidents. They might for example associate larger accidents with less potential for individual control. A more subtle possibility is that large accidents happen relative rarely, because most are the result of some unusual combination of human and system failure. There is therefore uncertainty about their future probability and characteristics. If people are averse to this uncertainty they might be expected to be willing-to-pay more to reduce these safety risks.

The finding of this study for London Underground was that the scale of incident did not increase people’s willingness-to-pay to reduce individual Underground fatality risks. The study did however find a context premium. People were willing-to-pay 15-20 percent more to reduce individual Underground fatality risks than to reduce their road fatality risk by the same small amount.\(^{90}\)

### 5.2.4. The role of quantitative analysis in railway safety policy

Textbooks on risk analysis often present three types of approach. One is based on the statistics of many accidents, and is typically applied to road transport. The second approach is “case based” on few specific (large) accidents. This is the traditional approach to railway safety. The third approach is based on quantitative risk analysis, and is typically applied in process industry, or nuclear plants.

Decisions can be made without an explicit trade-off between safety and other factors. However the trade-off has to be explicit if decisions are to be:

- transparent, and thus open to inspection by those who did not take the decision; and
- consistent in different places, at different times and in different technical areas, and so maximising safety for a given total expenditure.

These conditions, which are important for a dynamic railway industry with new technology, new entrants and new services, can only be achieved with risk analysis, including the analysis of safety benefits and their quantitative comparison with other factors.

This does not however mean that safety decisions can be wholly decided by numerical calculation. Most decisions of substance have a political and managerial context which will have a bearing on how the numerical calculations are interpreted. These considerations will include expediency in response to media, public and political sentiment,\(^ {91}\) described in sections 5.2.3.3 and 5.2.3.4 above as societal concerns.

Nor does it mean that Member States, or the EU as a whole, must be committed to a standard valuation for the risk of fatal or other injury. In practice, for many decisions, estimation of the costs and quantification of the risks is quite adequate for efficient decision

\(^{90}\) The published reference quotes a rail premium relative roads of 50 per cent. The lower figure quoted here reflects subsequent refinement by Jones-Lee and Loomes of their method of data analysis.

\(^{91}\) This is illustrated in the UK by the Discussion Document “Reducing Risks, Protecting People” (Health and Safety Executive, 1999), which offers a detailed exposition of the Executive’s decision rules.
making. In those cases where valuation of the risks is needed it is often sufficient to estimate the implied value, which can be compared with the available willingness-to-pay data for other small reductions in individual risk for railways and other transport modes, or other industries; and with the cost per prevented fatality of other safety investments.

Nor does it mean that there is no place for absolute maximum risk levels. Quite apart from the ethical case for some absolute upper limit on individual risk (which would rarely if ever be closely approached in practice), it is valuable in presentational terms to state that there is a level of risk which would normally not be tolerated. There is also a pragmatic case for conventions such as maximum risk levels that can be well suited to subsidiary decisions (e.g. Safety Integrity Levels for design components of larger systems), so long as they are consistent with a higher level cost benefit analysis.

Nor does quantitative analysis of trade-offs between risk reduction and other benefits mean that safety standards will overall be lower than they would otherwise be. The effect (apart from the perhaps much more important effects of allowing change in the industry to proceed more smoothly) would be to change the distribution of standards. Some risks would be given more weight. Some very small risks would be exposed more clearly as such and would be more likely to receive the weight which they merited. Safety expenditure would be more cost-effective, so that, to the extent that safety expenditure is constrained, the safety performance would be increased.

These principles apply at every level of decision making, whether it be the decisions of a Railway Committee in CENELEC defining a standard, a government Inspectorate defining regulatory principles, or a Notified Body assessing the detail of a piece of equipment.

Promoting any decision rule which balances safety and non-safety considerations is sensitive. However we suggest that decisions involving safety, at all stages from first proposal to submission for final approval, should be required to be supported by a statement

- specifying the proposal, and the base case/best alternative with which it is being compared;
- setting out the relevant costs and benefits, including safety, as they accrue to society;
- justifying the proposed course of action by reference to those costs and benefits which can be valued and an explicit account of other significant factors;
- making explicit any political or other judgements superimposed on quantitative analysis of costs and benefits.

Typically as an implied “value per life saved”. In practice it is usually found that the implied value is either near enough or below some value which would seem to be justified by the empirical evidence, or it is one or two orders of magnitude greater. These latter cases offer opportunities for often large expenditures, which could be spent on saving many more lives in other ways.

Or indeed other data, such as the implicit willingness-to-pay by industries or governments for risk reduction in different fields. While the individual willingness-to-pay is a cornerstone of some risk regulation regimes it is not in others, either because of a lack of data or because the principle of explicitly valuing such preferences is not accepted.
The level of detail would be appropriate to the decision. This approach would encourage analysis which always compares with the next best; and would encourage consistency across the range of safety risks.

It would be helpful if agreement could be achieved on a clear policy decision rule for European actions on railway safety. This might be on the lines of maximising the welfare of the EU, having regard to conventional economic costs and external impacts, and having regard to the longer term benefits of open markets as well as the short term costs of adjustment.

The requirement to compare costs and benefits is distinct from the requirements set out in Annex III of the high speed interoperability Directive, governing the development of TSIs. These are based on the “acceptable risk” approach discussed above, with no specification of how this acceptable risk should be related to empirically based social preferences. Absolute levels of risk of a particular hazard can be useful as practical guidelines, but comparing costs and benefits requires a prior analysis of how the level should be set.

The appraisal of social costs and benefits is also distinct from the impact assessment of effects on businesses, which is required of EU proposals.

5.2.5. Safety regulation of other transport modes

5.2.5.1. Road and water transport

Road and water transport are much less closely controlled than railways or aviation. Subject to simple rules applied by the vehicle operator, such as the “rule of the road” and speed limits, almost any road vehicle or any vessel can go more or less anywhere in their respective systems, and without the need for specific equipment. Thus the regulation of the vehicles can be, and is, separated from that of the infrastructure. The regulation of vehicles is now largely carried out under international regulations by national regulators. Most sea transport through European ports, and much of inland water transport, is international by its nature; road vehicles have become internationalised through the globalisation of the industry.

Road and water infrastructure are regulated largely domestically, and, given the absence of a close fit between vehicles and infrastructure, that causes few apparent problems.

Road safety is however relevant as the main context in which valuations of reducing the risk of personal harm have been developed for decision making. Almost all European and several other developed countries have and use official valuations (Elvik, 1995; ETSC, 1997).94 The values adopted vary widely, and not all countries base their values on the individual willingness-to-pay principle, although the trend is in that direction. In sharp contrast to public transport, governments generally choose to spend markedly less on road safety measures than would be justified by these willingness-to-pay criteria.

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94 Values used by the UK and suggested by the EU were noted in section 5.2.3.5 above.
5.2.5.2. *Aviation*

Commercial aviation shares with railways a highly regulated operating environment. No movement of any vehicle in either mode may take place unless authorised by the system controller. This is essential for reliable operation and for safety. Aviation safety regulation thus has much in common with railways. There are rigorous acceptance processes for equipment, training and health requirements for personnel, and operating regulations covering such matters as maintenance requirements, operating equipment, and periods of duty.

On the other hand aviation has always been an international industry, with ‘traction units’ and crew frequently crossing borders. Therefore there has been a need from the origins of the industry for harmonisation of safety regulations between countries, and the national safety regimes have developed in this context. The aviation supply industry has been globalised for decades and broadly the same vehicles are supplied to different countries. There is much less diversity in types of commercial aircraft than in types of railway traction. Also the role of the IM is sharply divided between air traffic control and airport service provision. The virtual absence of close contact between the moving vehicles and the infrastructure also means that the role of the infrastructure managers with respect to aircraft acceptance is minimal.

It is interesting that the safety regulation of aviation has in some of its functions some type A rather than type B characteristics. Aviation is more open and well defined (type B) than rail regulation in the availability of regulations and standards and, most strikingly, with regard to information about civil aviation accidents. Standard setting is also open in the sense of being industry led, with wide participation. However it is not based on clear substantive (as opposed to procedural) decision rules. Trade-offs between safety and other factors are not generally acknowledged, and as far as we know there have been no studies of air passengers’ willingness-to-pay for safety. With a few exceptions, such as cabin water sprays, willingness-to-pay arguments for safety measures are not used, and when the implicit costs of aviation safety measures have been retrospectively calculated, they have been found to be in some cases very high relative to their safety benefits (Ashford, 1991).

