CHALLENGE 2050

↗ SUPPORTING PAPER

THIS PAPER SUPPORTS THE VISION AND GOALS SET BY THE RAIL SECTOR IN ITS DOCUMENT "*CHALLENGE 2050*", PUBLISHED IN FEBRUARY 2013.

This paper describes many of the important drivers that were either the foundation or the catalyst for the changes necessary to arrive at our vision and goals for the rail system.
Whilst the main *Challenge 2050* document has been written as if the reader is in 2050 and looks back at the route taken, this paper builds from today and outlines some of the sector's key drivers.
The paper follows an iterative process that demonstrates how we aligned the vision to the goals and then developed this vision to achieve successful delivery.

1. THE DRIVERS OF CHANGE

Rail currently has a 6% share of the passenger market (measured in passenger kilometres) and around 16% of the inland freight market (measured in tonne kilometres) [1]. In contrast, road transport accounts for more than 70% of all passenger kilometres and freight-tonne kilometres.
By 2050 this has changed and the European rail system will have attracted and be capable of handling a multi-fold increase in traffic volumes.
The scale of these increases is accentuated when we allow for the underlying growth in transport demand by 2050: freight volumes are expected to increase by more than 80% and passenger volumes by more than 50% [2]. This suggests an eightfold increase in freight moved by rail and a twelvefold increase in passenger travel.

This growth is the core message in *Challenge 2050* and it presents rail with a significant opportunity. Rationally there is little alternative if we are to meet the demand for increased mobility within the constraints of significantly reduced greenhouse gas (GHG) emissions and the need to address congestion. Although the aviation sector has an 'aspirational goal' of reducing its net CO_2 emissions by 50% between 2005 and 2050 [3] it cannot match rail's green potential. On land, even the potential of e-cars, and other forms of more environmentally-friendly road transport – while mitigating the emissions impact of conventionally-fuelled vehicles – still leaves the problem of congestion. In contrast, rail excels at moving large volumes of passengers and goods [4].
The challenge for rail is to drive the behavioural changes and secure the physical means necessary to attract, manage and retain these new volumes of demand as forecast by experts [5-8] whilst remaining safe and the leading mode of land transport.

1. Source: EU Transport in Figures, Statistical Pocketbook 2011, tables 2.2.2 and 2.3.2.

2. Source: Commission Staff Working Document accompanying the White Paper, SEC(2011) 391 final

3. Source: Aviation Industry Commitment Action on Climate Change, Air Transport Action Group, (not for profit organisation representing all sectors of the air transport industry), Geneva, 22.04.2008

4. A journey from home to work by car consumes ninety times more urban space than the same journey by metro, and twenty times more than if it is by bus or tram. Source: UITP, 2010

Reductions in Emissions

European Union policy aims at 70% fewer emissions [5] than today: this will require a huge reduction in the use of conventionally-fuelled vehicles by 2050.

The role of public transport will be transformed with improved inter-connectivity between rail and other modes, particularly for longer journeys.

This implied increase in rail usage means providing modern infrastructure and equipment that removes bottlenecks, facilitates user-friendly cross-modal accessibility and fills missing links. Coupled with a step-change in service quality and efficiency this will, thanks to vision and commitment as well as significant investment on a Europe-wide scale, mean a much more attractive and efficient rail system.

We will need effort and energetic commitment to make this happen. With increasing global demand for carbon fuels and escalating extraction costs, there is no longer a continued dependency on oil, because reliance on oil is likely to be incompatible with continuing economic growth.

Congestion

Other cost drivers put the level of investment required into context. By 2050, the cost of congestion is projected to have increased by about 50% to nearly €200 billion annually [6]. Road and air congestion is expensive. It increases fuel consumption, generates additional noise and unnecessary additional emissions, wastes peoples' time and reduces productivity. Congestion means expensive resources cannot be used to their full potential.

New roads and airport capacity are land-take hungry, whilst providing increased rail track-capacity to ease network hotspots is comparatively efficient, because it is usually limited to established corridors with environmental intrusions mitigated. Public transport facilitates good land use. It permits higher-density settlements, avoids the need for expensive city centre parking and consequently saves scarce land resources.

Rail unit costs tend to fall as traffic density increases. With funding to provide sufficient capacity and EU-wide application of effective traffic management systems, rail is well placed to tackle congestion.

