

European Railway Technical Strategy

Technical Vision to guide the development of TSIs



European Rail
Infrastructure Managers



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Executive Summary

This is a vision of the railways of Europe in 2035 developed by the members of the association of European Rail Infrastructure Managers (EIM). In drafting this text, EIM sought input from other representative bodies, such as CER (representing railway undertakings and infrastructure managers), UNIFE (representing the suppliers), UITP (representing the public transport mode), ERFA (representing rail freight operators) and the European Commission (EC) and the European Railway Agency (ERA). EIM has developed this vision, and the strategies to support it, in order to ensure that the European railways gain increased market share in comparison to other modes in the decades leading up to 2035. EIM believes that this text will provide valuable input into the EC's strategy on Transport Scenarios with a 20 to 40 year horizon.

Scope

The scope of this document includes outlining a vision for 2035 and discussing the strategies needed to realise this vision. This document also assesses the economic, technical and social needs and requirements that will promote change in the railway industry. The strategy will also identify specific issues that can only be efficiently solved at the European level.

This document should be regarded as an umbrella document, setting directions and objectives, and which will be supported by more detailed documents as the need arises.

Needs and requirements for the future

The EC should, through the ERA, base its forecasts for the rail industry on the most challenging scenario, which assumes a high rate of economic growth (and therefore high growth in demand for both passenger and freight transport) coupled with continuing high levels of environmental concern amongst the public. This will drive attempts to reduce carbon emissions through greater energy efficiency as well as improvements in cost-effectiveness, measured in terms of capacity, per unit, per €.

Increased reliability, more cross border traffic and standardised materials resulting from the efforts put into achieving interoperability will contribute to an increase in efficiency. An increase of capacity on existing lines will also be needed.

The public will demand the maintenance of at least current levels of safety. However, the vision will need to take into account the safety challenges posed by increased capacity and the fact that the demand for safety increases as the level of wealth grows (measured as a change in Gross National Product - GNP).

The need for information to be provided to passengers and freight customers will increase dramatically and require new solutions. The Passenger Rights Regulation and the TSIs for Telematic Applications for Passengers and Freight are examples of such solutions.

Vision

The vision is based on EIM's interpretation of what business needs will be 30 years from now. It is EIM's belief that by 2035 the European railways will have increased their market shares from air and road transport in both passenger and freight traffic, as railways become more efficient.

One of the most effective ways to improve efficiency of the railway network is to differentiate between types of lines where appropriate, while continuing to use standardised components. The principle of differentiation must not impede interoperability on the defined interoperable lines and shall support the needs of standardisation. Increased line differentiation and technical standardisation will contribute to increased reliability of both trains and infrastructure. A highly reliable system requires less redundancy in terms of fallback modes and alternative routing.

This is in conformity with EC regulations creating interoperability for traffic and materials which allow an increase of cross border traffic and a substantial cost reduction for the construction and maintenance of rolling stock and infrastructure.

The business categories that have been identified are divided into passenger and freight services.

TABLE 1 : Business Categories

Passenger services	Freight services
High speed (speeds over 250KPH)	Conventional freight (as known today)
Conventional higher speed	Heavy freight (dedicated lines)
Inter-Urban	High speed logistical freight
Regional	
Suburban Metro	
Community (light rail)	
Tram services	

These business categories must be aligned with the line classifications within the TSIs (valid for conventional rail only).

Networks can be differentiated into the following categories, which are described in greater detail later in this document.

TABLE 2 : Differentiated Networks

Multi-purpose core network (under 250 km/h)
High Speed Network (at 250 km/h or over)
Heavy Freight network (at 100 km/h or under)
Regional network
Suburban Metro
Community/Rural Light network
Tramway

Note : The freight oriented network will use a mix of network types.



The vision outlines the dramatic changes that are foreseen in the coming decades. The introduction of ERTMS (European Rail Traffic Management System) reducing trackside installations, such as signals, new sources of energy for traction, real time information to passengers and freight customers and near-real-time asset status information provided by intelligent trains are some features of the future.

Rolling stock will adapt to the differentiated network by increasing homogeneity in terms of standardisation, performance and reliability of passenger trains and reduced difference between passenger and freight train characteristics. Freight will develop into “Logistical freight” that operates with speed and performance characteristics equivalent to passenger trains and “Heavy freight” that will operate on a restricted set of routes designed for the purpose and, where possible, keeping away from capacity challenged multi-purpose main lines. The differentiation of the network will enable trains to be designed according to a specific function and create a rational “family” of train conceptual designs for specific corridors and routes.

The need to minimise energy use and improve the environmental performance of the railways will encourage a reduction in train mass, the selection of sustainable materials and an increase in the efficiency of track-train interaction. This should offset the increase in mass per seat which occurred in the late 20th Century.

Strategy

To be able to achieve the vision several measures will need to be taken. A number of these are described below.

European regulations for interoperability

The TSIs (Technical Specifications for Interoperability) must regulate one target system (Class A). It must also be recognised that the national systems must be accepted as class B systems that will exist for many years to come. However, national implementation plans and a common European implementation plan should be made for the Class A systems and equipment, to establish the necessary framework for the transition period to an interoperable railway system.

The TSIs for conventional rail essentially apply to the TEN-T network. The TSIs for high-speed and conventional rail system will then be migrated into one set for the TEN-T networks, as foreseen in the recent revision of the Interoperability Directive.

While the TSIs should have a broad scope, and should cover as many instances as possible, they should not be applied when there are obvious reasons not to – if, for instance, a Cost Benefit Analysis does not support implementation. The TSIs will also need to regulate trains running under normal conditions to avoid the risk of super-sizing the network and rolling stock.

The migration plans included in the TSIs must offer a sensible migration from national technical systems into the target system. The migration into target systems must also be supported by an optimal business case; otherwise the migration must be assessed in more detail. The business case must take into account the existing traffic and rolling stock, the potential traffic, technical conditions of the existing infrastructure and financial possibilities. Positive impacts on society must also be a part of the economic assessment. Migration will be costly for many countries. EC economic support will be required both in order to make progress in the future, but also to support the taking of an optimal choice of target system. If EC funding was secured for a particular system, then it would make it easier for members to agree.

The ERTS outlines the likely demands on the network of the future. To some extent the TSIs for conventional rail will

assign today’s values to the same parameters. With the target system in mind it is important to state that renewals, upgrading and investments are long-term investments and therefore should take a longer time frame into account than is the case with the TSIs. The ERTS objective is to fill this gap.

The regulations must also deliver a situation that will create a market for standardised components and processes (interoperability constituents, IC) that will lower prices.

Keeping regional lines in operation will be facilitated when adopting the concept of line differentiation.

Cross acceptance

The procedure for one country’s acceptance of another country’s trains, components and processes and the cross acceptance procedure must be standardised and the results predictable so that the RUs can gradually generate interoperability even between networks that do not yet conform to the European common technical system. The focus on safety in the cross acceptance procedure must be balanced with a focus on economy. The closing of the “open points” (parts of the TSI text left unsolved at the point of publication because no technical consensus or solution could be found) will help ease the cross acceptance procedure.

The process of cross acceptance should not be restricted to rolling stock, but should also incorporate other issues such as railway maintenance machines, operators, contractors and common processes.

The optimisation of interaction between rolling stock and infrastructure

When designing new rolling stock and new infrastructure materials a close interaction takes place between the Infrastructure Managers (IMs), the Railway Undertakings (RUs) and the supply industry in order to optimise the final product. This optimisation must be done within the interoperability regulatory framework.

The charging systems for rolling stock must incentivise this interaction. The design of trains optimised for specific routes presents a huge opportunity to take costs out of infrastructure provision and maintenance. Some of this optimisation will happen naturally, but much will require planned strategic changes and reforms of incentives.

Monitoring systems will develop in their competences and abilities. The appropriate selection of track side or train board systems will be dictated by the appropriate technical solution for effective measurement to support the optimisation of the infrastructure.

Research

The vision indicates that substantial Research and Development work (R&D) will be required. The vision can be regarded as an input to European and national R&D plans in the coming years. It is however clear that while migrating to class A systems in the years to come further development of class B systems should be very limited.