It is beyond the scope of this railway study to judge whether the dominance of type A characteristics in some aspects of safety regulation has helped or hindered the aviation industry. (It has the advantage for example of being politically low-risk.) Until recently, air travel was largely dominated by cartels, which could have concealed any disproportionately high costs, but this is now much less the case and the safety regime has not changed.

However the case for development in the regulation of European railways arises mainly from the need to move from a national railway culture to that of a dynamic industry, with competing providers, including new operators, with the development of new routes, in a railway context. This is a railway context of safety regulation having a traditionally national focus and being intimately linked to the relationships between infrastructure managers and train operators; and with the life of both infrastructure and vehicles being extraordinarily long by industrial standards.

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95 As distinct from general aviation, where there is much “free flight” outside the commercial air corridors.
The circumstances and characteristics of aviation are very different. As noted above, the role and influence of infrastructure managers is radically different; the life span of aviation equipment is shorter; aviation globalised and internationalised long ago; it does not face major changes to achieve a new, more international structure. Nor does aviation have its back to the commercial wall; no authorities are expressing concern about what is needed to ensure the survival of the aviation industry, as did the previous European Commissioner for Transport about railways (House of Lords, 1996).

5.3. Ways Forward to Safety Regulation of a European Mainline Railway

This section first reviews the functions and discusses the procedures of railway safety regulation. This is followed by a discussion of how these characteristics might best be handled within Member States and non-government trans-national bodies as restructuring proceeds. This is followed in turn by a discussion of the EU role and, finally, our proposals.

5.3.1. The functions and processes of RSRRs

We consider the following functions.

1) High level policy: setting of general legal obligations.
2) The setting of practical standards and decision rules.
3) Conformity assessment.
4) Safety audit.
5) Inspection.
6) Accident investigation.
7) Penalisation.
8) Information and R&D.

To achieve the objectives, discussed in section 5.2.1 above, of effectiveness, efficiency, fairness and transparency and accountability, four characteristics appear to us essential. These are due process, sound and transparent decision rules, separation of powers to prevent distortions caused by monopoly power, and a free flow of safety information.

5.3.1.1. Due process

It is hard to see the effective development of national or EU wide safety regulation system without an increasing emphasis on due process.

To fulfil the requirements of due process, a procedure must:

- be documented;
- make relevant information available to all parties; and provide for all affected parties to be heard;
- be applied consistently, with specified substantive (as well as procedural) decision rules;
- give reasons for decisions;
• be subject to independent appeal; and
• preferably be subject to staged timetables (whether triggered by passage of calendar
time, or triggered by particular events).

Availability of the reasons for decisions provides a basis for independent appeal. Making
reasons explicit also creates a basis for making explicit the acceptance criteria and hence
better relating these criteria to informed public preferences.

There is a conflict between due process and the “Type A” style of safety regulation, as
discussed in section 5.2.2 above insofar as that style is based on the principles of “appeal to
authority” and of consensus within the expert community,\(^{96}\) rather than disclosure and
transparent discussion of options.

5.3.1.2. Decision rules

All substantive (as opposed to procedural) decision rules underlying acceptance criteria
involve trade-offs between safety and other factors. In the current national RSRRs these are
often not explicit and may be inconsistent.

For example, the principle that safety must always be improved or maintained is reasonable,
both politically and technically (given the presumption of both continuing technical
advance and, probably, continuing increase in people’s willingness to pay for safety).
However it is not efficient if it is applied too narrowly, say to components rather than whole
systems; nor if it is applied without further analysis of which trade-offs would bring the
greatest benefit; nor if it is focused strongly on issues of current political concern, at the
expense of others less exposed to public view.

Any practical decision rule will leave scope for managerial judgement. However an explicit
rule will make clear the information and the criteria on which the decision is based.

The benefits of making decisions explicit are:

• effectiveness and efficiency - because time and material investment in safety is directed
  consistently, to maximise safety; and because regulation is more predictable.
• fairness - because explicit decision rules make it possible to demonstrate equity or
  inequity.
• transparency and accountability - because society can better judge whether its
  requirements are being met by regulatory processes when it knows why decisions are
  taken.

At the EU level, explicit decision rules are needed for consistency and efficiency of the
multitude of decisions of the many standardisation committees requires.

\(^{96}\) There may also seem to be a conflict between the sharp clarity of due process and broad concepts, such the
GAMAB principle in France, or ALARP in GB, which define general principles. General principles of this kind are
however needed as a foundation for decision rules, as discussed in section 5.3.1.2 below. Due process also has
itself to strike a balance between rigid rules and flexible judgement.
5.3.1.3. **Separation of powers**

If all standards were determinate, conformity acceptance would require little skill. It could be delegated to anyone with integrity and the training needed to understand the standards. In practice conformity acceptance is a much more demanding task because many standards are not determinate, so their application requires judgement. Thus for many standards, in the present regimes, the requirement is “acceptor-dependent”: the applicant is dependent for approval on the judgement of the acceptor.

With the growth in the number of operators and suppliers in national markets, including new entrants, procedures requiring judgement can only be efficient and fair if they are transparent and accountable. This requires that responsibility for acceptance is given to an independent body. Approval of non-determinate standards also needs to follow due process, with adequate scope for appeal.

There are also good arguments, as set out in section 4.3.3.2 above, for independent accident investigation.

5.3.1.4. **Information**

One area in which safety is “special”, and where a traditional public service ethos is appropriate, is in the collection and sharing of information. The civil aviation industry is conspicuous for the rigour with which civil air crashes are investigated and the results applied throughout the industry to improve safety. Similar principles should apply to European railways.

As discussed earlier and in section 5.3.2 below, it is also important for the efficient management of safety for data about the infrastructure to be available to those who need it.

Another important issue of information, less immediately critical to RSRRs but still relevant, is comprehensive comparative data on safety performance.

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97 As defined in the Glossary: “A safety requirement is ‘determinate’ if any qualified observer, given the right data, could say whether the requirement is met without having to make a subjective judgement.”

98 This is generally desirable, so as to facilitate innovation and solutions tailored to the particular situation.

99 Also some standards, even though they are determinate, may require information which is held by the acceptor, but not by the applicant - especially where the acceptor is an IM.

100 Independent conformity assessment presents a problem where, as with the IM in Britain, the IM is legally required to be satisfied of conformity. It could be argued that this duty cannot be fulfilled with an independent Notified Body. This arises especially with the certification of train operators, where the issues can be highly judgmental. In our view, the difficulties can be met by a satisfactory process for selecting Notified Bodies, and by providing that interested parties have a right to be consulted by the Notified Bodies.

101 Performance standards are relatively new to the railway. So also are the issues of external conformity assessment. While it is desirable to clarify the requirements as much as possible, it seems likely that an evolutionary, “case law”, approach will be required to develop mutual understanding of how criteria such as “as low as reasonably achievable” can best be applied to particular decisions.
5.3.2. The allocation of functions in national RSRRs

In allocating functions, as listed in section 5.3.1 above, an important factor is the cost of complexity. The more bodies there are involved in a decision the more there is scope for the evasion or lack of clarity about responsibilities, and more scope for bureaucracy. However, in our view, further separation of powers (which are now often concentrated in IMs and RIs) is important.

5.3.2.1. High level policy

High level national policy, including the setting of general legal obligations, is a function of government, generally advised by an independent safety regulator, described in several Member States as a Railway Inspectorate (RI), which we use here as shorthand to describe this function. The RI might be confined to the safety of railways. It is almost certainly better for the RI’s coverage to be wider, for example covering all transport modes; or possibly as a part of a general national regulator of safety in the workplace. ¹⁰²

5.3.2.2. Setting of standards and decision rules

Much use is already made in Member States of international standards. However the usual railway practice is for standards and decision rules to be interpreted and imposed by the RI and/or the infrastructure manager. This is an obstacle to innovation. In other industries, the responsibility for fulfilling the general legal obligation normally rests with the industry. The safety regulator’s role is to supervise this, not to do it. We believe this should be the case with the railway.

This implies a national body which represents the infrastructure and train operators and the supply/maintenance industry. This body, say a Railway Industry Safety Committee, with a supporting executive staff, would also ensure that adequate R&D on system-wide safety issues was undertaken and promote a forward looking approach, for example on national policy towards European harmonisation.

