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# **RAILWAY STANDARDISATION STRATEGY EUROPE**

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This Railway Standardisation Strategy Europe has been developed and published by the UIC on behalf of stakeholders that are constituents of the Railway Operating Community (ROC) in Europe, and also represented in UIC European Regional Assembly.

Copies may be freely downloaded from the UIC website [www.uic.org](http://www.uic.org) and click on the link on the homepage.

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## FOREWORD

Rail is a vital service to European society and the transport backbone of a strong economy. It has an unprecedented opportunity to achieve the sustainability required to be a very powerful contributor to European success in the twenty first century. By doing so, it will be able to respond to customer expectations as the anticipated growth in transport demand, both passenger and freight, emerges.

In order to describe the associated challenges, in 2013 the entire railway sector developed the business-led vision “Challenge 2050”, highlighting what Europe’s interoperable railway should look like in 2050. As a development of that and focussing on developing the technical pillar, the Railway Operating Community (ROC)<sup>1</sup> published the Rail Technical Strategy Europe (RTSE)<sup>2</sup> in 2014 (See Fig. 1)

Despite being closely related to technology and innovation, both of these publications only deal with the issue of standardisation in a general manner. A separate document specifically focussing on standardisation was deemed reasonable. This is because the environment of railway standardisation is constantly evolving:

➤ innovation increasingly feeds the evolution of standards and standards in turn foster the implementation of innovation in the railway system, for example the mega-trends of digitalisation or e-mobility. This is especially relevant as more and more technology becomes common and is shared between different modes of transport and so the need for specific standards for rail application has to be challenged,

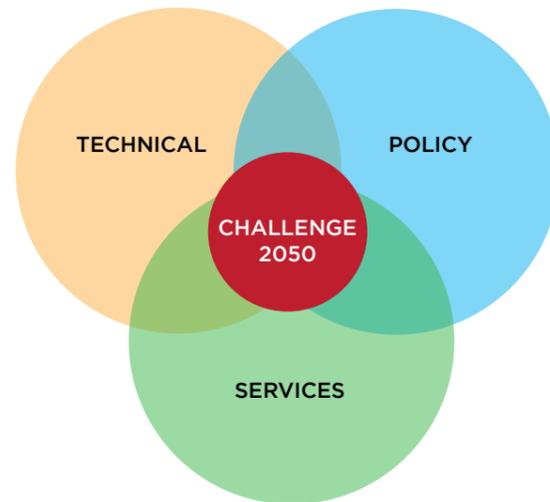


Fig. 1: Challenge 2050 – the three pillars

- the role of standardisation in the railway domain has changed as a consequence of liberalisation and the on-going creation of a Single European Railway Area (SERA). In parallel, it has also changed from an operator-driven approach to a kind of “shared responsibility” with the supply industry,
- as product markets become more global, there is a real opportunity for rail in Europe to be opened up to and be a reference for other global regions,
- the ROC is ultimately committed to and the upholder of the integrity of the Railway System as Europe’s safest, most environmentally sustainable shared infrastructure for mobility and as a healthy, self-sustained business environment that generates added-value to society. In support of developing the vision, in 2017, the ROC prepared “Boosting Railways for the 21<sup>st</sup> century”, an ambitious programme to drive the agenda for tomorrow’s railway.

1. See definitions section

2. [http://europe.uic.org/IMG/pdf/rail\\_technical\\_strategy\\_europe.pdf](http://europe.uic.org/IMG/pdf/rail_technical_strategy_europe.pdf)

## EXECUTIVE SUMMARY

The general benefits of standardisation are well known. Business-led standards provide a real potential for cost reductions, the creation of new business models or an increase in competition and greater opportunity for system effectiveness and efficiency.

For the shared network, where various operators use the same infrastructure, standards are in addition a key prerequisite for a safe and reliable operation, not only within but also beyond Europe. Furthermore, standards can incentivise the design of components improving maintenance logistics, enabling scale-effects and so on.

Since rail is first and foremost a system, any part of it must be developed with due consideration given to the safety and cost impact on other parts of the system of the topic to be standardised. It is this simple system purview that will ensure that the integrity of the system is considered.

**New standards, for example resulting from Shift2Rail, must commit to this systemic approach.**

Standards users groups that work in the railway domain usually respect this holistic point of view when adapting their standards to the latest state of technology, operational experience or legal demands. This approach ensures that system safety, integrity and interoperability are maintained. However there are players that follow a different set of principles.

**As a short-term action, any lack of coherence urgently needs to be minimised. The overall efficiency of the railway-related standardisation processes needs improvement**

This can only be delivered by strict, formal and comprehensive description of the key interfaces. For this the railway sector needs a highly effective standardisation framework driven by business needs and comprising a suite of attractive and competitive standards. In order not to re-invent the wheel, it may even be reasonable to think out of the box and consider standards already effectively applied in other industries/sectors as being suitable for the railway sector.

**The railway sector needs to be prepared to adopt and adapt solutions and innovative approaches from other sectors.**

This can however only be effectively achieved when the ROC is choosing, adapting and/or elaborating the standards in the core of their business and selecting the organisations of their choice to manage those standards.