Continued work

This document is the second formal version of the ERTS and there still remain areas for development to achieve a document that can answer the needs of the industry, and in particular EIM members. Areas where more input is needed are:

- Business vision – the other stakeholders will be asked to input to the business vision



- Aligning the ERTS with national visions of business needs
- Aligning national ERTS implementation strategies with corridor implementation plans
- Considering the effects of the proposed merger of High speed TSIs with TSI for conventional rail
- Considering the extension of the TSIs from TEN-T to the entire network
- Migration planning and models

Note, however, that not all these actions need to be incorporated in future versions of this document but could be made into separate supporting documents.

1 Introduction

Compared to other modes of transport, the European railway network is characterised by:

- Variable levels of usage
- Long asset life-length
- Fixed system architecture
- Relatively static technology
- High resistance to change and high cost of change
- High levels of safety
- Relatively low environmental impact

Across Europe today there are many very different types of railways - both in structure, organisation, funding and future growth demands. While the railway has continuously evolved over its 180 year history, there has been no fundamental change in the technology and geometry of the wheel-rail interface or, since about 1850, any fundamental change in the railway substructure or track design. Although trains themselves have changed radically in terms of their structural design and motive power, the basic concepts have changed very little. They remain as they have been since the mid 19th century: unintelligent vehicles constrained on a fixed guide-way and controlled by a driver in response to line side signals. Change has almost always been incremental. There have been a number of safety driven changes across the network, such as, block signalling and continuous brakes in the 1880s and various forms of Train Protection in the last 30 years. The only radical changes driven by economics were the change from steam to diesel from the mid-1950s and the expansion of electrification in the 1960s to 1980s, and the splitting of infrastructure and train operations in Europe at the end of the 20th and start of the 21st Centuries.

1.1 Purpose of the European Railway Technical strategy

The purpose of this document is to look forward thirty years to foresee the kind of railway that the rail industry is capable of supplying in response to European and national needs and affordability criteria, to assess whether this railway can be delivered through “natural” incremental change mechanisms, or whether some planned strategic changes are required.

Over the next 5 to 10 years, European railway interoperability and safety legislation and technical standards will be completed and enacted throughout Europe. The railways can influence the development of the new standards to ensure a ‘good fit’ with their business objectives and needs. The 2035 EIM vision will be used to drive both the railways’ response to emerging standards and the scope and degree of compliance adopted, where choices and flexibilities exist, in addition to providing an input into the European Commission’s work on “Transport Scenarios with a 20 to 40 year horizon.”



This document describes a vision and a technical strategy for the development of the European rail network over the thirty year period. It is intended to:

- Support a common vision of the future railway within the industry
- Help to shape the EIM, CER and UNIFE response to European initiatives
- Inform discussion on how to reach interoperability, i.e. the strategies for the development of the TSIs and cross acceptance. The proposal is to create a partnership between EC, ERA, and the industry (through EIM, CER, and UNIFE) defining a vision of the future railway, identifying the key decisions that need to be taken to deliver the vision, assessing the current incentives and recommending change where needed and prioritising industry improvement initiatives in such a way that the vision of the European railway network is fulfilled by 2035. In general the European Railway Technical Strategy will be driven by qualitative assessment of impact on the key strategic drivers, but supported by quantitative analysis and research where this can add value
- Open up for a line categorisation of the network in order to optimise the lines according to usage and by doing so also cutting costs
- Define key priorities for long term research by ERRAC
- Help industry prioritise current improvement initiatives
- Provide guidance for the specification of new assets and projects
- Helping to enhance the competitiveness of the railways with respect to other modes of transport

Combining the strategic objectives of the infrastructure managers allows EC policy to be applied uniformly. Equally, the EIM technical strategy enables individual infrastructure managers to make the ERA aware of the strategic areas that it must address in order to reduce costs for infrastructure managers – thereby releasing the capital tied up in the railway for further investment. In this way costs can be reduced and capacity increased.

The development of a strategy for the railways as part of an integrated transport policy is outside the scope of this document. The Railway Packages and Directives nevertheless will inform the development of such a policy. In particular, the EC and national governments' energy policies will be a key driver in railway traction policy.

1.2 Relationship to Railway Packages

The EC has published three Railway Packages. In addition, the TEN-T network funding programme covers the period 2007-2013. These texts define the specific outputs (in terms of safety, service performance and capacity) that the railway industry will be required to deliver over the period 2007-2013. The planning cycle will be repeated, with an updated Railway Package every five years. This strategy will therefore also need periodic updates.

1.3 Structure of the Technical Strategy

The Technical Strategy is structured into three parts:

- The first part covers the requirements which the railway will have to meet, as described in the emerging Railway Strategy, and sets them in the context of a strategic operational plan for the network, considered by sector. It represents the primary level for agreement between the EC/ERA and the industry. It will state outputs in terms of long term operational needs that the railway will have to meet, together with the supply side assumptions made by the EC and national governments in developing the Railway Strategy, at the level of detail needed to illustrate feasibility of the operational plan
- The second part develops the 2035 Vision for the network
- The third part describes the strategy required to achieve this vision, considers how the needs and requirements can be met and confirms the feasibility of the assumptions, all the while taking account of the likely impact of technological change and innovation. The impact of alternative investment scenarios is also considered. This part also further investigates the differentiated railway sectors, considering how change may be allowed to promote differentiation while maintaining the necessary degree of interoperability and standardisation between them. The primary drivers of reducing specific costs, increasing reliability and enhancing capacity in defined areas will drive change to the network, thus increasing the level of differentiation between different sectors. This part covers the migration plans (time-line for critical decisions), the scope of the TSIs, the cross acceptance procedures and line categorisation

1.4 ERTS in the overall EU rail strategy

The relationships between existing strategies and policies throughout the EU are shown in Figure 1. The primary guiding document is the EC White Paper on Transport 2001 and the mid term report "Keeping Europe Moving – Sustainable Mobility for our Continent". This sets out the objectives for high quality transport in Europe and drives the legislative framework that exists to support the internal market in transport.

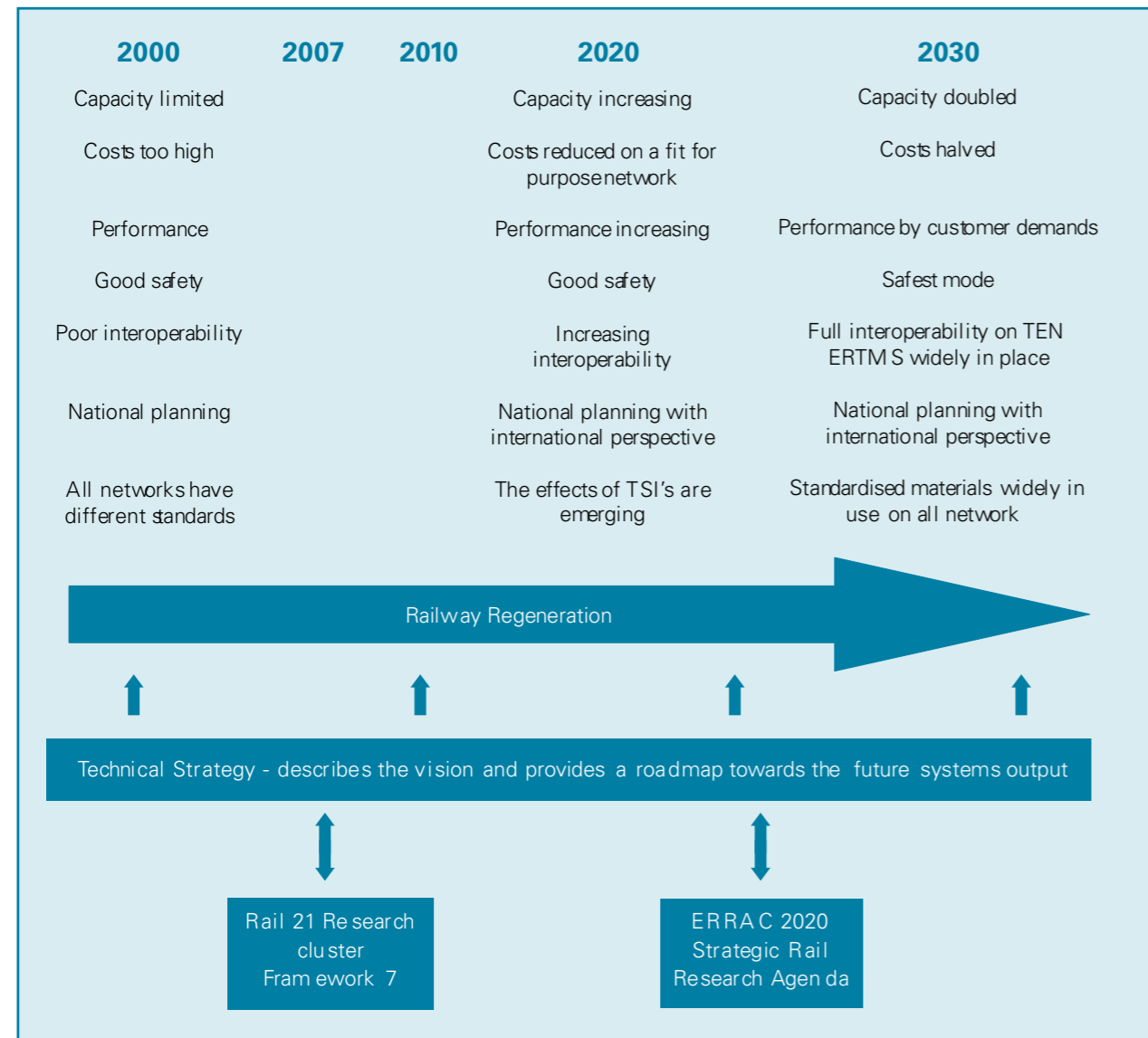
Allied to this is the concept and definition of the key transport corridors in Europe, the Trans European Network and the Freight Oriented Network. Supporting these are the Strategic Rail Research Agenda developed by the European Rail Research Advisory Council, which sets out the research needed to achieve the White Paper's goals and feeds into the programme of work for surface transport under the EC's FP7 research programme. Linked to these European strategy documents are European harmonised standards and ERTMS, which are drafted and managed by the ERA.