The standards and decision rules proposed by the industry need to be subject to veto by the RI. Trade union and consumer representative input should be through the RI, not through the Railway Industry Safety Committee.¹⁰³

One present obstacle to such a structure is that of funding. There is a strong public interest case for funding of a body such as a Railway Industry Safety Committee by a levy on the

¹⁰² Many Member States have governmental regulators to deal only with railway safety. The reasons are probably historical in most cases – either because railways were one of the first “modern” industries to present important risks to customers and the public, or because of the nationalised monopoly model for the railway itself. We question this arrangement. It fosters the ethos of the old railway. Safety regulation of the railway needs to become more clearly independent of the railway operators, more European, and more aware of and open to practice and experience in other industries.

¹⁰³ These principles should also apply to the safety decisions taken at EU level. The independent regulator function might be performed by input from ILGGRI to the Article 21 Committee and similar decision-making bodies. We do not support the suggestion in the draft Communication covering the draft Directive that trade unions and consumer groups be directly represented on the AEIF, but we do feel that they should be enabled to make an input.
industry, perhaps overseen by an independent Rail Regulator (such as the ORR in GB) with wider responsibilities.

The system might include a process for appeal to such a Rail Regulator against discriminatory action by the Railway Industry Safety Committee. It should certainly include regulation of the provision of information by the IM about the infrastructure.

5.3.2.3. Conformity assessment and safety audit

In the long term the primary regulation decisions - the definition of the required safety standards - may all be taken on a European basis, not a national basis. However secondary decisions - conformity assessment, audit, inspection and prosecution - are different ways of ensuring that the required standards are met. All of these functions, and arguably accident investigation, can be delegated to the national level. They are best conducted by organisations independent of each other and of the authority which sets the safety requirements.

The Notified Bodies for conformity assessment under EC96/48 will have an EU-level role initially. However it is proposed in the context of the new draft conventional interoperability Directive that they will also undertake conformity assessment of national requirements (which will remain important even for the mainline railway for many years). This is a most important requirement - even though the Notified Body undertaking conformity assessment and safety audit may not be based in the Member State in which the activity takes place.

It is already accepted that safety audit can be done by bodies which may be legally incorporated in a particular country, but which operate wherever their services are required.

These Notified Bodies need to be non-governmental and trans-national.

5.3.2.4. Inspection

Inspection is a function for the national government’s RI. It is a responsibility of the RI to ensure that the RSRR is being properly applied, and that weaknesses are identified. It is important that this is exercised locally, and with an open-ended remit.

5.3.2.5. Accident investigation

Accident investigation is best carried out by an expert but independent body. None of the bodies with any responsibility for the regulatory environment within which an accident occurred can be wholly independent.

As discussed in section 4.3.3.2 above, there are important benefits from such independent investigating bodies being responsible, as already in some Member States, for a wider range of accidents than those on railways alone.

It is at present assumed that an accident in a Member State will be investigated by authorities within that country. This need not necessarily be the case in the longer term. One option is to
establish a single EU-wide accident investigation agency, or regional agencies, as discussed in section 5.3.6.3 below. Another is to encourage several such bodies to develop within the EU, from the existing bodies and as spin-offs from existing Inspectorates.

In the Transport Safety Board approach noted in section 4.3.3.2 above the purpose of the independent accident investigation board is to identify systematic safety deficiencies and make recommendations as how they should be improved. The more traditional investigation bodies have however a record, as illustrated in footnote 83 above, of producing recommendations which have later been seen as misjudged. There can therefore be an issue of the extent to which particular kinds of board should be invited to make recommendations, in addition to establishing the facts and making observations.

In the Transport Safety Board approach noted in section 4.3.3.2 above the purpose of the independent accident investigation board is to identify systematic safety deficiencies and make recommendations on how they should be improved. The more traditional approach of ad hoc investigation boards has a record, as illustrated in footnote 83 above, of producing recommendations which have later been seen as misjudged. There can therefore be an issue of the extent to which particular kinds of board should be invited to make recommendations, in addition to establishing the facts and making observations.

5.3.2.6. **Penalisation**

Penalisation, such as prosecution, is not a role to which we give much weight. We know of no evidence, and see no good reason to believe, that a more strongly punitive regime increases railway safety. Because it tends to discourage the provision and exchange of information its effect on safety may well be negative. Prosecution for criminal offences must remain under the control of the relevant jurisdiction – national or EU. We believe that any prosecution, at least for the more serious offences, should be by an authority which is not a safety regulatory authority. However prime responsibility within the national RSRR for proposing any such action should be with the national RI.104

5.3.2.7. **Information and R&D**

The free flow of information on safety issues, and the commissioning and dissemination of system-wide R&D are important issues. Supervision of these issues within Member States might fall most naturally to the Railway Industry Safety Committee, supervised by the RI (and the Rail Regulator if such a body exists), although this leaves open options for funding.

5.3.3. **The European role: Views of Member States**

There is some variation in the extent to which Member States appear to wish for more European level control of safety regulation. Some appear to see EC regulatory activity in this field as an external influence, which they need to restrain from being unhelpful and then react to as Directives are approved. Others would welcome a more proactive EC role.

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104 There is a worldwide trend towards litigation by the injured parties. This too makes impartial investigation of accidents more difficult.
It has been suggested by railway experts in one Member State that the EC could usefully promote initiatives on a number of safety-related fronts. These involve technical issues which go beyond the scope of this study. However we judge that in many Member States, although views might differ about appropriate action, the points raised would be seen as issues for concern at a European level. The initiatives suggested would include action on the following. We include the list to illustrate the kinds of issue which some in the industry would like the EU to resolve.

- European standards for cab signal systems, track integrity, and the ‘vigilance button’ function.
- Precise indication of which EU standards must be respected for the supply of interoperable equipment.
- A more accurate definition of what is meant by safety equipment - a problem which has been partly ignored in the preparation of the high speed TSIs.\(^{105}\)
- Specification of requirements for professional qualifications for train drivers and maintenance staff (including language skills, and health).
- Definition of a set of harmonised rules and standard procedures for train drivers, and procedures for emergencies.
- Standardisation of a minimum level of diagnostics - for example for the definition and detection of anomalous on-board vibrations.
- Establishment of a European control and surveillance body to monitor the national Notified Bodies for conformity assessment (in order to ensure operational transparency and to avoid discriminatory behaviour in favour of national industries).

Relevant to some items in this list is a point which we have stressed as fundamental: that it is misleading to divide railway decisions sharply into ‘safety’ and ‘non-safety’. The key harmonisation decisions about safety are inseparable from engineering decisions on for example signalling, rolling stock and track; human resource decisions on operating rules, training and rostering arrangements; or marketing decisions on speed and timetabling of services.

No Member State would propose for the foreseeable future a European railway safety regulator to take over the roles of the Railway Inspectorates or other high level national safety authorities. However we believe there is widespread support for some strengthening of the European role in railway safety regulation. These might be the substance of the proposed Directive on railway safety.

**5.3.4. EU action to promote more efficient national RSRRs**

We discussed in section 5.3.1.1 some features of national RSRRs (due process, explicit decision rules, separation of powers and provision of information) which we see as necessary for the efficient development of a European railway. We consider here steps

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\(^{105}\) The European Commission express doubts about this comment on TSIs. It is however recorded as the considered view of one group of experts in the field, concerned with applying these standards.
which might realistically be taken at the European level to promote these features where they are not already established.

5.3.4.1. **A requirement for due process, separation of powers and the provision of infrastructure information**

It would be unrealistic, even if were efficient, for a Directive to lay down a detailed safety regulatory structure to be used in all Member States. However due process would seem to require as a minimum:

- Effective external regulation of the industry, by a body which is not linked in any way with any train or infrastructure operator.
- Representation of management’s of all sections of the national industry in the setting of standards and decision rules.
- Requirements for provision by infrastructure managers of infrastructure information needed for conformity assessment requirements.
- Notified Bodies for conformity assessment which are independent of infrastructure managers.

Effective external regulation is already applied in several Member States, typically by a government Railway Inspectorate, although the constitutional nature and responsibilities of this external body may vary.

Management representation of all sections of the industry in development of the regulatory ground rules is less common. In any case it has limitations as some parts of the industry - in particular monopoly IMs or very large operators - may find it much easier to accommodate such work in their business overheads than bodies which are smaller or facing stronger competition. However it is a necessary contribution to openness, as is recognised in European regulation. Moreover, as was noted in section 5.3.2.2, it is the industry which should have the lead responsibility for interpreting and imposing standards. We suggested earlier that such a body might be described as a Railway Industry Safety Committee.