**A key element is the strict focus on the need of the users (“standards by the sector for the sector”) and the need for system integrity constituted by the management of system interfaces.**

A successful future European railway system needs its assets to be of high quality and meet the criteria of reliability, availability, maintainability and safety (RAMS). The service that will attract and retain the customer has to be adapted to contemporary performance and quality expectations.

This will be assured through a process redesign of railway standardisation and the development, publishing and implementation of excellent technical solutions elaborated by the sector for the sector. Maintaining and improving these solutions in accordance with business needs, customer expectations and the provision of a positive travel experience, will demonstrate the competence of the ROC in collaboratively developing and continuously improving the rail system, so as to allow it to meet the challenges of the future.

# DEFINITIONS

(The following definitions are provided as being applicable to the content of this document.)

**Constraint:** an external requirement that shall be met by a specification.

**EU-Regulation:** a legal specification and therefore a constraint (e. g. TSI).

**European Standard:** a standard adopted by a European Standardisation Body and made available to the public.

**European Standardisation Organisation:** Incumbent organisation holding the monopoly to publish relevant standards based on intergovernmental agreements.

**International Railway Solutions (IRS) ©:** a structured framework of documents prepared and published by the UIC for use within the railway sector. They blend together a range of voluntary solutions to support the design, construction, operation and maintenance of the railway system and the services that the sector provides.



**Operating principles:** within the railway context, operating principles are the conceptual processes that enable trains to move safely and efficiently. The main area to which operating principles apply is to the control, command and communications sub-systems and the interfaces thereto, rolling stock, infrastructure and energy. Operational principles themselves lead to the development of the operational rules to guide the safe operation of the interfacing sub-systems as well as key services like telematics and maintenance.

**Railway Operating Community (ROC):** a generic term used to describe those European RUs and IMs that are members of the UIC, CER or EIM.

**Requirement:** a single documented physical and/ or functional business need that a particular design of a product or process shall be able to perform.

It applies within defined scope and constraints. In short: "What you want" Requirements:

- have an owner,
- have to be managed (by the owner),
- document a need (independent of the owner),
- request a solution.

(See Fig.2 opposite.)

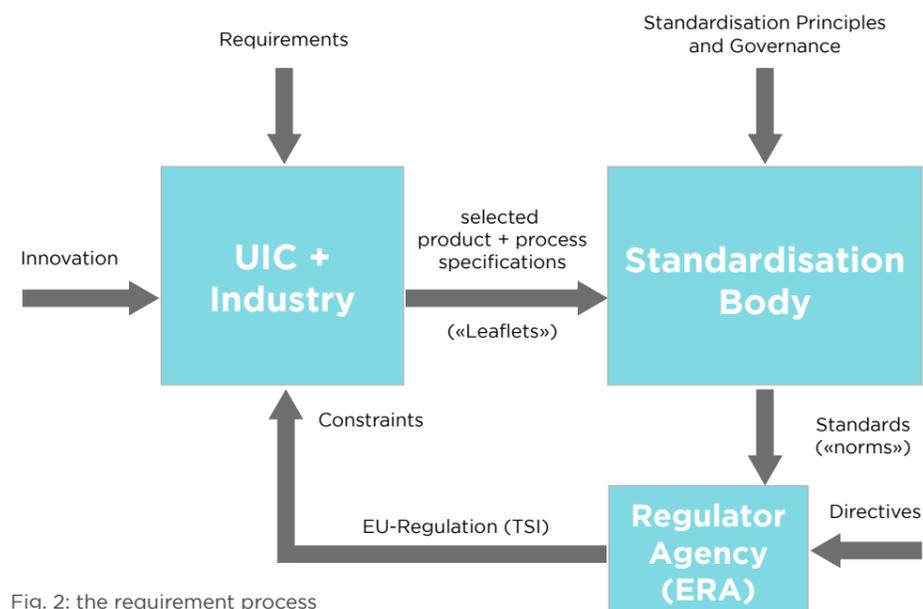


Fig. 2: the requirement process

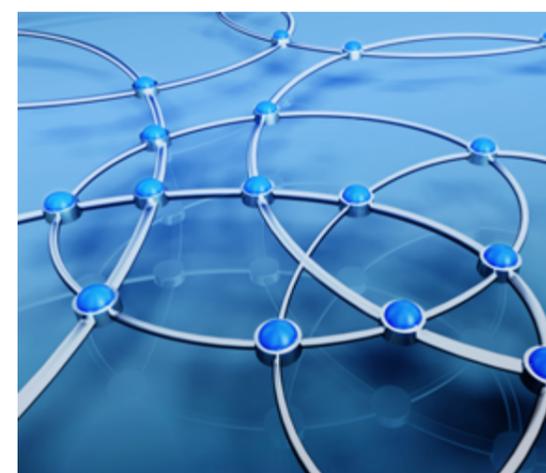
**Shared Network:** interoperable infrastructure where there is a mix of various train and traffic types operating together. The shared network manages to integrate this variety of traffic in terms of technology in operation to the optimum levels of safety and efficiency.