The European Commission is pursuing its interoperability initiative with overall objectives harmonised at European level, which includes a drive towards a common European market for railway assets, materials, components and processes. This should result in cheaper common products being supplied to the whole European network.

In each Member State there is a national transport policy, national research programmes and implementation strategy for the harmonised European standards and ERTMS. The EC seeks to co-ordinate and harmonise the Member State programmes.



Figure 1. ERTS in the overall EU rail strategy



Below this sit the individual infrastructure managers who have in house research and development and investment programmes.

The natural flow is down from the European level to the individual infrastructure manager. However, an important goal of the EC is to achieve the seamless integration of railways and other co-modal transport modes and to achieve full interoperability. This is only possible if the efforts of each individual infrastructure manager align to this objective and are coincident. This is the role of the European Railway Technical Strategy.

1.5 Definitions

Definitions of terms used throughout this document can be found at Annex A.

2 Framework for the Vision

2.1 Background

The requirements that the railway will have to meet in 2035 are set out in the EC Railway Packages and Directives. As these requirements are driven primarily by uncertain economic and social change, accurately predicting their development is difficult. The EC is developing these requirements in the context of a number of planning scenarios, the principal variables being economic growth and environmental concerns. The balance between the various transport sectors, and their interaction with future energy and environmental factors, must also be considered.

The most challenging scenario for the railway is to assume high future economic growth (and, therefore, high growth in demand for both passenger and freight), a continued high level of public environmental concern driving a reduction in carbon emissions (increased energy efficiency) and a requirement for high cost-effectiveness in terms of capacity per unit per €. This is in line with EC expectations and policy. The high economic growth scenario is the basis for this strategy since the railway sector needs to become more cost effective and also supply an attractive mode of transportation as environmental concerns drive the ever increasing freight and passenger traffic towards more sustainable solutions. This will help to attract the required financing. However, the strategy should take into account other economic and social scenarios, as well as local conditions (e.g. changing energy requirements).

In the scenario described above, there will be increasing demand for passenger and freight capacity. Current levels of service quality are unlikely to be acceptable to customers in 2035. Passengers will want better information, better integration of travel modes and new payment methods. Freight customers will demand real-time information and better estimated arrival times. Safety targets will be set at the European level in accordance with the Safety Directive. The base assumption is that the levels of safety demanded will be no less than at present but decision makers will need to take into account increased capacity and the fact that demands for safety increase with higher standards of living (measured as higher GNP – Gross National Product). Continued pressure on cost effectiveness can be expected, to the point where the railway absorbs no more than its fair share of public funding, taking account of the service it provides and its contribution to national objectives. This will require a railway which is fundamentally more reliable, requires less maintenance and carries more passengers and freight per year, per kilometre of track than it does today. Particular emphasis is required on regional railways which at present account for the majority of the EC and national government subsidies but a minority of passenger journeys. Regional railways therefore need to be made more cost effective - increasing usage (and therefore revenue) is one option.

The railway will be expected to make a contribution to the achievement of national sustainability targets and can best do so by improving its cost effectiveness while maintaining its environmental edge in the context of the major changes in energy costs and sources which are likely to occur and the parallel improvements which will take place in other transport modes (particularly automotive). By 2035 it can be expected that railways will need to have made major improvements in sustainability, not just during operations, but throughout the whole life cycle of railway assets. This has to be considered in the context of railways generally being a good example of long life utilisation.

The question of major additions to the network (for example, new High Speed Lines) is not one which this document is intended to address. If such additions are made by 2035, they are unlikely to radically change the pattern of use of the rest of the network. The most significant change would be a dedicated freight route or network which took heavy freight loads off of the Multi-purpose core.



The scenario described above will require the Multi-purpose core network to deliver all of the following, at reduced overall cost:

- Higher capacity (passenger km per km of track and freight ton-km per km of track)
- Higher service reliability (% on-time performance and fewer major delays)
- Lower carbon emissions (tons per passenger km or ton-km for freight)
- Reduced noise emissions
- Increased comfort and passenger facilities (onboard and in station)
- Increased accessibility (for the increasing numbers of less able)
- Better information (both before and during the journey)
- Better security (from point of entry to the system to point of exit)
- Stable levels of safety (overall equivalent lives lost as a consequence of system operation)

2.2 Critical Compromises

It is notable that reduced journey time is not seen as a key issue in itself for the core network, although the contribution that trip time reduction makes to the efficient use of staff and assets may be a driver in some areas.

In the urban area of the network, compromise on comfort and onboard passenger facilities may have to be accepted in order to meet the capacity needs.

In the peripheral areas of the network (rural and secondary lines), compromise on station facilities, accessibility and comfort may have to be accepted in order to meet the need for acceptable cost.

In order to achieve an acceptable compromises between passenger and freight traffic, restriction on the operating routes for heavy freight trains is likely to be needed, with a radical change in operating mode for lighter freight and the development of a Freight-oriented Network.

2.3 Legislative Requirements

Full implementation of the following existing and known legislation will drive change to the railway system:

- First Railway Package (currently being recast)
- European Safety Directive - 2004/49/EC (recently revised)
- The newly revised and merged European Interoperability Directives - 96/48/EC and 2001/16/EC
- European Energy Directive - 2003/30/EC
- European Noise Directive - 2002/49/EC
- European New Approach Directives - 93/465/EEC
- Construction Products Directive - 89/106/EEC
- Commission Decisions and Regulations regarding Technical Specifications for Interoperability (TSIs)
- Communication from the EC on ERTMS and ETCS - COM (2005) 298
- National network statements
- EC Communication on Freight Oriented Network, and proposed legislation expected in October 2008
- Greening Transport Package of July 2008, which includes proposals on noise and internalisation of external costs



3 The 2035 Vision of the Network and the Railway sectors

By 2035, European railways will have changed dramatically in comparison to the 20th century. In 2035 high speed passenger services as well as freight services will run across borders on the high speed and TEN-T networks. The TSIs for Conventional and High Speed rail will have been implemented by all Member States with national and EC financing. This means that the target systems, with minor exceptions, will be in place on the TEN-T network. The minor exceptions will be places where the target system is not economically defensible.

Passenger trains will run faster and freight trains will be heavier. The freight sector will also have seen an increase in demand and will increasingly use separate heavy freight lines. However, a major part of the freight is expected to inter-run with passenger traffic on the core TEN and regional networks. Standardisation of materials on the entire network will have increased due to the TSIs for high speed and conventional lines being implemented and the application of EN (Euro Norm) standards. Also, the procedures for certification of rolling stock should have been simplified by the introduction of a standardised procedure amongst the EU member states. Thanks to the launch of a differentiated railway (in terms of track and rolling stock) the regional lines, very costly in the early 21st century, will have seen an increase in performance and usage and a reduction in the cost of operating them.