Responsibility for information about the infrastructure is likely to become an increasingly important issue, as separation of infrastructure and train operation proceeds further, and train operators become more independent and diverse. It needs to be clear that the collection, maintenance and provision of such information is a responsibility of the IM.

We recommend that the Commission should consider a Directive which would lay down a general requirement for due process, together with these further requirements for separation of powers and for information.

We have considered whether there a role for European intervention in the decision rule used in national standard setting. This is a sensitive area on which it would be at best difficult to obtain agreement on anything which was operationally useful. It may also be pointless in the longer term, if all substantial standards development is by then taking place at the European level.
On the other hand there will always be a considerable role for local decision making, both on local issues and on the application of European requirements. The general requirement for due process thus requires at minimum, in our view, a statement of the decision rule for European standards which is clear enough to guide applicants, and to provide a basis for possible appeals against discriminatory action.

We have also considered the less tangible requirement of national regimes that they should encourage a problem solving, proactive approach to safety regulation, with a culture which is deeply concerned about safety, but also deeply concerned to develop a thriving, dynamic, European industry. We recommend that the EU should recognise this issue of regulatory culture, or ethos - of looking for and encouraging constructive change versus wanting to protect the status quo - as key to the rate at which the industry can develop. The development of bodies such as Railway Industry Safety Committees might help development of the culture in this way.

5.3.4.2. Encouragement of independent accident investigation

The procedures for accident investigation have much less impact on the development of new operators, new markets, or new technology than procedures which are applied when such innovations are proposed or introduced. However we are impressed by the arguments for accident investigation by bodies which are independent of the rest of the regulatory structure, and by the experience of those Member States that have already taken this step, as noted in section 4.3.3.2 above.

Some Member States have a good record of having important railway accidents professionally investigated, with input from all parties, and with reports being published. Others do not. We believe this degree of openness is important for public confidence. We believe it will be found vital in the multi-party environment. Investigation solely by the NI or IM will not be found credible. Adversarial and legally-based proceedings will be found inefficient and grossly protracted. Further, the diminishing number of major accidents, the harmonisation of railway technology and more demanding public standards will mean that all European railways must be able to benefit rapidly from the unfortunate experiences of individual operators.

We believe it is desirable for the Commission to take a high-profile lead in improving feedback from accidents, and in maximising the EU-wide benefits to be derived from effective accident investigation. Accordingly, we recommend that the Commission should impose an obligation on Member States requiring independent investigation of major accidents, following best practice and due process, and publishing the reports. The extent of “independence”, the definition of “major”, the nature of “best practice” in this field and whether accidents in other modes should be included, are all for debate.

5.3.4.3. Influence of other measures for European harmonisation of national RSRRs

National RSRRs would be strongly influenced by some of the EU actions proposed in section 5.3.6 below, to promote efficient harmonisation. This would apply especially to the
requirement that new national standards should be cleared at a European level for compatibility with European standards.

5.3.5. Strategies for efficient harmonisation

Many potential policy responses to regulatory diversity were listed in section 4.4.4 above. Most have something to offer in the right circumstances. It is a matter of “horses for courses”. Each of these potential responses is discussed in turn below.

5.3.5.1. Common standards

There are cases, such as power supply, where the transitional cost of moving from today’s inheritance to a common future standard would more than offset the long term benefits. Indeed on the railway it is often difficult to make the case for investment, because of the exceptionally slow rate of asset replacement - with major assets having lives of many decades; and because of the integrated nature of the system. This often leads to extremely long lead times for the benefits of harmonisation. Transitional arrangements can be difficult to design, given the operational and safety risks of mixtures of equipment and procedures.

At the same time mandatory, EU-wide standards are in many areas essential for interconnected railways. And even where not essential they may often be justified, especially to enable trains and train crew to move at lower cost across borders. Vast effort is going into strict harmonisation of systems such as EIRENE and ERTMS, associated with the high speed interoperability Directive.

Mandatory standards may be prescriptive, or they may be performance standards, or standards for management systems. There is a place for all three.

We have reservations though about using European law to impose elaborate formal management systems, as for example through ENs 50126, 50128 and 50129. System standards of this kind appear to us to be appropriate in some circumstances, but not all. If businesses would choose to take decisions in this way in any case, there is no need for the standard. If they would not, the implicit assumption is that the committees of standards institutions know better how to run the companies in the supply and operating industry than those who are selected and paid to do the job. Such standards carry the risk of generating bureaucracy and cost without corresponding benefit. They can become paper systems separated from the real management system.

Steps are needed to help EU standard setting to move more explicitly towards explicit decision criteria and the requirements of due process. There are no agreed criteria at the EU level for standards, in terms either of level or degree of prescriptiveness. National interests, reinforced by enduring technical differences in existing assets, make harmonisation difficult and lead to levelling-up. This imposes higher costs than can be justified by public preferences and damages railway competitiveness.

The introduction of common standards can also involve investment which falls unequally, as where country B and country C replace their systems with country A’s, with a large
overall gain, but much more immediate cost to B or C than to A. In such situations, there may be a European role in facilitating the sharing of costs.

A conspicuous feature of the European railway standards setting scene is the extraordinary imbalance between, on the one hand, the massive resources devoted to engineering debate in technical committees and, on the other hand, the resources devoted to central management of this activity. This needs urgent attention and we welcome the proposals in the draft Directive for a “strong permanent organisation” for the AEIF.

5.3.5.2. Mutual recognition

Mutual recognition in EU Member States of approval granted in other Member States has major attractions in principle, particularly since the EU is relatively uniform in economic, technical and cultural terms. However many of the problems of railway safety regulation arise from local issues. Drivers’ route knowledge of Italy is not assured by testing their route knowledge of Spain. More seriously, rail safety presents exceptional difficulties for the application of mutual recognition, because controls or standards relating to one element of the system (e.g. rolling stock) are so often closely interrelated with others (e.g. track). An item of rolling stock, for example, may be safe in conjunction with one national infrastructure but cannot be assumed to be so in another.

We have considered an approach whereby the default option would be that acceptance by one Member State’s RSRR was sufficient for another Member State, unless the second Member State gave good reason why this should not be so. The onus of justification would shift: instead of the applicant having to show that his prior certification was sufficient, the second regulator would have to show why it was not.

We recognise that the differences between the engineering and operating systems on the different railways are pervasive and important, and local issues often dominate. Consequently, mutual recognition might have little practical effect.

However it has the potential to deal with minor matters, such as some of those listed in section 4.4.3.1 above. It could help to identify issues where national RSRRs differed for reasons of historical rather than current relevance. A “right to mutual recognition” would be useful in putting defenders of the status quo on the defensive. On balance, we recommend that the Commission should propose a Directive that approval by one Member State should sufficient for another Member State, unless the second Member State provides good reason why this should not be so.

For many mainly small differences in national standards, such as those illustrations in Group 3 of the list in section 4.4.3.1, the only obstacle to harmonisation is differences of view, or the institutional difficulties of accepting change, within one or both Member States. It would be premature to try to force such harmonisation in individual cases, at least without substantial groundwork on the technical details. However identification of these differences is an issue which the Commission needs to address.
5.3.5.3. Policed decentralisation

Policed decentralisation lives naturally with the EU principle of subsidiarity, in areas such as goal-setting standards, high-level standards and approved codes of practice. It leaves the initiative with the affected parties. It works within existing institutional structures, which for railways have in many cases recently been adapted or newly designed. This largely avoids the costs, delays, and possible safety risks of organisational upheaval.

Policed decentralisation would however require codes of due process to be overlaid on whatever institutions the Member State have in place. This includes the prevention by the EU of new national standards which are not compatible with European standards.

Where due process is already established, policed decentralisation would involve little more than converting an administrative practice into an enforceable right. However, as was discussed in section 2.3.3.5 above, there is evidence that in many cases the fulfilment of the due process requirements is incomplete.

5.3.5.4. Networked regulation and self-regulation

The networked and self-regulated approaches are already established in many areas of European railway regulation. They should be encouraged by continuing to allow the industry freedom to take such measures, although there is a role for EU requirements about representation, decision rules and due process.

There are areas where single European acceptance rather than multiple national acceptance, is in the interests of all parties – suppliers, customers, even regulators - if it leads to more rapid introduction of safety measures. One example which has been suggested is software integrity for systems such as automatic trackworker warning systems.