However, this requires a level playing field between transport modes, including the internalisation of external costs, for example, by identifying the costs of congestion, accidents and environmental impacts and allocating these costs to the modes that actually cause them. We must apply a consistent approach across modes to factors such as passenger rights, energy costs, social conditions and taxation. Transparent pricing, the evolution of multi-modal transport technologies and policies that optimise efficient co-modality will allow rail to gain a considerable competitive edge over other transport modes by 2050.

Costs

The cost of providing the infrastructure required to meet the growing demand for transport across all modes is estimated at over €1.5 trillion between now and 2030. Rail will require the largest share of this investment if Europe is to meet its GHG reduction targets [7]. Without significant economic growth, finding this money from the public purse will become increasingly difficult. Funding adequate welfare provision for an ageing population coupled with falling excise revenues as reliance on carbon fuels declines, will require ever more innovative methods to reduce costs and secure new sources of finance.

Meeting those challenges will be determined by the sector's ability to deliver attractive services to passengers and freight customers at competitive prices. We must offer cost-effective and safe services without compromising on quality. We must seek economies of scale through developing and applying common standards for interoperability, eliminating wasteful national duplication of matters that can be dealt with effectively at European level, particularly standardisation, safety certification and equipment authorisations.

5. The contribution of the various modes to the GHG emissions of the transport sector (including international aviation and marine but excluding combustion emissions from pipeline transportation, ground activities in airports and harbours, and off-road activities) was as follows in 2008: 71.3% came from road, 13.5% from maritime, 12.8% from aviation, 1.8% from inland navigation and 0.7% from diesel-powered rail transport. ibid

6. See Impact Assessment on the Transport White Paper, SEC(2011) 358 final.

7. Source: Commission Staff Working Document accompanying the White Paper, SEC(2011) 391 final

To have a real chance of levelling the playing field with other transport modes, the rail sector must reshape the legacy of the numerous and frequently incompatible national standards. These frustrate innovation and efficient procurement and inflate the sector's administrative costs. The sector carries an unnecessary burden that constrains the opportunities for opening markets and increases end costs to passengers, freight users and taxpayers.
Placing this responsiblity within a standardisaton framework that focuses on European-level requirements and is run by the rail sector for the rail sector (rather than the current very nationalistic framework) will dramatically improve system efficiency and quality, and reduce overheads.

User attitudes to rail

Although performance and reliability is the single most important driver of user satisfaction, journey times also determine rail's market share in competition with other transport modes [8]. By 2050 the rail sector will have done everything possible to develop its competitive edge over passenger air travel. This is especially important for conurbation-to-conurbation rail journey times where a duration of up to four hours remains competitive with air travel. This suggests that high speed rail is a credible alternative for journeys of up to 1000km. Innovation of the high speed product offer may see and increase in this in the future.

With freight traffic, rail will offer shippers important benefits such as frequency, reliability, service quality, price and convenience of access between modes at ports and other transhipment points. High speed freight will play a significant role in ensuring that rail is the attractive logisitics backbone of the European system and one that customers see as their first mode of choice.

A top-line analysis of customer perceptions of rail services highlights many common themes across Europe. Rail users want services that are reliable: passengers and freight should reach the destination safely and on time, with facilities provided as advertised. Customers value convenience - they want to be able to access their preferred service at the time they want. For example, a change of train; a complicated connection with another transport mode; or a freight consignment that has a complicated transfer or is left sitting in a siding for a long time, can deter potential customers from even thinking about rail as an option. Customers don't like complicated tariff arrangements. They also want easy and immediate access to relevant information about times, facilities and costs. Not least, users want value for money and to arrive at the destination on time and safely. These are the principal drivers of customer satisfaction across Europe.

The rail sector recognises the importance of further transformation to achieve higher levels of customer satisfaction. We know from user responses to modernisation programmes that we can achieve change and benefit business. This matters if rail is to win the additional traffic that policy planners believe it ought to attract.

Government attitudes to rail

An eight or even twelvefold increase in passenger volume won't be achieved by default. At the very least, governments will look for some degree of public support before providing the funds essential for modernising the system. Without this investment there is little chance of achieving the vital step-change in service quality necessary to smooth an increase in market share. Public perception and support is part of a virtuous circle that could make or break the EU's ambitious transport strategy.

Research consistently shows that the operational performance of the rail system, particularly punctuality and reliability, is the main driver of customer satisfaction. Conversely, the failure of service providers to manage disruption adequately is a major source of customer dissatisfaction. Disruption has such a negative impact on rail and society as a whole, because most people plan their activities around published times. Effective customer information gives people confidence that the system is being managed effectively.