The development of the railway sector is predicted to show similarities with the road sector. New trains are expected to be more intelligent, having taken over the intelligence that was previously located in the trackside infrastructure, thus releasing resources for infrastructure managers to invest in improved performance and reduced track access fees. The cost to the RUs for the increased intelligence of the trains will have been pushed back through standardisation and economies of scale.

Electrified lines will be standard on the major lines where defensible economically and portable energy - such as fuel cells - will be the alternative for the rest of the network. Increasingly the trains running on the major lines will be able to run on portable energy as well, making the overhead lines obsolete.

The overall objective on a European scale is to increase the possibilities for cross border rail traffic and to cut costs for infrastructure and rolling stock. On a European level the ways to cut costs are to:

- Recognise that cost savings can be achieved by having the development of both the rail network and rolling stock interact to create cost savings for all. Cost savings through optimisation by one party often increases costs for the other party.
- Introduce legislation that drives standardisation of materials and procedures. This includes the TSIs.
- Open up for line differentiation so that performance is driven by real business cases.

3.1 Impact of Technological Change

The section on the impact of technological change is divided into two parts. The first covers the changes that will appear on the Multi-purpose core network. The second covers the changes to rolling stock.

3.1.1 Overview of the Multi-purpose core vision

The impact of technological change for the Multi-purpose core in each of the individual disciplines of Control-Command and Signalling, Energy, Infrastructure, Train Operations & Management and Telematics is described below.

Control-Command and Signalling

Developments in ETCS that minimise track side infrastructure requirements by relying on the increasing ability of trains to manage themselves will lead to the greater use of cab-signalling. Each train will provide its own localisation data back to a small number of control centres which will manage train regulation to minimise delay and reduce energy consumption. ETCS will develop to reduce unit costs and infrastructure equipment needs by using satellite and other technology in preference to track circuits and trackside cabling. Safe access for track workers will become an integral part of ETCS.

Energy

The selection of a propulsion system is driven by EC and national energy policies. As fossil fuel supplies run out, governments may choose to supply railways with electric power from nuclear and other renewable sources. In this case, the Multi-purpose core and high speed routes will be electrified throughout. Regional routes may either be electrified, if there is a positive business case and energy strategy, or powered by portable systems such as bio-diesel or hydrogen.

Infrastructure

The emphasis will be on minimising whole life cost and maximising availability of infrastructure. Infrastructure design will increasingly use less trackside equipment, such as track circuits and cabling, and will increasingly introduce track forms from Innotrack and other innovative projects. Increasing the capacity of infrastructure can be achieved through improved braking characteristics (enabling reduced separation), automatic driving and speed supervision systems and new standardised command control signalling systems.

Train Operations & Management

Within the Multi-purpose core there will be a need to manage a mix of sectors, including a number of different passenger sectors and logistical freight. The performance of the trains will be similar but freight will be increasingly on-demand. Therefore the emphasis will be on smart and fast scheduling as well as perturbation recovery.

Telematics

Advanced IT and communications systems will enable the provision of the right information in real time to end-users whether passengers, freight customers, maintainers or operators. Such information will be based on precise train location and up to date asset bases.

Telecommunications

The railways' telecom systems will migrate in accordance with developments in the global telecommunication market and technology.



3.1.2 Overview of visions for business categories

High Speed trains

High Speed rolling stock will run for the most part on specially designed dedicated track. Command, control and signalling will require a minimum of track side infrastructure and ETCS will provide in-cab signalling, with the train reporting location itself. The Control centre will regulate services to minimise deviation from the timetable. Rolling stock technology may continue to be steel wheels running on steel rails, but other technologies may be introduced if there is a good business case for doing so. IMs are likely to support the use of lighter trains with a good track/wheel interface. Rolling stock will generally be electric on the high speed and core networks. A debate with EC and governments on alternative energies will be essential (i.e. how 'green' do railways need to be?).

Regarding information technology, the emphasis will be on using telematics to generate railway specific information merged with other intelligent sources, and applying advanced mobile telecommunications and information technology to direct information to the passengers. Operators including maintenance staff will benefit from information gathered from intelligent infrastructure and intelligent trains. Passengers will be able to use their own devices to access entertainment and business services provided by the railway.

Conventional Higher Speed trains

The conventional higher speed trains will run on the Multi-purpose core. They will generally be electric, but perhaps with bimodal power design configurations to allow operation to the peripheral parts of some national networks. Due to the need to travel over lines with lower speed alignments and tighter curves, the trains will probably use a compromise suspension design to optimise the wheel/rail interface (stiff for high speed stability and soft for low speed tight curving), and be provided with similar business and entertainment facilities as high speed trains. The signalling will migrate to ETCS. In the longer term the removal of track circuits and other track side equipment will also be aspired to.

Inter-Urban trains

Rolling stock could be dual traction (where necessary) – electric where the track is electrified but hybrid- hydrogen fuel cell type technology elsewhere. Double deck and longer trains will be used for increased capacity but with an emphasis on reducing weight. Otherwise facilities will be the same as for high speed.

Suburban trains

Suburban trains will continue to be electric. The national signalling will migrate over time and signalling renewal plans to ETCS.

Regional trains

The Regional Railway services which do not run on the Multi-purpose core network will run on two different types of route:

- Regional Passenger which will be only for passenger trains run under 'line of sight.'
- Regional ETCS based around minimal infrastructure will be used where service levels justify it, and for Regional Mixed which will allow for both passenger and logistical freight services.

Rolling stock will be lightweight and powered by new technology hybrids or hydrogen fuel cells. Generally, the track quality will be reduced to lower infrastructure costs, but with trains specifically designed to provide adequate passenger ride comfort.

Community trains

Community Rail will run on dedicated lines. Community Rail will also run on passenger only Regional Railways. It is expected that Community Rail will not normally run on Heavy Freight, High speed, Inter Urban or Suburban routes but will need to run close to some of these sectors to provide integration between passenger modes. Where it is necessary to inter-run for short distances, risk analysis will consider the amount of signalling and other protection systems that could be needed. At the interfaces an appropriate balance of risk needs to be applied to keep costs to a minimum. Rolling stock, energy supply and infrastructure will be similar to that for Regional passenger only. In a few cases, consideration may need to be given to dual use of the infrastructure – automotive and rail.

Heavy Freight trains

Heavy Freight will run mainly on dedicated lines to enable a high axle load to be provided which would not be economic on the bulk of the network. The locomotives will be electric or hybrid hydrogen fuel cell powered, dependent on whether the line is electrified or not. The locomotives will be cab signalled with ETCS.

Logistical Freight trains

Logistical Freight will inter-run with passenger services but, as it will run on both electrified and non-electrified lines, it will be dual source hybrid - hydrogen fuel cell powered or, if running only on specific electrified routes, it will be electric only. Logistical freight will be cab signalled with ETCS.

The table below shows how the various business categories are expected to change between 2006 and 2035 with respect to maximum speed and axle load. While there is a general expectation that train mass would otherwise decrease there are reasons why axle load does not change for certain sectors. There are pressures to make passenger trains heavier – power doors, installed power, air conditioning, controlled emission toilets and other passenger expectations.

Therefore weight savings on bogies or bodywork may be used elsewhere. In the case of high speed passenger trains, Shinkansen trains initially dropped to around 14 tons but have more recently increased up to 17 tons for aerodynamic reasons, not least resistance to high cross winds. Therefore the gain exchanged for mass in the case of high speed trains will be maximum speed. For inter-urban and inner suburban trains, mass reduction will be counteracted by bigger carriages, longer carriages and more capacity. Lower costs can be expected from longer and fewer vehicles. Regional and Community rail vehicles will most likely be lighter, but will still be expected to provide adequate ride comfort and fatigue life, despite running on lower quality track. In order to further contribute to EC sustainability goals it is expected that freight loads will increase, albeit on lines specifically designated for freight. Where shared with passenger services, freight services will operate at lower speeds for freight to reduce track wear.