5.3.5.5. Indirect harmonisation

Indirect harmonisation is a major, even dominant factor in railway safety regulation, where many aspects of safety, such as signalling and braking and other aspects of vehicle and infrastructure design, are largely controlled by engineering standards. This emphasises the closeness of the link between safety and engineering, and the need for them to be seen as a whole, and not as separate issues.

5.3.6. EU actions to promote efficient harmonisation

At the European level a top priority to promote harmonisation is the introduction of stronger measures to manage and develop due process and clear decision rules in the setting of European standards.

This is not specific to safety. It relates to the whole standard setting process. However we believe that such measures are badly needed, to improve the cost-effectiveness of the standard setting process, including the analysis of safety.
5.3.6.1. **A new commitment to central coordination**

It is generally accepted, and we agree, that the man responsibility for action this field lies with the industry. Historically this role has been fulfilled mainly by the UIC. More recently, in the context of the high speed interoperability Directive, it has been shared with other industry bodies within the AEIF, mandated by the EU as the joint representative body for that Directive. The present AEIF has a part time Board and mainly part time staff provided by the UIC and, to a lesser extent, UNIFE. Although more staff have been seconded for work on TSIs this structure falls far short of our perception of what is needed for the central progressing of the European railway industry.

It is widely accepted that the AEIF should be strengthened from its present very slender resources. We support a move of this kind. We recommend that the central industry function should be slightly widened to include rolling stock maintenance companies and infrastructure contractors. We also recommend that the central industry functions should be extended to include all those discussed below.

This central coordinating body needs far sighted, full time leadership and a fully committed, professional secretariat. It needs to represent operators, manufacturers, the maintenance industry and leasing companies. However trade union input should be through their own industries and through independent national safety regulators. Trade union representation on this already somewhat bureaucratic central coordinating body would be no service to employees or the industry.

The central coordinating body also needs consultative input from the national Railway Inspectorates.

Another proposal which, if not widely accepted, has been a regular issue for debate, is the concept of a Railway Agency. We support such a proposal. We see no significant conflict between an Agency and a strong railway industry body. Indeed the need for an Agency, as an executive interface between the policy activity of the Commission and the activities of the industry, would be increased by stronger European level activity within the industry.

We recognise that, although a stronger industry body and a Railway Agency would subsume some functions which are already being undertaken, both would need additional financing. This is envisaged to some degree in the draft Directive (Financial Impact Annex) and we welcome this.\(^\text{106}\) We believe that the benefits of strengthening the central steering of the harmonisation process in this way would be very many times greater than the costs. Much of the benefits would ultimately accrue to passengers and freight operators, from whom the costs should eventually be recovered.

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\(^{106}\) To a limited extent, if necessary, funding could come from reducing the front line work of the standards committees. If the professional time spend on standards committees was charged to those organisations the problem could be dealt with almost wholly by redistributing expenditure from front line work on standards to central management. However in practice only travel and subsistence costs are charged to standards committee budgets; whereas central management generally requires the payment of total staff (or consultancy) costs.
There are many functions which need clear executive management at the European level. We list seven of these functions below.

5.3.6.1.1. Central management of the European standards machinery

In today’s more complex and more rapidly changing circumstances there is a serious disproportion between the efforts devoted to front line work on the development and approval of standards and the central coordination of this massive activity.

There is a need for professional management of the process, which is confined to railways but stretches well beyond the scope of any one of the European standards bodies. This would include issues of coordination and progressing, including the coordination of questions such as the extent to which, in general terms standards should or should not be specified. It would also include the continuing review of processes against the requirements of due process.

This is a function which needs to be contracted out to a body with wide experience of engineering project management.

This proposal could only proceed with the support of the standards institutions, who have a reputation for independence. It should not be interpreted as implying either any criticism of their work or any reduction of their authority. The proposal is for a new function, which would increase the effectiveness of the massive and essential work which they do.

5.3.6.1.2. Development of risk assessment and decision rule methodology

We discussed in sections 5.2.3 and 5.2.4 the scope and role for quantitative analysis in railway safety policy, including the need to develop procedures for comparing costs and benefits. In section 3.2 we noted the cost-benefit procedures proposed for the interoperability TSIs and in section 5.1.4 we commented on how these could be used. The central bodies need to carry this forward with an active, informed debate on methodology and data. This should draw on experience from other industries, including road transport and the process industries.

This function would need a small number of technical staff with a spread of disciplines and experience from outside the industry.

This would be a contribution to all of the policy responses to diversity in section 5.3.5 above.

5.3.6.1.3. Wider public access to the TSI process

We noted in section 5.1.4 that, despite the extremely formal and well defined administrative procedures for developing TSIs, some of the key documentation was largely unknown or even confidential, for no apparently good reason. A study is needed of how the existence of documents can be more widely broadcast and accessibility increased. A website of the central industry coordinating body, cross referenced from those of its member organisations, would seem to be the natural instrument for providing such information.
5.3.6.1.4. Clearance of new national standards

National railway standards continue to be introduced which are incompatible with European standards. An effective procedure is needed whereby a central secretariat is informed of proposed new national standards, with identification of any potential conflict with European standards.

The central coordinating body or the Agency should have authority to rule against such standards, subject to a process of appeal. This is an aspect of policed decentralisation as discussed in section 5.3.5.3 above.

5.3.6.1.5. Recognition of relevant approvals by other Member States

At present issues of recognition by one national authority of another’s approvals are typically negotiated, if this is necessary, through COTIF. This would however be a natural function for the central coordinating body or the Agency.

5.3.6.1.6. Identification and resolution of “zero-cost” measures

As noted in section 4.4.3 above, there are many measures where harmonisation or mutual recognition would bring benefits - at least in the longer term - at little or no cost. Apart that is from the bureaucratic cost of reaching agreement between different authorities that one or both of them should change their conventions for the benefit of the railway industry as a whole.

This is an issue which can only be resolved by the industry in consultation with national RIs. It would come under several headings - common standards, mutual recognition and networked or self-regulation.

5.3.6.1.7. European railway safety data

Regulatory coordination and harmonisation is hindered by poor information flows and poor stocks of basic information on networks, safety performance, and other safety relevant matters. Information is needed so that, for example:

- Member States' regulatory procedures are known and comparable.
- Information is widely available on technical data, controls and systems as encountered in Member States, especially data on safety-relevant and interoperability-relevant features of the infrastructure.
- Information on enforcement and compliance levels is available.
- There is uniformity of approaches, assumptions and modes of collecting and analysing accident and other safety data (or at least substantial progress in this direction).

The last of these functions includes some of the current activities of the UIC, but is wider and more proactive. It would entail close cooperation with the EU and national statistical authorities, who would presumably wish to share in such a development.
All these functions need again to be managed and largely financed within the industry, with EU involvement.

5.3.6.1.8. Problems of language

As discussed in section 4.4.4.2 above, language is emerging as a significant obstacle to interoperability. The UIC in particular is coordinating work in this area, but there would be value a stronger drive, involving the industry as a whole.

5.3.6.2. European certification of Notified Bodies

Another potential European function is certification of Notified Bodies for conformity assessment and safety audit. This could be a major step towards harmonisation and towards opening up markets to new entrants. It could greatly increase the incentives for national regulatory bodies to accept the technical approvals of Notified Bodies based in other Member States.

The European certifying authorities would need to be managed by the Agency, as the industry could not fulfil this role. However it would probably need new legislation which might be difficult to achieve. We understand that there are in any case reservations about the EU accepting the liabilities implied by this role, which are under present procedures borne by the governments of Member States.

If such a structure were achieved, it should be self-financing from fees for certification. It would be a further contribution to policed decentralisation.

5.3.6.3. European accident investigation

As noted in the context of national RSRRs, the procedures for accident investigation have less impact on supply costs and interoperability procedures which applied at an earlier stage. However it is still a supremely important function, the management of which needs to reflect changes in the railway structure. It might be timely to consider the establishment in due course of at least regional accident investigation boards, covering parts or all of the EU. We argue that it is worth considering for a number of reasons.

First, there are economies of scale in terms of marshalling the scarce human resources and technical facilities to investigate major accidents. This is very important. Few countries have the expertise to dedicate to accident investigation full time. A multinational team (with the Investigator-in-Charge being a national of the “host” country) could function as a professional and independent unit. At present, only the United States and Canada have dedicated scientific laboratory and computer facilities for the technical investigation of accidents. A Europe-wide authority could provide state-of-the-art resources to all of its members and would be an efficient use of European resources.