The future transport structure

By 2050 rail will be embedded at the heart of an integrated transport system where each mode plays to its strengths in an environment

8. Air and Rail Competition and Complementarity, Steer Davies Gleave, August 2006

of cooperation and competitiveness, enabling a more competitive European economy.
Rail has a unique potential within land transport to gain very high modal shares over intermediate and long distances, both within the EU and through providing reliable and competitive links to Asia, the Middle East and beyond.
Developing the competitive edge inside and outside the sector is widely acknowledged to have delivered efficiency gains and a more business-oriented culture in the rail sector.

Unlike other transport modes, the rail sector depends on efficient and effective 24/7 management of a range of core internal interfaces such as the interface between wheel and rail and external internal interfaces between third parties. A safe railway relies on effective management of this and many other core interfaces. Keeping these interfaces working effectively whilst encouraging technical innovation will be a core challenge as we model the future rail system.

The rail infrastructure is vital to this transition. By 2050, infrastructure managers will have reinforced their cooperation to create a stronger emphasis on the need for reliable corridors and a strong network focus with more joint ventures across state and territorial borders and greater alignment of technical standards.
To facilitate these necessary trends, both technical and market development should be collaborative, with supporting regulation organised at a pan-European level and the underpinning standardisation framework run for the sector by the sector with a firm business-led approach.

High Speed passenger services

High-speed lines will have been upgraded and extended by 2050. A European high-speed network will provide services connecting the major European metropolitan areas and airports on trains free of operational constraints.

The need to manufacture high speed trains represents an important challenge for the supply industry, both in terms of the quantity and quality of the trains and the technological developments we need to achieve over the coming decades. Partnerships between industry and operators for the design, manufacture, operation and maintenance of high speed passenger and freight trains will provide the future way of working.
The move in this direction will mean greater operational availability and maintainability of trains by 2050. This will help high-speed passenger and freight services to become a major pan-European success story.

The rail infrastructure will improve continuously, allowing it to cope with higher speeds. This includes improved maintenance concepts for ballasted track, new or improved construction of slab track, and new materials for catenary. Reducing noise and vibration and improving energy efficiency will make high speed services one of the most sustainable service types.

Standardisation will be key to reducing costs and making high speed services more cost-efficient. We can best achieve these efficiencies as a sector by preparing and publishing our own production standards at a European level, rather than relying on third party development with a national focus.

Developing freight

Freight transport today is often reduced to a minor part in a logistics chain. It is imperative that we develop European freight mobility systems and logistic chains in a co-modal transport perspective, where ultimate competitiveness results from combining the best performance of each transport mode.

Rail must enhance its present role in co-modality by tackling the challenge of the physical movement of load units as an industrial process as well as the options resulting from that. Part of that challenge is to develop and, where it makes good economic sense, adapt the existing network to accommodate the high speed movement of freight traffic between major conurbations on a city to city basis.
By 2050 most freight trains will perform similarly to passenger trains, and this will allow interleaving without the loss of capacity.

Demographic change

Rail users are likely to become more demanding over the coming decades. Customers are getting older: a 65-year old woman in the EU can expect to live on average for a further 21 years while her male counterpart will

on average live for another 17.4 years [9]. This highlights the importance of special needs and the issues facing people with reduced mobility.
The dominance of the private car illustrates consumer expectations. In their cars, people are cocooned in their own private space when travelling, frequently insulated by air-conditioning, cradled in variable geometry seats and calmed by high-quality audio of their choice. The rail sector must develop insight and innovation to tempt people out of their cars and reinforce modal shift. Another demographic trend is individualisation, an aspect that has been supported by the use of private cars and one that provides a challenge for the interior design of passenger environments.

Urbanisation

Most of Europe's citizens live in urban areas with more than 10,000 inhabitants. Those in urban conglomerations face particular transport problems where traffic congestion and pollution is at its worst and where dependence on public transport is at its greatest. Enhancing mobility while at the same time reducing congestion, ensuring efficient land use, and reducing accidents and pollution is a common challenge for all the major cities in Europe. The rail sector is ready to work with spatial planners to address these problems. Rail has a unique contribution to make in reducing congestion, ensuring more efficient land-use, greater safety and much lower levels of pollution.

End-to-end journeys

Relatively few journeys (freight or passenger) involve a single leg, but they frequently involve several modes. Typically, medium and longer distance journeys – those in which the EU White Paper foresees the principal shift to rail – involve a change of services for the last or first leg of the journey.