NOTE: as an example of good practice of standardising within the shared network, the Railway Group Standards published by RSSB in the UK is a very good one.

**Standard:** a specification that is formalised and agreed by a wider community of stakeholders according to a governance process that applies the standardisation principles.

**Standardisation principles:** transparency, openness, impartiality, consensus, maintenance, availability, quality, stability, effectiveness, independence from particular interests, market relevance, coherence.

**System Rail:** when speaking about "the railway business", there are two distinct high level components that can be identified. "System Rail" is that part that is spread over the entire European continent and beyond and has been connecting national railway systems together for in excess of 100 years. System Rail provides the "operational foundation" that is the basis for the individual business activities of IMs and RUs - including issues such as access for trains to the rail infrastructure.



### Types of Standardisation Bodies:

- **Officially Appointed Standardisation Bodies (OASB):** for the purposes of this document this definition is used as a generic term for those organisations at National (NSBs – AFNOR, DIN, BSI...), European (ESOs – CEN, CENELEC, ETSI) and -/or International (ISOs – ISO, IEC, ITU) levels that are producing Norms and/or Standards under an institutional mandate.
- **Standards Setting Organisation (SSO):** is any organisation whose primary activities are developing, coordinating, promulgating, revising, amending, reissuing, interpreting, or otherwise elaborating professional technical system standards that are intended to address the needs of a constituent body of users.
- Most standards are voluntary in the sense that they are offered for adoption by people or a sector without being mandated in law. Some standards become mandatory when they are adopted by regulators as legal requirements in particular domains.
- **Standards Development Organisation (SDO):** whereas, the term National Standards Body (NSB) generally refers to the one-per-country standardisation organisation that is that country's member of the ISO, the term Standards Development Organisation (SDO) generally refers to the thousands of industry- or sector-based standards organisations that elaborate and publish standards that are specific to that standard or business sector.
- Some economies feature only an NSB with no other SDOs. Large economies like the United States, Japan and Europe have several hundred SDOs. In some cases, international industry-based SDOs such as the Institute of Electrical and Electronics Engineers (IEEE) and the Audio Engineering Society (AES) may have direct liaisons with international standards organisations, having input to international standards without going through a national standards body. SDOs are differentiated from standards setting organisations (SSOs) in that SDOs may be accredited to develop standards using open and transparent processes.



# 1. RAILWAY STANDARDISATION TODAY

There is a wide range of standards applicable to the design, construction, operation and maintenance of the railway system in use today. These have differing levels of scope of application and relationship to the EU legal framework.

Equally there are a number of players engaged in the creation of standards with varying degrees of not only business relevance to the design, construction, operation and maintenance of the railway system but also

varying degrees of applicability to the 21<sup>st</sup> century rail system.

This section of the RSSE highlights a number of challenges related to standardisation in general and the complexity of the present framework.

As an introduction however, it is helpful to briefly recall the background within which and to what extent standards are used within the railway system.

## 1.1 “SYSTEM RAIL”

From a technical point of view, System Rail consists of **several functional and structural subsystems** and their components which need to work together in a reliable manner (*the RTSE, has more detail about the technical system and the objectives for its future development*).

In the domain of railway operations, a whole range of operators, offering different types of product to the end-user, train types and

operational processes, perform on the shared networks. They all need to be able to efficiently interface with each other.

**Safety is therefore a paramount prerequisite and a systemic approach is essential at all times when dealing with “System Rail”.** It is well constructed business-led standards that are able to provide the framework for ensuring the efficiency levels of the operational railway system.



## 1.2 TYPES OF STANDARDS IN USE IN THE RAILWAY SECTOR, THEIR RELATIONSHIP WITH THE LEGISLATIVE FRAMEWORK

Liberalisation of the railway sector introduced the principle of an interoperable trans-European rail system. Starting with the high level directives (the “why” this is being done), the legislative framework moves to a specific set of EU documents (the TSIs) which describe the “what” needs to be done and that support the directives. These are then followed by the standards that set out to describe “how” to design the railway system in order to enable the implementation of the TSIs and to steer the transformation process as depicted in the Fig.3 below.

Contrary to the earlier TSIs, today’s “New Approach TSIs” limit their essential requirements to those ‘whats’ that must as a minimum be in place for system interoperability within the EU. These regulations are now published and

the need going forward is for their implementation into the operational rail system.

Standards provide voluntary detailed requirements and related assessment criteria for how compliance with mandatory requirements of the TSIs can be achieved. Standards also set out a range of options which will guide the end user in implementing the TSIs and in developing business opportunities.

The main responsibility of the ROC is to find solutions for the technical functions and interfaces that enable harmonisation of the operational and maintenance principles that are the catalyst to a cost-effective, safe railway system. Put another way, product standardisation follows process standardisation.