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107 And arguably for accident investigation, although this raises some even more difficult issues.

108 As noted in section 4.3.3, we do not develop the issue in this Report the substantial issue of whether such authorities should have a wider transport safety role.
Second, many accidents already involve more than one country and this will increase as cross-border rail transport increases. Included in the investigation must be not only the “host” country where the accident takes place, but also the countries of origin and destination, the country under whose flag the equipment is licensed, and the countries manufacturing the equipment. Thus, an effective investigation must often be multinational anyway.

Third, many of the lessons learned in terms of accident prevention transcend national boundaries, and these would best be promulgated by an authority without any specific national allegiance.

From any single country’s perspective, rather than being investigated “by a body from outside the Member State,” it would be investigated by “a body including the Member State”. The existence of ITSA, the European Transport Safety Council, and other international bodies already attest to the internationalisation of transport safety.

5.3.7. A transition strategy

If a shift towards a truly European railway is accepted as the goal, the task then becomes designing a “transition strategy” towards the necessary structures. We suggest that a transition strategy will include the following elements:

- A Directive requiring the RSRRs in Member States to adopt certain characteristics, where they are not already in place, as set out in section 5.3.4.
- Adaptation of the draft conventional interoperability Directive to establish, during 2000, a central coordinating body of the European railway industry, with a structure and functions as described in section 5.3.6.1.
- Action to establish a railway Agency, with sufficient authority to be able to take a substantial proactive role in support of EU policy objectives.
- Adaptation of the draft conventional interoperability Directive to reflect the need for safety standards, and tolerable levels of risk, to be based on a balance of costs and benefits.
- Definition, by DG Energy and Transport, in consultation with the European railway industry and regulators, of “due process” and “decision rule” requirements, for further development by the central coordinating body and the Railway Agency.
- Setting up a structure to monitor and promote these requirements in EU-level proposals and decisions involving safety.
- Research into the nature of differences between national railway safety requirements, to greatly extend the illustrative list in section 4.4.3.1, and provide technical and procedural insights into which should be further considered, and how.
- Research into the European needs for safety performance and other safety related data and into the action which might be taken to meet these needs.
- Research into risk assessment methodologies (including the comparison of costs and safety benefits) across other transport modes and other European regulated industries, including process industries.
5.3.8. Summary of potential new European structures

The proposals in sections 5.3.4 and 5.3.6 imply the institutional picture in Table 5.2. Alternatives to an explicit and transparent shift to a stronger European role are:

- an absence of railway safety regulation at EU level, despite the major technical decisions being taken there; or
- a covert shift, effectively leaving decisions on safety to the multitude of standards committees which shape the EU-level technical decisions.

Both of these look far from optimal for the EU or for its railways. Neither would be efficient. Both would expose the Commission to serious public criticism in the event of an accident which the media could associate with European regulation.

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<tr>
<th>EU</th>
<th>Executive responsibility for</th>
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<td>Definition and oversight of European self-regulatory functions managed by the European railway industry</td>
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<td>Requirements for national RSRRs</td>
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<td>[Certification of notified bodies]</td>
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<td>European railway industry (in parallel with EU Railway Agency)</td>
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<td>Public access to the TSI process</td>
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<td>Clearance of new national standards</td>
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<td>Recognition of relevant approvals in other Member States</td>
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<td>Identification and processing of “zero-cost” and other harmonisation measures</td>
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<td>Trans-national</td>
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<td>[Accident investigation]</td>
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<td>Safety regulation of non-mainline railways</td>
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6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusions

6.1.1. General conclusions

C1 Railways are unique in the pervasive and exclusive nature of their infrastructure. They are much more strongly integrated than any other transport mode. Thus while comparisons with aspects of the safety regulatory regimes of air, road, or marine transport can be valuable, but they need to be drawn with care. (Section 5.2.5)

C2 Safety considerations are a factor in all the key design decisions. It follows that safety harmonisation is driven largely by harmonisation of operational standards. (Section 5.3.6.1.1)

C3 Because of the close integration of vehicles and track, many of the important decisions involving safety straddle the responsibilities of the infrastructure manager and train operators, owners, or suppliers. These institutional divisions make managing these decisions more difficult. Restructuring of the industry means that, in the development and application of standards, due process and explicit decision rules (i.e. technical criteria for choosing between alternatives) have become more important. (Sections 5.2.1, 5.3.1)

C4 The level of professional skill, energy and commitment within the railway operators and suppliers, and their representative bodies, and among the independent regulators, is very high. The history of railways has also bequeathed a strong safety tradition and high levels of passenger safety (Sections 1.3, 2.3.7)

C5 The present railway safety regulation regimes (RSRRs) within Member States do however offer scope for development in response to the new demands of interoperability, the single market, new operators and other innovation. Development of RSRRs might bring only marginal gains in safety, but could contribute substantially to the industry’s competitiveness and potential for growth. (Sections 4.3.4, 5.2)

C6 The differences between national RSRRs present further obstacles to development of the European railway. There is considerable scope for reducing these differences. (Section 4.4)

C7 Present procedures in railway safety standard setting and implementation may not include examination of all the relevant options, or provide the means of systematically comparing safety and other benefits. (Sections 2.3.4, 4.4.3.2)

C8 Criticisms have been made regarding the inaccessibility of some key documents generated by AEIF in the TSI development process, and more generally the lack of awareness of information available within the rail industries in the Member States
and the low level of impact that AEIF and other EU level initiatives have had on national RSRRs. (Section 3.2, 5.1.4)

C9 The introduction of a cost-benefit procedure into the process of developing interoperability TSIs is a positive step. We believe that the manner of their application in practice should be carefully monitored by the Commission. (Section 3.2, 5.1.4)

C10 EU policy on conventional interoperability is still being formulated. In developing policies in this area to secure the interests of rail users and taxpayers, we think it will be particularly important to ensure that cost effectiveness tests are applied at all stages of the process of developing and evaluating options. (Section 5.1.4)

C11 There is no conspicuous evidence of differences in liability or insurance arrangements being a serious brake in the development of the European railway; although the exemption of national railways from requirements to buy insurance can be a small bias against new entrants. The insurance industry is actively looking for opportunities to provide services for the evolving market. (Section 2.3.6)

6.1.2. Conclusions on national safety regulation regimes

C12 National railway safety regulatory regimes will remain for the foreseeable future. However their role in respect of the mainline railway will be increasingly focused on supervising the implementation of safety requirements which have been laid down at European level. (Section 5.3.3)

C13 In restructured national railways, the infrastructure manager (IM) has usually been given a strong regulatory role. But the IM is also likely to carry either the culture of the traditional state monopoly, or that of a new private monopoly. Neither faces incentives to encourage or reward new ideas elsewhere in the industry. (Section 2.1.3.2 and 5.1.3.2)

C14 The principle of due process in railway safety regulation appears to be widely supported in principle. However it is contrary to the traditions which evolved in the unified national railways. (Section 2.3.3.5)

C15 Due process and separation of powers will be assisted by independent “Notified Bodies” approving conformity assessment. IMs should not be eligible to be Notified Bodies. A body which lays down a requirement in this field should not also assess conformity with it. (Section 5.3.6.1.4)

C16 National regulation would also be helped by the development of national bodies, with supporting executive staff, representing the infrastructure and train operators and the supply and maintenance industries. (Section 5.3.3.2)

C17 There is widespread reluctance to acknowledge in formal procedures that choices have to be made about safety, which can involve trading very small gains in safety
against substantial other benefits. These choices need to be recognised more explicitly. (Section 5.2.3. and 5.2.4)

C18 The public subsidisation of railways can weaken incentives to look for more cost effective ways of doing things, including the achievement of safety. National governments have an important role in defining the purpose of subsidies and managing them in ways which do not seriously distort incentives. (Section 5.1.3.3.2)

C19 Designers of equipment and services require data about the infrastructure in order to fulfil safety requirements. Infrastructure managers should be responsible for providing this. (Section 4.3.3.1)

C20 There is a case for independent accident investigation bodies, as already set up by several Member States. It is helpful if such bodies’ responsibilities extend beyond railways. (Section 4.3.3.2)

C21 There is no strong evidence that differences in safety regimes are a serious constraint on the greater use by tramways or metros of mainline track. (Section 2.3.5)