TABLE 3 : Protected railway flows

Railway Sector flows	Max Speed 2007 (km/h)	Max Speed 2035 (km/h)	Axle load 2006 (tons)	Axle Load 2035 (tons)
High Speed Passenger	300	360	18	18
Conventional Higher Speed passenger	200	250	20	18
Inter-urban passenger	160	160	20	20
Suburban Metro	120	120	22	12
Regional Railways	100	100	15	10
Community Railways	100	80	10	5-7
Heavy Freight (specified lines only)	100	100	25	Up to 35 (if no technical constraints exist)
Conventional freight	100	120	22.5	25
High Speed / Logistical freight	160	Up to 250	20	18

Note: this table defines the projected railway flows from a perspective of potential business needs and not technical requirements. The classification of the network in accordance to the line differentiation strategy will be set by the member states network statement, which of course will be done in discussion between the member state, IM and RUs.

3.2 Needs and expectations

The strategy needs to define the position of EIM in the general environment of railway transport. This includes defining the positions of all the stakeholders, describing for each of them: position, interests, expectations, points of conflict/synergy with the other stakeholders. In particular it implies identifying the market's (passengers and freight) long terms expectations; to encapsulate them in the ERA/EU prescriptions (for safety, social, economical and political aspects) and then to evaluate the technical lines of development to share with CER and UNIFE (with the support of the standardisation bodies).

4 The Technical Strategy

4.1 Differentiation of the network

Differentiation of lines is something firmly established in the road sector. As everybody knows, not all roads are motorways and not all roads are dirt roads – each road is adapted to local and business needs.

Historically, the ideal railway has been seen as a single network and the optimum design as one which allows any train to run anywhere. In practice, although pressures to create trains with long life and flexible deployment continue, this has never been achieved. The existing railway network and rolling stock form a heterogeneous system with complex constraints on interoperability based largely on history. A more cost-efficient vision for the railway of the future should be based on planned differentiation at infrastructure level between the Multi-purpose core network, where a number of different business categories (heavy freight, high speed passenger, interurban passenger and freight, regional) share the same routes and other lines where the route is largely used by one sector. Otherwise the differing needs of different route types and classes of traffic will demand too many compromises. This approach closely parallels work by ERRAC at European level.

Prioritisation criteria such as regional development, geographically peripheral locations and scale (country size) are criteria to be considered when categorising the national networks according to the differentiation approach.

The classification of the network in accordance to the line differentiation strategy will be set by the Member States network statement, which of course will be done in discussion between the member state, IM and RUs. The principle of differentiation must not impede interoperability on the defined interoperable lines and should support the needs of standardisation.

Figure 2 : Railway Sectors in 2007

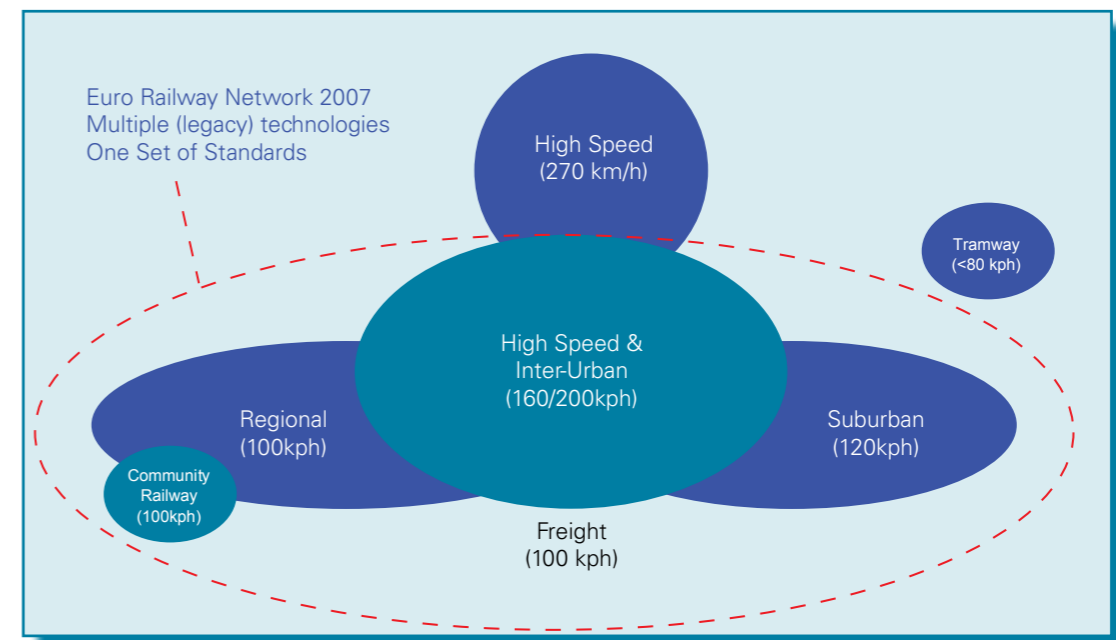




Figure 2 shows how, although railway routes vary enormously in terms of demand and traffic varies greatly in terms of speed and mass, in today's railway the entire network is maintained to a single set of standards, based around that part of the network which shares inter-urban, suburban and heavy freight sectors.

Figure 3 : Rail Sectors in 2035

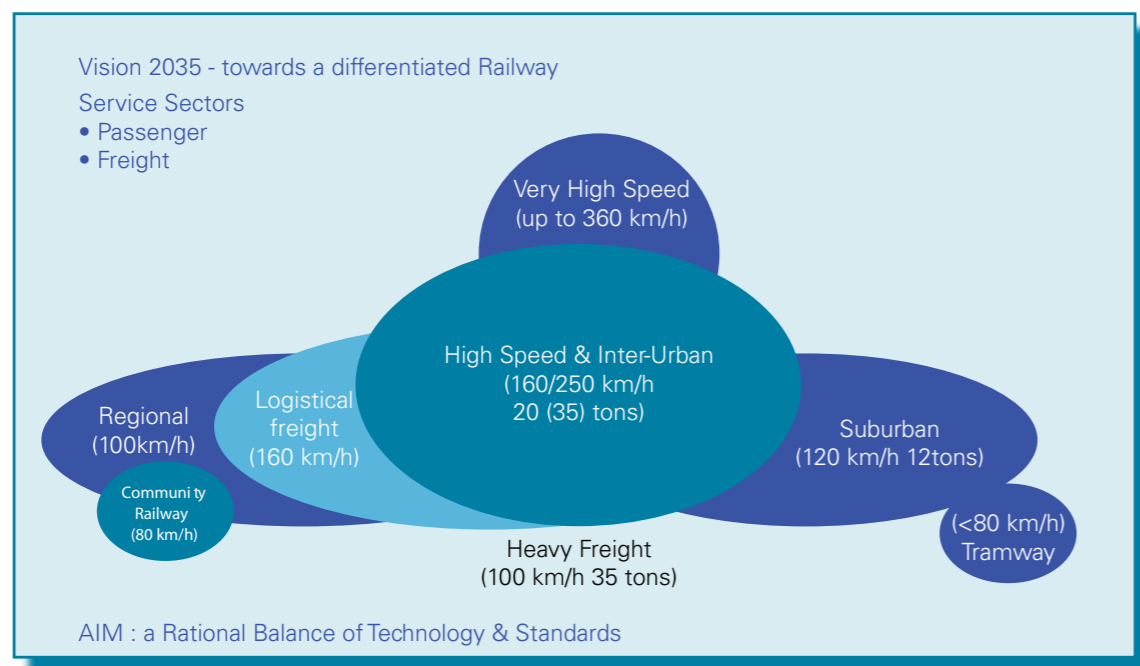


Figure 3 shows how the railway sector could change through increased differentiation, while maintaining interoperability. In order to achieve this, it may be necessary to limit the mobility of some classes of traffic, particularly heavy freight. There is an opportunity to develop dedicated heavy freight routes where that part of the railway can be optimised for this purpose. This could result in increased capacity for heavy freight.

Furthermore by introducing logistical freight to inter-run with passenger services, further freight growth can be accommodated to make use of capacity at a time when passenger train operations are not operating in peak flows. There have been a number of unsuccessful attempts to introduce a significant amount of logistical freight for at least 40 years. These attempts have failed as rail has not been attractive compared to road haulage. By 2035 there will be two factors which should counter major business case obstructions to this mode of operation. The first factor is that increasing public environmental concern could reduce the attractiveness of road haulage in favour of rail. The second factor is that with the development of e-commerce the point of delivery is becoming less retail outlet based. Therefore locating distribution warehouses close to the railway rather than in proximity to retail outlets may be less of an issue that it is today.