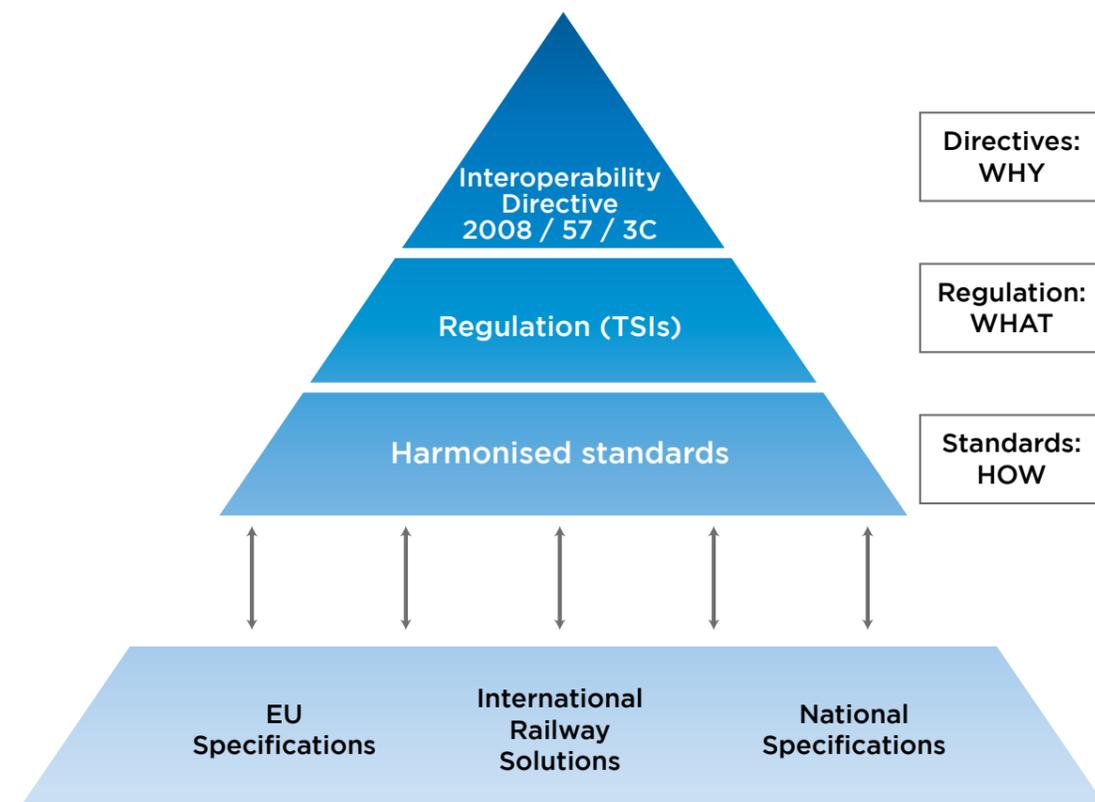


Fig. 3: the standardisation hierarchy

Basically, two types of railway standards exist (see Fig.4):

### 1. Process-related standards

Process-related standards are **general application principles that can be used by a wide range of stakeholders for the daily operation of the railway system**, harmonising the related provisions (procurement, operation, maintenance, etc) of the companies concerned.

**These contain functional and system requirements** including key safety and quality criteria and assessment methods **for a specific process or processes**.

As an example, the requirements for **braking performance** are contained in a process-related standard that is sourced from the principles of operating and maintaining the railway system. When all the product components of the braking system (regenerative, brake blocks, brake discs, etc) come together, they are required to work in perfect harmony ensuring that the train can be properly controlled and stopped in the right place.

### 2. Product-related standards

These **product-related standards** enable a basic common **harmonisation of the technical equipment** necessary for the operational principles of system rail.

**They contain functional and system requirements** including key safety and quality criteria and assessment methods **for specific technical components** and are particularly useful during the procurement process.

An example of such a standard would apply to **brake blocks or discs** - it defines the necessary characteristics of such a component (like shape, size or material mix) that guarantee its individual functioning essential to the safe and efficient operation of System Rail.

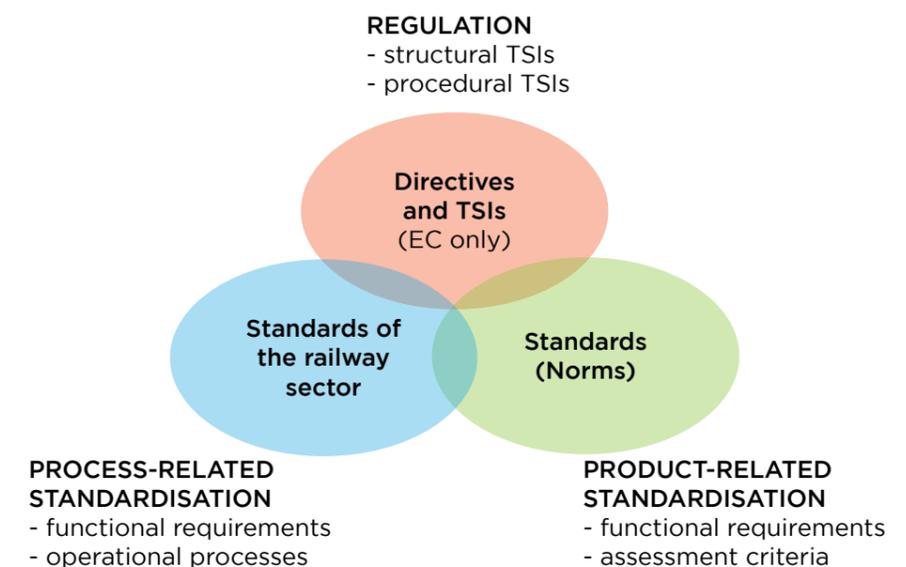


Fig. 4: Interaction between regulation and standardisation

### 1.3 ORGANISATIONS RELATED WITH STANDARDISATION AND TSIS

The European field of standardisation has many participants. There are today prominent roles for ERA, the EC-mandated standardisation bodies and the UIC:

#### 1.3.1 European Union Agency for Railways (ERA – the “Agency”)

The principle role of the ERA is to act as an enabling agency to assist the EU and the Members States in implementing the Directives for safety and interoperability of the EU railway system.

The Agency’s major publications are the Technical Specifications for Interoperability (TSIs) which can be found on their website and are free to use for anyone who wishes to download them. The development of TSIs follows certain key principles – which should be the benchmark for the elaboration of standards:

- Unique identification of business needs at requirement level: Identification of single requirement.
- Justification of any requirement: Trace back any requirement to an objective or a business need (e. g. in the TSI each requirement is justified by meeting at least one essential requirement of a directive).
- Any requirements shall be assessable by independent parties: Provide pass-fail criteria for each requirement.

The Agency’s involvement in standardisation is to ensure that standards are requested through the formal channels where a TSI:

- refers to the need for the creation of a standard to complement the specifications in the TSI or
- to support the application of a TSI by voluntary standards providing design solutions proven to be compliant with this TSI.

#### 1.3.2 The European Standardisation Organisations (ESO)

CEN, CENELEC and ETSI are bodies that draw their membership from the National Standardisation Bodies as well as under contract to the European Commission. Depending on the details of the specific arrangement, they prepare, publish and market “Euro Norms” (ENs) in a very wide ranging number of sectors.

ENs within the rail sector are often prepared in order to support specifications in the TSIs and are frequently used as part of the conformity process to those TSIs. ESOs are more and more challenged by creation of free trade areas that naturally request the mutual recognition of standards fitting a common legal framework.

#### 1.3.3 UIC

The UIC is considered as a Standards Setting Organisation (SSO) which fits very well with the role that the UIC performs for the Railway Operating Community.

The major publications that the UIC produces are International Railway Solutions (IRS)© (formerly known as UIC leaflets). The UIC has more experience in publishing these kinds of documents than almost any other organisation in this domain. It prepares and publishes IRS that are collaboratively and consensually agreed. They are produced in accordance with the business needs of the ROC and provide harmonised operational requirements, generic methodologies and assessment criteria for the efficient design, construction, operation and maintenance of System Rail.

IRS are freely available to members of the UIC and are able to be obtained via the UIC website by any and all stakeholders involved in the rail sector and in any other sector.

The UIC is not an International or European OASB nor does it have pretensions of so-becoming. However, it has always been and will continue to be the UIC’s objective to work closely with all these bodies and others that have and will have an impact on the development of the business of railway transportation. This interaction can be seen in Fig.5.

#### 1.3.4 Others

There are standards organisations that are specifically developing standards in individual Member-States for application within the legal framework of that country. These can be national standardisation bodies such as DIN, AFNOR, BSI... or specialist bodies such as DIN FSF, BNF, RSSB and so on.

Also there are interest groups, starting from initially limited consensus among a few stakeholders on a dedicated subject, publishing specifications that could in effect be the starting point for an entire sector stream of standardisation. Examples: EuroSpec, EU-Lynx, White Book on Freight Wagons, ...

There are also bodies such as ISO and IEC which publish standards that are applicable on a global basis, some of which are applicable to the rail community. A Rail programming body : System Forum Rail named JPC-R aims at defining a standardization prospective and program.

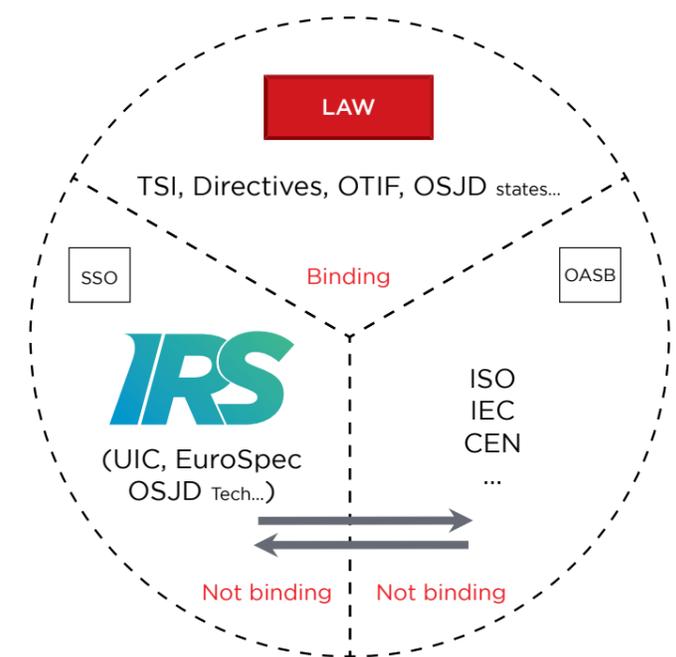


Fig. 5: IRS and other standards types

### 1.4 WEAKNESSES OF THE CURRENT STANDARDISATION SYSTEM AND PROCESSES

There are a number of areas in the current standardisation framework that require improvement.