C22 A well regulated commercially motivated railway may be operated more or less safety than a regulated railway run as a non-commercial public service. The evidence suggests that, in a European context, no material difference should be expected between the safety levels of a well regulated commercial railway and non-commercial, public service railway. (Section 5.1.3.3)

C23 There is no evidence, nor clear reason to suppose, that a strongly punitive RSRR will provide a higher level of safety, or more efficient regulation. To the extent that it encourages secretiveness, it could be a negative influence. (Section 5.3.2.6)

6.1.3. Conclusions on action at the European level

C24 Progress in safety regulation within Member States merits strong, continuing drive at the European level. Implementation in Member State needs to be driven largely by the railway industry, with the views of suppliers, new operators and other enterprises in competitive markets carrying as much weight as the established national railways. (Section 5.3.4.1)

C25 There should be some general European requirements for due process, separation of powers and information in national railway safety regulation. The current proposals to require independent national bodies to supervise railway safety, and independent Notified Bodies, are constructive steps in this direction. (Section 5.3.4.1)

C26 A European level structure is needed to handle the following issues:

- Central management of standards machinery: There is a serious imbalance between the massive activity in the many hundreds of engineering committees within the standards institutions and elsewhere and the lack of
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Central management coordination. One prime requirement is the installation of professional project management of this activity.

- Central development of risk assessment and decision rule methodology.
- Clearance of new national standards.
- Recognition of relevant approvals in other Member States.
- Identification and analysis of “zero-cost” and other measures for harmonisation, having regard to engineering, economic, commercial, political and social factors.
- Railway safety data development, dissemination and coordination.
- The problems of language.

(Section 5.3.6.1)

C27 Part of this European structure should be a substantially strengthened central role for the industry, including manufacturers and the maintenance industry, including the present functions of the AEIF. (Section 5.3.6.1)

C28 Trade union input into safety regulation is important, but it should not be through this central industry function. It should be through employees own industries, through independent national regulators, and through EU institutions. (Section 5.3.6.1)

C29 There is a strong case for also establishing a Railway Agency, which would provide an executive interface between the policy functions of DG Energy and Transport and the European industry. (Section 5.3.6.1)

C30 There is a case for European, as distinct from national, certification of Notified Bodies for conformity assessment and safety audit, although this would require a new European certifying authority, and would place some ultimate liability on the EU. (Section 5.3.6.2)

C31 Further progress is needed on the methodology of risk assessment in railways. This should involve more exposure to practice in other industries and more exposure to the practicalities of valuing risks of death or injury, and the roles of tolerability limits and societal concerns. (Sections 5.2.3 and 5.2.4)

C32 The case should be investigated for the development in the medium term of a European accident investigation body (or regional bodies). (Section 5.3.6.2)

6.2. Key recommendations

6.2.1. Due process, decision rules and the definition of safety

R1 We recommend that EU policy should be designed to steer European rail safety regulation progressively towards due process, within which procedures:
- are documented;
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- make relevant information available to all parties; and provide for all affected parties to be heard;
- are applied consistently, with specified substantive (as well as procedural) decision rules;
- give reasons for decisions;
- are subject to independent appeal; and
- are preferably subject to staged timetables (whether triggered by passage of calendar time, or triggered by particular events).

(Section 5.3.1.1)

R2 We recommend that information on safety performance (relating to both accident investigations and overall statistics) should be publicly available. (Section 5.3.1.4)

R3 We recommend that EU policy should be designed to steer European railway safety regulation towards stronger analysis of costs and benefits and explicit decision rules. (Sections 5.1.4, 5.2.3, 5.2.4)

R4 We recommend that decisions made under EC Directives involving railway safety (which may include most standard setting), at all stages from first proposal to submission for final approval (for example to the Article 21 Committee), should be required to be supported by a statement:
- outlining the proposal and alternative ways of achieving the given objective;
- setting out relevant costs and benefits, including safety benefits, quantified and valued where possible;
- making explicit any political or other judgements superimposed on quantitative analysis of costs and benefits.
- justifying the proposed course of action by reference to those costs and benefits which can be valued, and an explicit account of other significant factors;

This approach should be adopted for informal as well as formal decisions. (Section 5.2.3.1)

R5 We recommend that, when European legislation is used to harmonise on technical, engineering and operational matters, safety issues should be dealt with explicitly, but as an integral part of those rule-making processes. Safety regulation and safety management are specific and important tasks, but the separate classification of issues into either ‘safety’ or ‘operational’ should generally be avoided. (Section 5.3.3)

6.2.2. EU promotion of actions at Member State level

R6 We recommend that the EU should seek to encourage, through legislation, the railway safety regulation regimes of Member States to provide the due process, separation of powers and availability of information needed for the satisfactory development of interoperability, the single market, new operators and other innovation. (Sections 5.3.2, 5.3.4.1)
R7 We recommend that the Commission should encourage the development of independent accident investigation in Member States and consider a Directive to this effect. (Section 5.3.4.2)

6.2.3. EU promotion of actions at the European level

R8 We recommend that bodies at the European level should be strengthened or created to carry forward a number of key central tasks, including the following. (While some of these tasks extend beyond safety, they are necessary for the effective development of safety regulation.)

- Appointment of an engineering project management team to manage the coordination of the output of the many technical committees which are contributing to the development of European railway standards and to promote due process.
- Development of methodology for risk assessment, including procedures for the identification of options, and for quantifying and valuing the costs and benefits of safety regulation proposals.
- Widening of public access to the TSI process, for example by release to a web site of the relevant documents and current drafts.
- Clearance of new national standards, with the explicit requirement that Member States do not to make rules or take decisions on rail safety issues that materially detract from interoperability or the development of the single market.
- Negotiation of recognition by Member States of relevant conformity approvals in other Member States.
- Identification of “zero-cost” and other potential measures for harmonisation which may be cost effective. Assessment of costs and benefits of such measures and realistic time scales.
- Development of safety performance and other safety-related data.
- Promotion of European level debate on the problems of language.

(Section 5.3.6.1)

R9 We recommend that these tasks should be carried forward by:

1) A much strengthened railway industry body, extended from and including the joint representative body function of the interoperability Directives, now carried by the AEIF; and
2) A new railway Agency, as an EU institution, providing an executive interface between DG Energy and Transport and the industry.

(Section 5.3.6.1)

R10 We recommend that the Commission should consider the option of establishing an EU-wide rail accident investigation agency, or regional agencies. (Section 5.3.6.2).
6.2.4. EU promotion of research

R11 We recommend that the Commission should fund research on the following, to lay the foundations for stronger central coordination:

- identification of differences in specific rail safety regulations or procedures which it may be cost effective to remove or reduce, and assessment of the associated costs and benefits and time scales.
- means of developing safety performance and other safety related data.
- use of different risk assessment methodologies (including the comparison of costs and safety benefits) across European regulated industries.

We recommend that the Commission should seek the assistance of the independent national regulators in these tasks. (Section 5.3.8)
## GLOSSARY