The overlaps of services represent parts of the network where the track is used by all the services shown in the overlapping shapes. For example, part of the network will be shared by inter-urban and suburban metro services.

A significant part of the network will be used by high speed and inter-urban sectors. This is defined as the Multi-purpose core because it is largely shared with other sectors, including very high speed, suburban metro, heavy freight, logistical freight and regional railways. It makes sense to maintain this part of the infrastructure to one standard but the rest of the network could be maintained to standards appropriate to their usage, using appropriate technology.

Figure 4 : Definition of the Multi-purpose core standard and differentiated standards Interoperability and standardisation

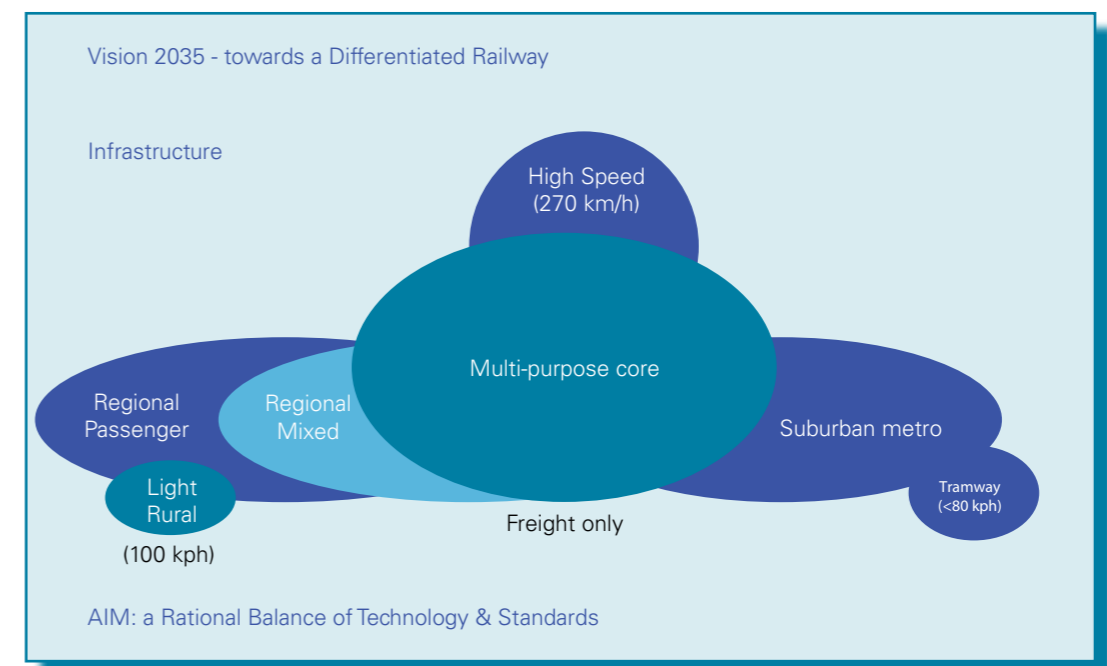


Figure 4 shows the Multi-purpose core network and which standards and technologies prevail for the mixes of sectors.

4.2 Interoperability and standardisation

Interoperability is currently the objective for the TEN-T network and the trains running on these lines. This means that these networks are the focus of the TSIs for High Speed and Conventional rail (CR). The TSI requirements for standardisation may also provide business benefits for regional lines and other rail networks with no requirements for interoperable trains. Standardisation of materials could to some extent, however, create interoperability on these networks over time. One example is the use of a standard sleeper everywhere, but placing them with different spacing depending on axle load.

The merger of the TSIs for High Speed and Conventional rail indicates that the entire network will fall under the scope of the TSIs. The effect of this enlargement of network coverage is being considered by the EIM.

The TSIs for conventional rail must describe one target system or target value for each line category and specification. These target systems/ values are to be called class A systems/values. Other systems/ values that exist nationally will



be categorised as class B systems/values that will be migrated into the class A system/values over time according to the migration plans agreed by the Member States. An example of a target system is ERTMS and an example of a target value is minimum train lengths of 750 metres.

The TSIs should set the basic requirements for the interoperable railway and the ENs should set the detailed specifications where referenced in the TSIs. UIC leaflets should be transformed into ENs where appropriate.

Planning of standardisation schemes for products/components must take into account the need for backward compatibility and interfaces. The possibility of achieving economies of scale must also be evaluated before deciding what products/components should be standardised.

The scope of the TSIs is to develop the network in such a way that trains running under normal conditions can operate. The TSIs must not promote the construction of a network or rolling stock to the highest common denominator, which will be oversized in relation to actual business needs. The example would be the multi-engine loco where one engine fails with a reduced speed as a consequence.

The scope of the TSIs must also allow for exceptions, or specific cases, when obvious reasons, such as landscape conditions, make it extremely costly to conform to a specification. An example would be a steep gradient or a tight curve. These exceptions must not, however, hinder the actual interoperability, but only limit the performance on that very spot, through a speed reduction, for example.

The TSIs set a minimum level to achieve. If there is a need, or desire, to reach a higher level one can do so, but the cost must be covered by those requiring the higher level of specification.

The selected target systems and values must reflect the requirements of the future and not those of today. Train speed, for instance, is expected to increase in the coming decades and therefore it is these speeds that must be reflected in the TSIs.

There is a difference in life cycle span between infrastructure and rolling stock, where rolling stock has the shorter life span and therefore can be expected to be the more flexible component in the drive towards interoperability.

During the migration period into the common 'class A' target system, an efficient common European procedure for the authorisation of new trains and components must be established in order to make it possible to operate interoperable trains on parts of the networks that do not yet meet the requirements of the TSIs.

The short term creation of limited interoperability for existing trains is achieved by an effective cross acceptance procedure. This procedure is based on mutual recognition and must be established. Agreement on what areas should be covered by mutual recognition is vital as are the common acceptable values of the specifications. The communication of conditions on a national level is made in the Network Statement, where it must be clearly stated if the mutual recognition level applies or if there are other national conditions to be met. Economic issues should be settled through national track access fees.

Interoperability can be considered both internationally, in relation to the aspirations of the European Commission, and nationally, in creating a differentiated but interoperable network. However, it is clear that over the period discussed in this document, a number of things are likely to change:

- The European railway classifications on which the TSIs are based will become more differentiated, consistent with the lead given by ERRAC and mirroring the approach outlined in this document.
- The scope of the Conventional TEN-T network will change and the HS and CR TSIs will be merged.
- The TSIs may become more specific, with less room for national options but more graduation, consistent with the differentiated approach outlined above.

In view of the scope of possible change outlined above, it is appropriate to define within this Strategy the EIM/CER/UNIFE/UITP vision for the railway. This will both help decide on the scope and timing of our plans for compliance with existing TSIs and help influence the wider European change process. It is thus assumed within this document that the need for TSI compliance is not, at first pass, a constraint on the Vision or on differentiation.

4.3 Short term priorities

During the process of producing the ERTS a number of priority short term issues have been put forward. These need to be considered in the continuing work.

- Increasing current capacity of infrastructure
- Alignment of EC and national strategies with consideration to
 - Funding arrangements
 - Technical issues
- Gauge harmonisation
- The greening of the railway
 - Energy
 - Environmental footprint (i.e. noise, weight and soil)
 - Heritage
- Inter-modality
- Security
- Lifecycle management / asset management
- Control of strategic land resource and efficient use of railway assets
- Interoperability of Rolling Stock with other Rolling Stock (RS) – e.g. for rescue
- Professional competencies of the workers and develop, for the effect, continuous qualification and formation programmes for the foreseen technological development



- Accessibility for people with restricted mobility (considering affordability and practicality)
- Migration plans for command control signalling systems
- Cross acceptance procedure
- Quality of service to the end customer
- It is important for EIM to have a common position on how the procedures for certification of materials and works will be carried out. If these procedures become too extensive there is a risk that the gain in efficiency created by the line differentiation, increased standardisation and interoperability is countered by a demanding certification procedure
- Considering the effects of the merger of the High Speed and Conventional Rail TSIs which will extend the scope of the TSIs to the entire network

4.4 Key Interfaces & Parameters

As well as the operational viewpoint, developing a vision for 2035 requires a clear understanding of the changes to key track-to-train and network-to-public interfaces which will inform the design of the network and its assets in the long term. The key parameters for infrastructure and rolling stock are as follows:

Infrastructure:

- Axle load, mean gross tonnes, axle spacing from end of one vehicle to beginning of next, spacing between axles on vehicle
- Gauge clearance
- Design frequency (trains per hour)
- Maximum speed
- Electrification
- Train protection
- Accessibility
- Security
- Information

Passenger and Freight Rolling Stock:

- Dimensions (gauge)
- Axle load (max, loaded)
- Acceleration
- Brake rate
- Maximum speed
- Train length (in max configuration)
- Mass per seat for passenger rolling stock
- Passengers per metre of train, volume capacity per metre of train
- Train protection
- Power source
- Power to weight ratio

There is an interaction between the infrastructure and rolling stock parameters that must also be considered as the trade off may yield considerable cost efficiency for the railways.

