

Andrzej Harassek

European Railway Agency and development of the TSIs for European High Speed Railway System

Due to historical reasons the European railway network is still a patchwork of the national systems that have been developed over the last nearly 200 years. These systems have been built to great extent independent and separate from each other. This resulted in a variety of technical, operational and organisational solutions applied in different countries, and sometimes even within one country. This diversity, although not very harmful for domestic services, constitutes a very serious barrier for the international rail traffic. This is particularly important in case of the high speed trains, where the traditional approach (change of locomotives and staff at the borders) cannot be applied.

The European Union has already long time ago recognised this problem, and launched the activities aimed at making a smooth and unhindered international rail traffic possible. A new concept of 'interoperability' was developed; this means not only conditions for exchange of the passenger carriages and freight wagons between the railway undertakings, but in broader sense, ability of uninterrupted movements of trains across the borders between different countries and different rail systems.

Interoperability of the European railway system

Interoperability of the European railway system is seen as a key factor, contributing to further development of the railway transport, and to increase its competitiveness vis-à-vis other modes of transport. Having this in mind, the Council of the European Union has adopted directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system [1]. Five years later the European Parliament and the Council have adopted directive 2001/16/EC of 19 March 2001 on the interoperability of the trans-European conventional rail system [2]. Both directives were later amended in 2004 [3] and 2007 [4]. In 2008 the high speed and conventional interoperability directives were replaced by the Directive 2008/57/EC of 17 June 2008 covering entire European rail system [5].

As interoperability depends, amongst others, on harmonisation of certain parameters of both vehicles and fixed installations, development of relevant specifications was necessary. These specifications have been named **technical specifications for interoperability** (TSI). The two interoperability directives constituted a basis for development and adoption of series of TSIs, covering both high speed and conventional trans-European rail systems.

In line with 'new approach' procedures, the legal acts should be limited to mandatory so-called 'essential requirements'. The specificity of the railway system requires, however, that certain technical parameters are also defined in order to ensure interoperability. The overall legal framework for interoperability is shown on figure 1.

Let us have a look on what are the TSIs, what is their purpose, and how should they be used?

The TSIs are legal documents, being issued by the European Commission, earlier by means of Commission Decisions, and

more recently as Commission Regulations. The requirements of the TSI are applicable and mandatory for all the subsystems and components covered by the scope of the relevant TSI.

As already mentioned, the aim of TSIs is to contribute to the interoperability of the European railway system by defining and assuring 'an optimal level of technical harmonisation' (art. 1 of interoperability directive 2008/57/EC). It is wise to note here that an optimum level of technical harmonisation is not the same as full harmonisation; the TSI should not try to standardise everything, but only what is necessary to deliver the interoperability of the European railway system. The parameters that need to be harmonised, include first of all those relating to the compatibility of the vehicles with the railway lines. Apart from the parameters that manage interfaces between the subsystems, certain parameters may also be specified in order to ensure mutual acceptance between Member States. This basically relates to rolling stock where such requirements are necessary to establish a 'level playing field' in the market, or to prevent Member States imposing additional requirements that could form a barrier to the free movement of TSI-compliant rolling stock from one Member State to another.

TSI is a set of mandatory, generally functional requirements aimed at ensuring the interoperability of the rail system, meeting at the same time the essential requirements as listed in annex III of the directive 2008/57/EC. Having this in mind, it is important to remember that TSI is not a design handbook. A railway asset cannot be designed using only the TSI as a basis. Apart from TSIs, the designers and builders of the railway subsystems must take into account requirements coming from other legal acts. These acts include railway-specific national technical rules (NTR) that are still applicable due to historical reasons (e.g. those related to 'specific cases' – see below). Those rules need to be notified to the Commission. Apart from that, there are other, general rules that are also applicable to the railways, like environmental protection rules, electromagnetic compatibility, sanitary requirements, and so on and so forth. And of course, the design of the new

Legal framework for interoperability (based on the „new approach” procedures)



Fig. 1. Overall legal framework for interoperability (ERA)

subsystem must meet the needs and expectations of the customer, normally expressed in the user's functional and technical specification. For obvious reasons, the latter are not covered by any legal documents. Figure 2 sets out the roles and positions of different documents, applicable to the railway system.

Another important issue that needs to be remembered is that the TSIs apply to all new, upgraded and renewed railway subsystems (within the scope of the TSIs), but normally not to the systems already in operation. However when the existing subsystem is undergoing renewal or upgrade, the TSIs must be applied according to the specific provisions of the interoperability directive and relevant TSI.

The TSIs may be divided into two types: functional and structural. The functional TSIs cover functional subsystems, as defined in annex II of the interoperability directive 2008/57/EC: traffic operation and management, and telematics applications for passenger and freight services. The structural TSIs cover infrastructure, energy, and rolling stock subsystems. Some TSIs, like those concerning persons with reduced mobility, safety in railway tunnels, and control-command and signalling, contain not only technical, but also certain organisational and operational requirements. Therefore those TSIs are considered as 'common', belonging to both, 'functional', and 'structural' type.

Structure of technical specification for interoperability (TSI)

The TSIs have a unified structure: each TSI consists of 7 chapters. In an introductory **chapter 1**, brief explanation of the scope and content of the TSI is given. **Chapter 2** defines the subsystem concerned by the TSI and explains more in details the geographical and technical scope of the document. Description of the relevant essential requirements and of the way how they are addressed, is given in **chapter 3**.