| **Acceptance procedures** | Procedures applied to equipment, or services, or operating procedures, or management structures, *after* they have been designed but *before* they are accepted for normal commercial operation on the railway. These may include procedures which are internal to the organisation commissioning and/or operating the equipment etc, but the main concern of this study is procedures which are applied by an *external* organisation in exercise of a regulatory function. Acceptance procedures may include procedures to verify that determinate design requirements (q.v.) have been fulfilled, but the main concern of this study is procedures concerned with aspects of safety where determinate requirements have not been laid down. Acceptance procedures which are not simply verifying that determinate design requirements have been fulfilled are likely to be concerned with: • engineering issues which present novel problems; • “soft” areas such as management structures; • areas where controls are necessary but where there is room (or need) for much local variation. |
| **Class of safety requirements** | A type or set of safety requirements (as defined below) which: • are laid down by a particular decision-maker (e.g. the Minister); *and* • have the same source of authority (e.g. Regulations under the Health & Safety at Work Act). |
| **Decision criterion, Decision rule** | The logic underlying the decisions taken by a particular body for a particular class of safety requirement. |
| **Design requirements** | Safety requirements which: • apply to organisations other than the one setting the requirement; *and* • apply at the design stage; *and* • apply to design features, as opposed to the outcome in terms of risk. *Design* applies more widely than to the design of engineering products. It can also apply to: - operating procedures e.g. train despatch from platforms; - management processes e.g. objective setting and monitoring; - organisations e.g. numbers of staff, allocation of responsibilities; - personnel procedures e.g. selection and training arrangements. |
| **Determinate** | A safety requirement is “determinate” if any qualified observer, given the right data, could say whether the requirement is met without having to make a subjective judgement. |
| **Due process** | A procedure which fulfils the requirements of due process:  
• is documented;  
• makes relevant information available to all parties; and provide for all affected parties to be heard;  
• is applied consistently, with specified substantive (as well as procedural) decision rules;  
• gives reasons for decisions;  
• is subject to independent appeal;  
• is preferably subject to staged timetables (whether triggered by passage of calendar time, or triggered by particular events). |
| **Enforcement** | Investigation of apparent violations of legal requirements, preparation of cases, and initiation of processes to impose sanctions including bringing cases to court and imposing sanctions.  
Not all bodies responsible for enforcement will undertake all these functions. Enforcement, as defined for the First Questionnaire, does not include supply establishing that safety requirements have been complied with. |
| **External audit** | Examination by an external, independent agency of whether an organisation is fulfilling certain requirements. Audits may be mandated by law or regulation, or may be at the option of the body being audited. The form of audit may be determined by the mandating authority (e.g. railway-specific regulations under the law), by the body being audited (e.g. train operator), or by the body carrying out the audit (e.g. infrastructure controller). A body responsible for audits may perform them itself or contract them out. Auditing does not include post-accident investigation. |
| **External safety regulation** | The imposition of safety requirements by one organisation, by legally enforceable means, on another legally distinct organisation.  
This normally includes the definition of requirements, some form of inspection, and enforcement where necessary (although these activities may be done by different organisations). |
| **Infrastructure** | Fixed assets used for the operation of a railway including its permanent way and plant used for signalling. It does not include a station. |
| **Inspection** | Personal visits to the site of operations by a safety regulator to check the adequacy of safety arrangements of an operator or supplier.  
Inspection may include informal, ad hoc examinations as well as the more formal procedures of audit. It need not be confined to checking compliance with explicit safety requirements.\(^{109}\) |
| **Mainline railway** | The railway network connecting cities within and between Member States, but including railways which are more local in character where they are organisationally integrated with the inter-city network. It excludes:  
• sidings, yards and depots serving the mainline; |

\(^{109}\) This definition of Inspection includes activities which might in everyday language be described as safety monitoring, surveillance of safety performance, and assessment of fitness for use.
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<th>Glossary</th>
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<td><strong>•</strong> services which use the mainline network for a small fraction of their journey, and the railways on which they run for the rest of their journey.</td>
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<td><strong>Railway operators</strong></td>
<td>Companies providing train services (train operators), or controlling train movements on railway infrastructure and making train paths available on it (infrastructure managers).</td>
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<td><strong>Railway Industry</strong></td>
<td>The totality of train and infrastructure operators. It does not refer (in the context of the First Questionnaire) to suppliers of equipment and services to those operators.</td>
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| **Risk assessment** | Formal analysis of risks and of the consequences of alternative ways of controlling them. A risk assessment should normally:  
- be explicit, quantitative, and recorded;  
- examine the effects of potential new measures (e.g. alternative forms for a new regulation) on safety, in terms of:  
  - the risk(s) being reduced;  
  - the people affected;  
  - the scale of the effect on safety;  
  - any incidental effects, including increases in other risks.  
- examine other effects, including:  
  - costs in time and other resources to implement and maintain;  
  - environment and transport policy impacts.  
Risk assessment provides input to decision making about safety regulations. |
| **Safety requirements** | Railway safety requirements must:  
I. apply to some aspect of railway operations, such as equipment, services, operating procedures, or organisation;  
II. apply to railway operators (whether or not they apply elsewhere);  
III. be obligatory (whether by force of law, contract, internal instruction or otherwise); and  
IV. be imposed for safety reasons, either directly or under a procedure designed for safety purposes.  
They may apply either within the organisation setting the requirement or to other organisations. They may take the form of:  
- determinate conditions for the design of the aspect in question (e.g. Standards); or  
- benchmarks for the safety performance of the aspect in question (e.g. Approved Codes of Practice); or  
- processes to be applied (e.g. Safety Cases, audit); or  
- safety outcomes to be achieved (exposure to be less than a specified threshold level) |
REFERENCES


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APPENDIX 1. PROJECT SPECIFICATION

SPECIFICATIONS ATTACHED TO THE INVITATION TO TENDER

Invitation to tender No VII/B2/35-98 concerning a study of safety regulations and standards for European railways

1. INTRODUCTION

(1) Community’s current transport policy is aimed at strengthening the position of railways on the transport market. For this purpose a range of measures have been and still remain to be taken within the framework of the Commission’s White Paper “A Strategy for Revitalising the Community’s Railways”. The technical developments and legal requirements within railway traffic are strongly influenced by a safety philosophy that tends in general towards a very high safety level. The Commission clearly underlines, that it does not intend at all to question or to reduce the high safety level of railway traffic. However, it is perceptible, that different Member States have different views on concrete measures to achieve this high level.

(2) The Commission seeks therefore to gain an overview of rail safety in the Member States and to assess to what extent different regulations or practices have an impact on railway interoperability, in particular measures on cross-border traffic operation and on the railway supply market.

(3) Interoperability problems due to safety regulations can occur even within the Member States, as the emergence of light-rail transit systems revealed that different safety regulations exist for tramway lines and “ordinary” railway lines. As light-rail systems blur the frontier between tramways and railways, it is worthwhile assessing the possibility of developing a common approach to safety in rail transport in general that helps avoiding interface confusion.

(4) In some Member States it is perceptible that a higher liability for accidental risks is applied to railways than to other modes. Although this principle logically leads to a very high safety standard, not only could its financial implications cause considerable competitive distortions, but also its conversion into operational instructions could create perverse effects.\(^\text{110}\)

(5) For the longer term the Commission wishes to consider a harmonised safety approach within the European Union that helps to maintain the traditionally high safety level of rail transport, but removes interface problems due to different safety practices or regulations at borders of different rail networks where those exist. For

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\(^\text{110}\) For instance: In the case when a technical fault with a level crossing is announced to the train driver, he must slow down his train, which is, of course, a reasonable and undoubtedly necessary measure. But, even in the case when he, while running slowly, states that the barriers are down, the red lights for road vehicles are on and the cars are waiting, he must stop his train, get off his locomotive, turn a key at the level crossing’s control box, then re-climb on the locomotive, give an acoustic signal and slowly pass the crossing. Although everyone learns at driving school that trains are always given priority at level crossings - independently from the fact whether red lights or barriers are working! -, this procedure seems strange, because it reflects the carefree behaviour of car drivers at level crossings and in fact converts the priority of the train into a priority of the car in case of technical fault. This is often underlined by the fact that railways are in many cases judged responsible for accidents at level crossings.
Appendix 1: Project Specification

the medium term, the Commission is interested in knowing which concrete measures should be taken to overcome current divergences in safety rules.

2. PURPOSE OF THE CONTRACT

(1) The main objectives of the study are to:

(a) provide an overview over existing safety regulations for railway operations among the Member States; the consultant should concentrate on the following questions:

Which institutions/bodies supervise railway safety:
with regard to traffic operation, and
with regard to rolling stock?

To which extent are safety standards - for operation as well as for equipment - set by the railways themselves or by legislation?

Which differences in safety philosophies exist among the Member States and what is their impact on railway equipment manufacturers?

To which extent are safety regulations based on risk assessment analysis?

(b) identify those cases where different safety regulations for different types of rail networks (e.g. tramways light-rail/“ordinary” rail) exist within a Member State;

(c) provide an overview of different liability standards for railway operations among the Member States (including the identification of cases where railways are subject to strict liability);

(d) assess the impact of existing differences in safety regulations and/or practices among the Member States on seamless rail traffic operation and on equipment.

(2) The contractor will firstly give an overview over all EU Member States. Depending on the variety of information he gains, he will concentrate mainly on the situation in France, Germany, Italy, the Netherlands, Spain, Sweden and the United Kingdom for his further investigation. If he discovers an interesting approach in some of the other Member States, which he considers worthwhile to further investigate, he shall examine this further.

(3) Finally, the contractor will develop his recommendations for a common safety approach to rail transport within the EU. He will outline the necessary long-term steps, considering the links of national safety regulations with general principles of liability. Furthermore, he will propose suitable short and medium-term measures in order to overcome existent divergences among the Member States.