1. The first deficiency of the current standardisation process is that standardisation is often considered as a universal remedy. It is often the case that quantity overcomes quality.

But this can be effectively remedied through the design of a lean business-driven standardisation framework.

Before starting to draft new standards, there needs to be an identification by the railway sector of which operational processes and products are NOT required to be standardised. Then producing new standards at a European-level has to result in withdrawal of existing (national) technical rules.

There are too many standards elaborated for the rail sector that are sector-specific. This impedes significant joint economies of scale which would improve if greater use of well-proven standards of other

sectors such as aeronautics and automotive was made.

- There are **too many organisations** addressing the same processes and technology. There is also **not enough care taken** that the standards and rules they are elaborating **are coherent with the rest of the railway system**.

There is not enough attention given to the **financial impact** the standard may have or that there is even a **business need**. The number of organisations is one reason why there is too great a number of railway standards.

- It is **too often the case that standards are built in silos** or on the basis of national rather than rail business need and there is therefore a propensity for duplication or contradictory and at times irrelevant content. This can raise a number of **safety concerns as a result of the ambiguity** of the requirements in such standards.

This can also lead to the **failure of certain**

**standards to be fit for 3<sup>rd</sup> party assessment**. If there is ambiguity, it is clear that there will also be **uncertainty regarding precise pass-fail-criteria** per requirement that is then able to be applied by Notified Bodies.

- The intensive standardisation **effort of the sector** is currently expended on multiple and disjointed, i.e. fragmented, often very narrowly-scoped individual processes and products (see example in clause 1.2). This **leads to a multiplicity of standards 'focused' on specific detail and detracts greatly from a focus on standardisation of and across the railway system as an integrated whole**.

Standards developed for narrowly-scoped functions ultimately lead further to proprietary solutions and the implementation of specialised, generally more expensive, ad-hoc hardware or software. This has a negative effect on technical compatibility and interoperability.

Fig.6 pictorially represents the situation today which shows at positions 1 & 2 the sources for the generation of standards and that the sector voluntary standards processes (at position 3) are outside of the main standardisation framework.

- Standards need to be prepared and published so that they are responding to the business needs of the sector. **In many cases today there is no economic assessment and no impact analysis performed before publication of standards**.
- The previously mentioned **New Approach TSIs place an entirely different emphasis on the scope and the role of standards**. As shown above, there is no lack of standardisation as such but the **standards of today struggle to meet this new role and scope**. They generally **fail to provide the substance to be user-friendly enough**.
- Bringing the standards together to form a cohesive set of user-friendly business-centric solutions** to the design, construction, operation and maintenance of the railway system **requires a consistently-applied professional working method**. This is largely missing today and there is a **lack of centralised databases and IT-support for guiding** the elaboration of

standards. Part of a consistent approach to standards involves the use of an equally consistent set of terminology. **The absence of a single reference terminology database for the railway sector** that ensures that the same vocabulary is used in **both regulatory and standardisation** as well as among all various technical areas, poses a real **quality issue**. As an example there are understood to be more than 50 different definitions for "safety" due to uncoordinated elaboration of various standards.

**All this demonstrates the urgent need for action**. Especially the need for professional management of standards requirements, transparency, accessibility to shared information and, last but not least, a strong focus on the business needs and the expectations of the end-user, the customer.

There is a risk to this process and that is the propensity for the European instances to legislate the railway sector for a whole range of issues. A strong well-structured standards framework with business-focussed outputs that are developed in conjunction with the EC and others would ensure that there is less need for such legislation.

It is the sector stakeholders and the ROC in particular that have the overall system view, a sound understanding of the operational principles of the rail system, the business developmental priorities and the all-important perception of the needs of the end-user – the customer.