The changes to the above parameters which are implicit in the differentiated vision are set out in the table below:

TABLE 4 : Rolling Stock Characteristics developing through to 2035

Train Parameter	Heavy Freight	Conventional Freight	High speed logistical Freight	Community Light Rail	Sub-urban Metro Passenger	Inter-urban Passenger	Conventional higher speed	High speed	Regional (passenger only)
Max Speed (km/h)	100	120	250	80	120	160	200-250	360	120
Axle Load (max, tons)	35	25	18	7	12	18	18	18	10
Acceleration									
Brake Rate									
Train Length	<750m								
Mass per seat									
Capacity/metre	-	-							
Train Protection and Control	ETCS where necessary	National migrating to ETCS	National migrating to ETCS	none	National migrating to ETCS	National migrating to ETCS	National migrating to ETCS	ETCS	None/Regional ETCS
Gauge	Nat	TSI	TSI	Nat	Nat	Nat to TSI	TSI	TSI	Nat
Power source	Portable *	Portable *	Elec or Portable	Elec or Portable	Electric	Elec or Portable	Elec or Portable	Elec	Elec or Portable depending BC
Onboard catering	-	-	-	No	No	No	Yes	Yes	

* Note: Blank spaces indicate that the values have not yet been calculated.

"-" indicates not applicable.



TABLE 5 : Infrastructure Characteristics developing through to 2035

Parameter	Axle Load (tons)	Gauge Clearance	Train Control	Design Frequency (tph)	Accessibility	Electrification	Max Speed (km/h)
High Speed	18	TSI	ETCS	12	Full	Yes	360
Multi-purpose Core	25 (35)	TSI	National migrating to ETCS	4-24	Full	TBD	225/160(100)
Regional	10 (15)	National	Regional ETCS	1-4	Limited	No	120 (80)
Suburban Metro	12	National	National migrating to ETCS	30	Full	Yes	120
Heavy Freight	35	TSI	None on isolated lines to ETCS where required	1-6	-	Yes, where justified	<100
Community	7	National	None	1-4	Limited	No	80
Urban Tramway	7	Local	None	12-30	Full	Yes	80

Conventional rail is made up of all categories except Community and Urban Tramway.

TABLE 6 : Operational Interoperability

Train	Heavy Freight	Interurban/ logistical Freight	Light Rail	Inner Urban Passenger	Interurban Passenger	HS	Regional
New High Speed	No	Yes	No	No	No	Yes	No
Multi-purpose Core	Yes on defined routes	Yes	Limited for access	Yes	Yes	Yes	Yes for access
Regional	No	Yes	Limited	No	Yes but limited	Yes but very limited to access	Yes
Suburban Metro	No	Yes but limited to access	No	Yes	No	No	Yes for access
Community	No	Yes but limited to access	Yes	Yes but limited to access	No	No	Yes for access
Urban Tramway	No	No	Yes for access	No	No	No	No
Heavy Freight Only	Yes	Yes	No	No	No	No	No

In addition to the parameters above, the detailed interaction needs to be considered for all scenarios; for example differences in maintenance might result in rail grinding on the open track but not in tunnels. As a train enters a tunnel, it experiences a step change in some track parameters which could result in shunting.

4.5 Multi-Purpose Core Network

The definition of a Multi-purpose core network for the railway starts from an operational viewpoint. It consists of routes which are designed for multiple use, so that they are available for all traffic from logistical freight through high speed passenger to local stopping services. There needs to be differentiation within the Multi-purpose core for heavy



freight, with only nominated routes being available for high axle loads. The Multi-purpose core network defines the railway which is essentially flexible and can carry a varying mix of traffic depending on demand over the years. It is not a measure of importance as it is recognised that many regional and community lines are also important for the local communities and regions which they serve.

The Multi-purpose core network for 2035 will largely be the existing TEN-T network – some redefinition will be required to get a 1:1 correspondence between the Multi-purpose core and the TEN-T network.

Historically, the Multi-purpose core network has been designed for speeds of up to 160 km/h (100 mph). Certain routes have been upgraded for speeds of up to 200 km/h (125 mph). For 2035, these two standards are expected to remain, but technological development is expected to enable speeds of up to 250km/h (155 mph). The main standard is principally designed to accommodate logistical freight services operating at speeds up to 250 km/h and inter-urban passenger services operating at today's speed of 160 km/h. Freight and passenger services will inter-run. Inner suburban and regional traffic will be expected to operate on this network for limited distances only because of their limited top speed. Heavy freight with up to 25 ton axle loads will be able to run anywhere on the Multi-purpose core, with up to 35 tons on designated routes. Both of these types of services will need to operate differently on the Multi-purpose core than on the Suburban Metro and Freight networks.

The upgraded part of the Multi-purpose core network will allow 'conventional higher speed trains' and high speed logistical freight to run at a higher speed up to 250 km/h. High speed trains which run at speeds as high as 360 km/h (225 mph) on dedicated lines will inter-run at 250 km/h on this part of the Multi-purpose core network.

One area which needs addressing is capacity - another is reliability. Improved reliability will lead to increased capacity.

Having reached an initial view of the Multi-purpose core network in 2035, it is necessary to consider the standards and types of technological change which could be applied to the core network to address the needs identified in part 1 of this document. Four scenarios should be considered for each technological change until it is clear what budget will be expected to be available. Scenario 1 considers no funding for changes and assesses the impact of not applying technological change. Scenario 4 considers the most optimistic funding option and Scenarios 2 and 3 represent intermediate funding scenarios.

4.6 Migration

The actual migration will be carried out by the national IM in cooperation with the national government and relevant RUs.

Until a significant degree of network harmonisation has occurred it will not be possible to get many Interoperability Constituents (IC) approved and therefore accrue real benefits. The ICs therefore represent an important part of the 'make or break' of the affordability of TSI implementation.

It must, however, also be pointed out that the application of the target systems will inevitably drive the use of IC materials thus making them more affordable. Once a few IMs start to demand IC materials other IMs can follow later at a lower price. The industry will, most likely, supply intelligent technical solutions that enable the IMs to migrate

smoothly. One such example is the new Dutch overhead lines that, apart from current voltage, can also be fed 25 kV when the target system is fully in place. The single target system approach gives a clear signal to the industry as to where the business will be found in the future.

For new infrastructure systems such as high speed lines, the application of the technical specifications defined by the EC is a starting condition; in the current conventional network the process is more complex and dependent on many variables and constraints.

The real hurdles for implementation have to do with civil engineering issues. For instance it is difficult and in some cases impossible to change the gauge of the physical infrastructure. Life cycles of the different subsystems are also hurdles to the implementation of the interoperability specifications. Destruction of capital and investments must be prevented – In other words, changes must be backed up by a solid business case (CBA).

The return on investment should meet commercial standards and should be reached within a limited period of time; otherwise the migration must be assessed in greater detail. The business case must take into account the existing traffic and rolling stock, potential traffic, technical conditions of the existing infrastructure and financial possibilities. Impacts on society must also be a part of the economic assessment.

Currently, general strategic access planning operates to fairly short term timescales (typically 5 years ahead) on a route by route basis and is focused on making best use of infrastructure and rolling stock. Specific "what-if" cases are developed to suit particular projects.

The development of a long term strategy for the railway requires the development of a long term operational plan which defines, in principle, how increased demand will be met route by route (whether by train lengthening, metro style trains, double deck trains, reduced headway, increased use of infrastructure margins or new infrastructure).