These can consume disproportionate shares of the overall total journey time: people have to wait for connections and freight is transferred between modes. This adds significantly to users' perceptions of inconvenience and does not tempt people away from using private transport. Solving the problems of inter-connectivity, overcrowding and seamless journey planning is clearly important for achieving significant modal shift.

Leadership

The structure from which this vision will emerge is one that reflects its origins in a range of local commercial initiatives or, at best, the national ambitions of individual Member States. Today this is reflected in the multiplicity of processes and standards across the European railway area.
The railway sector recognises the need to focus on the economic efficiency of the whole system but at the same time respect the principle of subsidiarity.
The principal challenge taking the sector towards 2050 is to find new ways of exploiting innovation and developing business opportunities within the framework of an efficiently performing internal market. For this to happen an effective collective leadership must emerge so that rail is able to position itself as a mode alongside other modes and give itself that competitive edge [10].

The sector can best achieve this through a comprehensive strategic programme of standardisation that is led by the rail sector and based on the sector's business needs from a strong European perspective.

The European railway supply industry currently supplies more than 50% of the worldwide production of rail equipment and services. It is a global leader in the production of equipment for high speed services and urban services. The total accessible world market for the rail industry in 2011 was estimated at more than €146 billion [11].

Despite global economic problems, annual growth of the world rail market has continued at around 6%. This has been stimulated by the success of high speed services in Europe, the flexiblity and attractiveness of rail freight products, European industrial leadership in metro network technology and the attractions of the success of European rail transport management systems.
The increasingly important role that rail is expected to play in the future of European society and its sustainable economic growth,

9. Eurostat: http://epp.eurostat.ec.europa.eu/cache/ITY_PUBLIC/3-19042012-AP/EN/3-19042012-AP-EN.PDF

10. Dr Libor Lochman, Executive Director of CER, Understanding the McNulty Report from an EU Rail Perspective, February 2012. http://www.cer.be/images/events/2012/120201_CER_ATOC_Event/cer_atoc%20event_presentation_cer.pdf

11. UNIFE World Rail Market Study, 2012

provides a rare opportunity for the European rail sector to consolidate its position worldwide, providing the basis for innovative technological development within Europe and generating significant additional employment in enterprises of all sizes spread throughout the Union. We can only achieve this with a strong vision and leadership that is working for the entire sector.

2. PLANNING TO DELIVER

Once published, *Challenge 2050* must be given life.
The sector will need to carefully plan delivery to achieve the massive shift to rail that is vital to meet the goals of emissions reduction, sustainable economic growth and social cohesion.
This is a huge opportunity and will need considerable commitment from the entire rail sector to introduce this change and encourage the massive predicted modal shift to rail.
We will achieve many of the visionary elements in this paper through a consolidated research, development and innovation programme which will need additional investment, particularly to achieve the capacity and reliability challenges.
This *Challenge 2050* is of course where the vision starts with delivery being enabled as a result of the detailed research needs as set out in Rail Route 2050 produced by ERRAC and with the support of innovation vehicles with the proposed Shift^{2}Rail being a key focus.
The ability to raise the funding for that investment will depend on gaining the political support necessary to turn our vision into reality.

The European institutions have an important role in providing the right framework for success:

- The institutions must ensure the level playing field that will enable different transport modes to compete transparently and to play collaboratively to their strengths. Legislative arrangements to secure the internalisation of external costs are central to this, as they are to the evolution of a more competitive European economy.
- The EU institutions can facilitate the creation of appropriate and innovative new funding arrangements – as the Commission has already done with its proposals for the Connecting Europe Facility which is intended to lever significant new infrastructure funds from private sector sources.

Europe's rail operating community needs a programme of harmonised rail standards created by the sector for the sector:

- This includes timely and cost-effective interoperability and safety specifications jointly elaborated with the relevant organisations, such as the ERA.
- These will deliver the vision contained in *Challenge 2050*.

Europe's rail supply community can continue to be the global leader for cutting-edge technology in world markets whilst supporting the capacity and reliability of the European railway system:

- But this requires significant funding, inspired leadership and a European framework that nurtures innovation and reflects the importance of the whole sector as one of the pillars of sustainable growth in Europe.

Only the enthusiastic support of Europe's rail users will enable the economic success of the rail system.

- Continuous dialogue between the sector and user groups will provide focussed input for developing innovative solutions to meet shared challenges.

We will regularly update this paper to take account of sector and external developments.