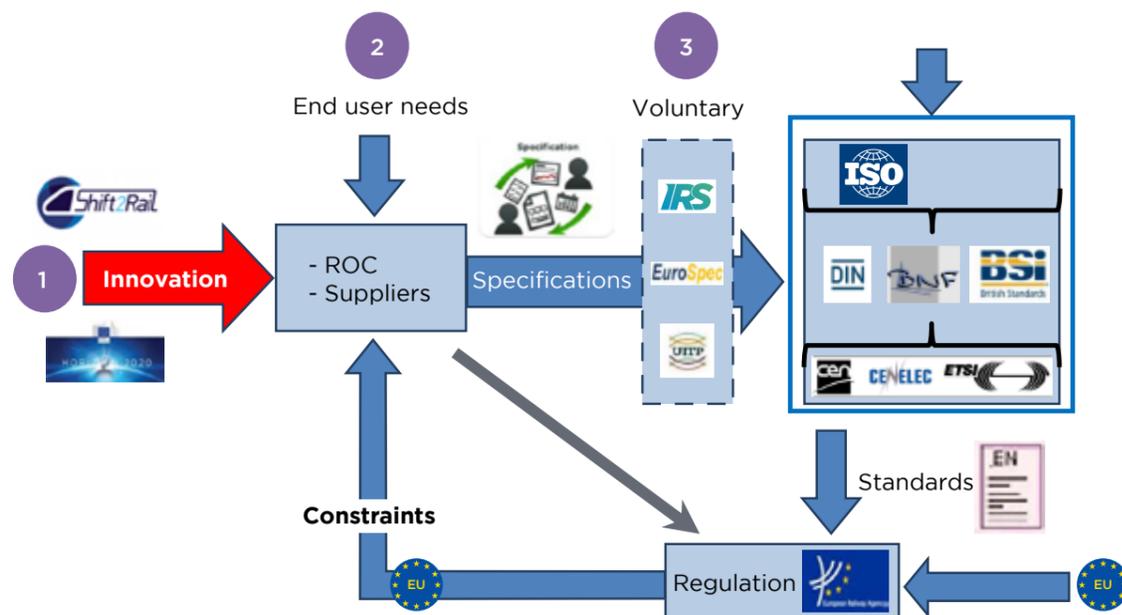
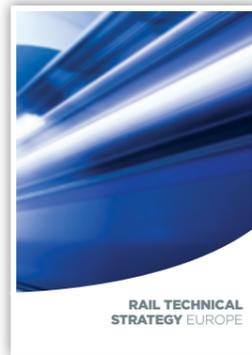


Fig. 6: the process today

## 2. MOVING FORWARD – WHAT IS NEEDED

### 2.1 IDENTIFYING THE BUSINESS NEEDS



The 2014 RTSE formulates technical objectives needed to enable the achievement of the future European railway system.

The related enablers are focused on the need for cost-effective system solutions that are “plug and play”, bring high reliability and have low maintenance requirements. Some of them, such as those linked to the customer experience and digitalisation of the system require the elaboration of (interface) standards. These are generally regarded as a solid tool not only for quick and efficient assessment but also for technical compatibility and for making available the deliverables of innovation once they are widely agreed.

These solutions will facilitate the design, construction, installation, operation and maintenance of a safe and efficient future European rail system and the services offered to the customer.

This RSSE, in support of the ROC's objective of providing itself with the means for enabling the RTSE effectively, sets out a redesigned standardisation process. This has the objective of guaranteeing the interoperability, integrity and efficiency of the rail system as a whole both as a technical infrastructure and as a market-driven, self-sustained business environment, while complying with stringent safety and passenger rights regulations.

The elaboration process of solutions for the railway of tomorrow must be **focused on the business needs of the future European railway system** and access to a broader base

of mass production suppliers of standard technology. Ultimately this shall lead to a sustainably efficient cost-effective railway system that is attractive to the end-user whilst maintaining a sustained high level of safety performance and green credentials.

The redesigned standardisation process that this document outlines, **shall promote the largest possible injection of business-focussed innovation from the widest possible range of the rail and other sectors, the supply industry and actors engaged in research and innovation.** Working with the future European railway system in mind, all these stakeholders are feeding competing product and procedural specifications to a selection and standardisation process. In this process the specifications are evaluated according to their effective technical and business contribution to the benefit of the rail system as a whole.

**Selected specifications or parts thereof are finally published as voluntary IRS.**

The Fig.7 builds on the earlier one and pictorially sets out the target as described in this document. The inputs remain largely the same. But the sector standardisation processes and products (position 3) are now fully integrated as being part of the main standardisation framework.



Target:

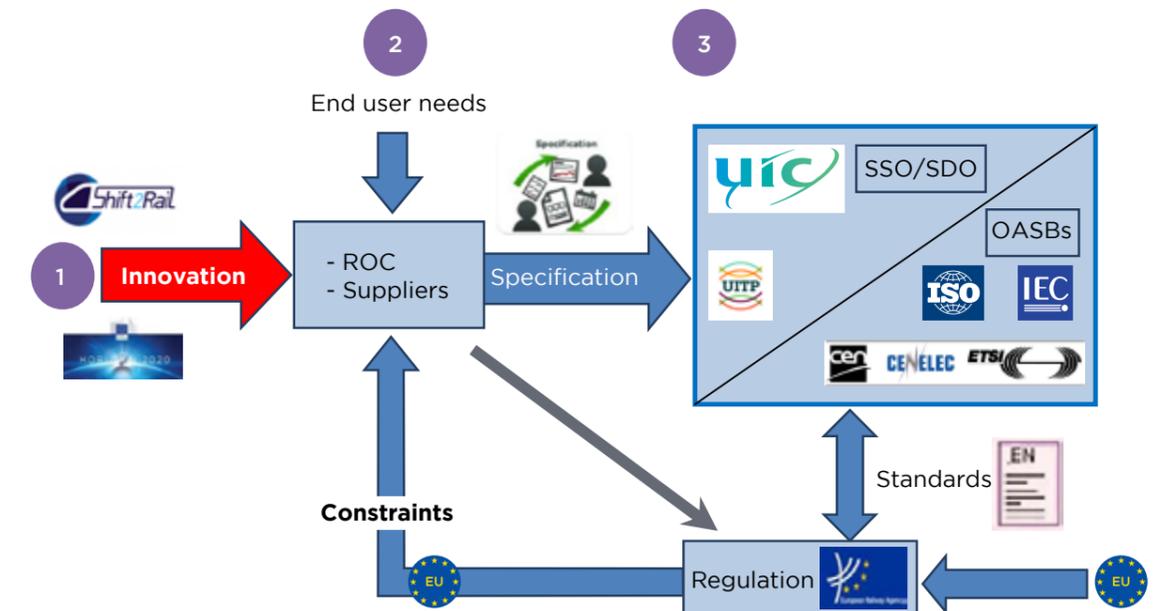


Fig. 7: the process tomorrow

### 2.2 REDESIGNING THE STANDARDISATION FRAMEWORK – DELIVERING THE OPPORTUNITY

The principle advantage of opening the field of railway standardisation to input from other sectors is economies of scale plus new innovation impulses. Considering the current general economic situation of the Railway Operating Community, both would be highly needed.

A revised standards elaboration and publication framework shall be based around identified business needs that will support the development of the future European railway system.

Taking the RTSE as the inspirational foundation, it is now the opportunity to change current standards elaboration in the following way:

1. The target of the railway sector is not all-encompassing standardisation. The business added-value of a particular standard must be assessed before starting the elaboration of a new standard.

2. There shall be a significant reduction in the number of national technical rules/-standards.

3. Substitution of railway-specific solutions – where appropriate – by well-proven standards from other sectors such as aviation, aeronautics and automotive. Railway-specific requirements could be codified in an annex to these non-railway standards.

4. Accept the method by which TSIs are developed as the key principle to future development of standards.

5. Those standards that are deemed essential to the efficient development of the future European railway system should be provided, free of charge, downloadable from a recognised and well-coordinated web portal.

## 3. PLANNING TO DELIVER

### 3.1 THE CHALLENGE

Having the ideas and setting them out in a document such as this one is in many ways the easy part. The complex issue is turning those ideas into sustainable actions that will be of benefit to the whole sector.

The dynamic and successful railway sector that this strategy supports will be one that works holistically and innovates to evolve its share of the transport market. It can only really effectively achieve that if the solutions-developing process can be used to accelerate the injection of innovation from any pertinent source in support of enabling the ROC's RTSE.

The railway sector needs to increase its ability to compete, to remain current and to retain and attract new end-users and can only do this by enabling and developing the objectives set out in the RTSE in pursuit of the *Challenge 2050* vision.

This can be achieved with the aid of the re-designed standardisation process set out in this document; a process that widens the opportunity for standards and innovation from other sectors.

At the same time however, the ROC, with its responsibility for the operation and maintenance of the railway system as a whole, must contribute to the development of these specifications into standards in accordance with the objectives of the RTSE. It is through this approach that rail will be able to better contribute to wider social and economic goals within the European community that it serves.

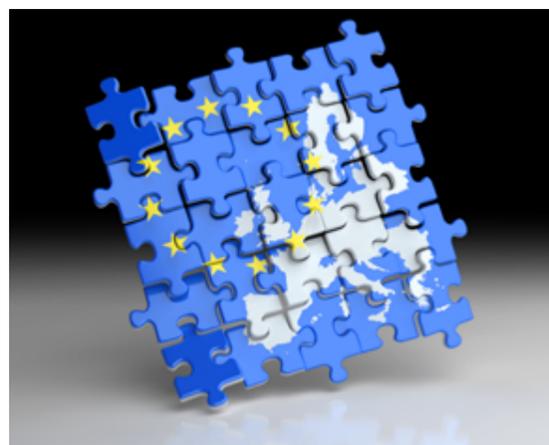
Any strategy that is created in a sector that is as diverse as the railway sector and which involves so many different stakeholders with widely varying business interests, relies not only on technological innovation but also on a culture of developing its capabilities, being receptive to new ways of delivering custom-

er service, and willing to challenge barriers.

To maximise benefits, the ROC is prepared to develop and implement the structure set out in this strategy and is planning to set itself the challenging target of having it developed and operational within 2 years of the publication of this strategy. The ROC will therefore examine how best to facilitate change, including the establishment of advanced organisational and operational structures and systems.

Fundamental to delivering a solid and effective standardisation model, is the sector's ability and willingness to look outside its own boundaries at the types of good practice that exist in other sectors. The model adopted by IATA is one such example but there will be other domains such as information technology developers and other specialists from whom the rail sector can and must learn.

Learning from other sectors and other global regions through a strong international reputation for innovation will also act as a lever for the sector's contribution to the European export market in railway products, services and know-how.



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