The ETCS will be affected by needs for transport integration, which needs to be fully considered in discussion with CER/UNIFE/UITP (and with EC/ERA). The migration plan of railways to a compliant ETCS system will be dependant on the type, condition and age of the existing systems and migration plans will be developed to best suit the business needs of the railway and deliver ETCS along corridors. The early identification of these needs will drive a business requirement for the development and procurement of new systems or technical solutions.

It is envisaged that the long range operational plan will consist of a series of maps showing routes, service frequencies and rolling stock characteristics (train length and passenger capacity) which are intended to meet demand. It may be appropriate to produce a series of such maps going further into the future (e.g. 2014, 2024, 2034).

There is a need to define what each route is capable of supporting at present and what the aspiration is with time. Each EU country is required by directive 2001/14, on the allocation of railway infrastructure capacity, to produce a Network Statement to describe the current railway. The UIC ERIM project is currently defining routes and usage. The Network Statement concept could, with minor development, show how the IM plans to accommodate interoperability by adopting the TSIs on a long term basis.

In practice, the IM's Railway Renewal and Upgrading plans will be designed to implement TSI requirements and anticipated business demands. Asset databases are the key to this type of asset planning.



4.7 Funding

The migration is very much connected to the funding of changes in the infrastructure. It is recognised that the funding is, and will continue to be, predominantly national. Constraints will therefore certainly exist both on a national and European level. Railway companies are likely to need additional economic support for this phase and should also be considered in a financial and economic evaluation. EC financing will most likely be necessary to avoid the risk of sub optimisation when, in the work of the ERA, national representatives argue for choice of target system. The choice of a target system will have a dramatic effect on cost for many IMs. This cost will not be spread evenly, since some countries will have to do more (and pay more) to apply the TSIs than others. EC financing would help to identify the best target system for Europe as a whole.

4.8 Time Line

Once the vision and the scope of change is clear, a time-line to 2035 can be constructed, identifying the key decisions that need to be made which will influence delivery of the Vision, the industry party (or parties) who will make each decision, whether the appropriate incentives exist and any changes to the regulatory framework needed to drive the appropriate result. The timeline, the decision matrix and the assessment of incentives form an essential part of the Technical Strategy.

TABLE 7 : Time Line

Year	Decision
2006	CoCoSig: The ETCS implementation plans to be completed
2006-08	Production of long term Route Utilisation Strategies for every part of the Euro railway network for 2014, 2024, 2034
2007	Europe: Submission of CoCoSig Implementation plans to EC
2012	Revise/update technical strategy
2014	Complete ETCS corridor implementations

2017	Revise/update technical strategy
2023	Revise/update technical strategy
2030	Revise/update technical strategy
After 2030	ERRAC targets for items below <ul style="list-style-type: none"> • Implement differentiated infrastructure maintenance polices • Passenger Interface: Smart ticketing, pay by mobile phones, integration with other modes of transport. • Switch to use of composite (plastic) bridges • Replacement of level crossings with bridges/tunnels • Use of low maintenance track (Slab track) in tunnels and where justified

4.9 Gap Analysis

Gaps in knowledge, both of the technology implicit in the Vision and of the tradeoffs which will inform its further refinement need to be identified. In addition there is a need to identify the research themes to fill these gaps, and map these to the improvement initiatives currently being driven within industry and government.

The results of this Gap Analysis will inform the ERRAC Research Strategy, identifying the research themes needed to fill the gaps, and mapping these to the improvement initiatives currently being driven by EC, governments, and industry.



5 Further work

The following list represents areas currently identified as requiring further work:

- “Creating the Vision”
 - Consultation
 - Adoption by industry
- Need for IMs to check national visions and the correspondence with ERTS. This must input to business and line categorisation
- “Refining the Vision”
 - Cost/benefits modelling
 - Research needs
- “Delivering the Vision”
 - Incentives
 - Information
 - Cooperation
- Need to define new, renewal and upgrading as terms in the TSI’s
- Need to define “specific cases” and criteria for these
- Further issues are described in section 4.3 Short term priorities
- Safety and security issues - input from ongoing work
- Scan for the use of technical standards for fixed installations and equipment to reduce lifespan costs, apply ICT for improving efficiency internally for IMs and RUs and make the interfaces between infrastructure and RS simpler

EIM will work to develop plans to tackle these issues.

Annex A Definitions

Term/Abbreviation	Meaning
Community Rural Railway	Passenger service with frequency designed around demand that varies throughout the year, low to medium distance, currently at speeds up to 80 km/h and 6t axle loads. These railways are run on the basis of partnership, and dependant on active support from one or two local authorities, users and community groups
Heavy Freight	Passage of goods, not passengers, typically routes from ports to operations locations at generally low acceleration rates, long train length, currently at speeds up to 100 km/h and 25-30t axle loads, generally low value and high weight/volume goods e.g. steel, coal/aggregates less speed critical than logistical freight
Conventional Higher Speed Passenger	Passenger Service with high frequency during peak, medium distance, clustered stopping in urban areas where the track has been upgraded to enable higher speeds than interurban, currently speeds up to 200 km/h and 20t axle loads, in the future could be improved to 250 km/h and 17t axle loads
Inter-urban Passenger	Passenger service with high frequency during peak, medium distance, clustered stopping in urban areas currently at speeds up to 160km/h and 20t axle loads
Line of Sight	Line of Sight is a means of operating slow, light trains such that they are able to be stopped by a driver before reaching any obstacle. It relies on good sighting by the driver allowing sufficient time to allow for reaction and braking action. The brakes are designed to stop the train in a short distance, for example by means of track brakes
High speed Logistical Freight	Passage of goods, not passengers capable of interworking with Inter –urban Passenger services by matching acceleration, speed and weight, generally medium to high value/lower weight goods – delivery time and speed critical, currently at speeds up to 160 km/h and 20 ton axle loads, rapid product handling required



Term/Abbreviation	Meaning
Regional Railways	Low frequency during peak (lower demand – not main flows), medium distance service currently at speeds up to 100 km/h and 10 ton axle loads
Suburban Metro	Passenger service with high frequency, during peak, short distance, frequent stops, high acceleration rates, powerful trains and dramatic changes in load, currently at speeds up to 120 km/h and 12 ton axle loads, e.g. British Rail class 150s, 455s and 376s
TEN-T	Trans-European Transport Networks
TSI	Technical Specification for Interoperability
Upgraded Inter-urban Passenger	Passenger service with high frequency during peak, medium distance, clustered stopping in urban areas where the track has been upgraded to enable higher speeds than interurban, currently speeds up to 200 km/h and 20 ton axle loads e.g. UK West Coast Main Line, East Coast Main Line and potentially Midland Main Line
High Speed Passenger	Passenger service with low / medium frequency during peak, long distance, and high speeds, currently up to 270 km/h (in the future 360 km/h) and 18 ton axle loads on track specifically designed for high speeds (generally straight) e.g. Channel Tunnel Rail Link (now High Speed 1 / HS1), stops at major conurbations only, acceleration as defined in the HS Technical Specifications for Interoperability

Annex B Acronyms

EIM European Rail Infrastructure Managers
ERA European Railway Agency

AEIF	European Association for Railway Interoperability (No longer in existence)
CCB	ERA Change Control Board of ERTMS Change Control Management
CER	Community of European Railway and Infrastructure Companies
CEN	European Committee for Standardisation
CENELEC	European Committee for Electro technical Standardisation
CIP	Critical Infrastructure Protection
CMW	Certification of Maintenance Workshops
CSI	Common Safety Indicators
CSM	Common Safety Methods
CST	Common Safety Targets
EC	European Commission
EMC	Electromagnetic Compatibility
EN	Euro Norm (European standards)
ENE	Energy TSI
ERRAC	European Rail Research Advisory Council
ERTMS	European Rail Traffic Management System
ETCS	European Train Control System
ETSI	European Telecommunications Standards Institute
GSM-R	Global System for Mobile communications-Rail
HS	High Speed
IC	Interoperability Constituents
IM	Infrastructure Manager
INF	Infrastructure TSI
ISO	International Organisation for Standardisation
MS	Member State
NSA	National Safety Authority
RS	Rolling Stock
RST	Rolling Stock TSI
RU	Railway Undertaking
SSMG	System Safety Management Group (UIC)
SafeCert	Safety Certification and Authorisation
TAP	Telematic Applications for Passenger TSI
TSI	Technical Specification for Interoperability
UIC	International Union of Railways
UITP	International Association of Public Transport
UNIFE	Union of the European Railway Industries



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