Chapter 4 presents characterisation of the subsystem, covered by the TSI. This is the main part of the TSI, where all the mandatory requirements for the subsystem covered are specified by means of the description of 'basic parameters' that have to be met by the subsystem. The interoperability constituents (IC) are described in **chapter 5** of the TSI. An Interoperability constituent is *any elementary component, group of components, subassembly or complete assembly of equipment incorporated or intended to be incorporated into a subsystem, upon which the interoperability of the rail system depends directly or indirectly. The concept of a 'constituent' covers both tangible objects and intangible objects such as software* [5, Art. 2(f)]. The aim of ICs, as described in this section, is to simplify the assessment process in cases where the same component may be used in several projects. This, however, does not mean that the certified ICs need always to be interchangeable. It should be noted that once the component is identified as an interoperability constituent in the TSI, only certified ICs may be used within the scope of the TSI (the exceptions, if any, need to be clearly mentioned in the TSI). The ICs should normally be described by reference to the relevant basic parameters as described in the chapter 4. The description of an IC should be strictly limited to the requirements related to interoperability, relevant for the concerned component.

Chapter 6 deals with the conformity assessment, both of the interoperability constituents, and the subsystem. In the last **chapter 7**, implementation of the TSI is described. This includes, the way in which the TSI would be applied to the new subsystems, as well as for the existing ones, being subject to renewal or upgrading, and transition periods where necessary. The description of

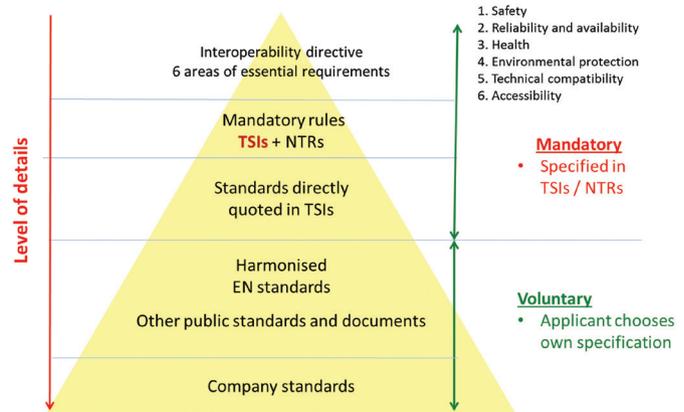


Fig. 2. Mandatory and voluntary specifications in the legal framework for interoperability (ERA)

the 'specific cases' constitutes an important part of chapter 7. A 'specific case' is a specific provision for a part of the railway system (usually one or more Member State) due to geographical, topographical or urban environment constraints, or to maintain compatibility with the existing system. The specific case allows certain requirement not to be applied, or defines another value of parameter than specified in chapter 4 of the TSI, within the given area (MS). The requirements related to specific cases may, preferably, be described in the TSI, or may refer to the national technical rules that need to be notified for this purpose.

The TSIs often refer to the European standards (ENs), both in relation to the parameters and requirements, and to the methods of conformity assessment. In such a case, the referenced standard or its part becomes a part of the TSI, thus becomes mandatory. Otherwise use of the standards is voluntary and remains up to the decision of the investor, designer or manufacturer.

The first set of TSIs for high speed rail system was developed in 2002, around the time of adoption of the first interoperability directives. These TSIs were developed by an organisation created especially for this purpose; the European Association for Railway Interoperability, commonly known under French name *Association Européenne pour l'Interopérabilité Ferroviaire* (AEIF). The first TSIs related to infrastructure (HS INF), energy (HS ENE), rolling stock (HS RST), control-command and signalling (HS CCS), and traffic operation and management (HS OPE) subsystems of the trans-European high speed railway system.

Although not directly linked with the high speed system, it is worth to mention that in 2006 the first TSI related to conventional rail freight wagons (CR WAG) was adopted. In the same year the TSIs concerning the telematics applications for freight (TAF), traffic operation and management (CR OPE) and control-command and signalling (CR CCS) for the trans-European conventional rail system, as well as TSI concerning rolling stock – noise (NOI) have been published. Two years later, in 2008, all the TSIs related to high speed system have been revised, and two new TSI, relating to safety in railway tunnels (SRT) and people with reduced mobility (PRM) have been issued.

One of the key facts in development of the single European railway system was adoption of the so-called second railway package of 2004. Within the package, the European Parliament and the Council adopted the Regulation (EC) No 881/2004 of 29 April 2004 [6], establishing a European Railway Agency; the regulation was later amended in 2008 [7]. The main objective of the Agency is to *contribute, on technical matters, to the implementation of*

Tab. 1. TSI that apply to the European railway system from 1 January 2015

Specification name	Legal act	Amendments
TAP	Commission Regulation (EU) No 454/2011 of 5 May 2011 on the technical specification for interoperability relating to the subsystem 'telematics applications for passenger services' of the trans-European rail system. OJ L 123, 12.5.2011	1. Commission Regulation (EU) No 665/2012 of 20 July 2012 amending Regulation (EU) No 454/2011 on the technical specification for interoperability relating to the subsystem 'telematics applications for passenger services' of the trans-European rail system. OJ L 194, 21.7.2012 2. Commission Regulation (EU) No 1273/2013 of 6 December 2013 amending Regulation (EU) No 454/2011 on the technical specification for interoperability relating to the subsystem 'telematics applications for passenger services' of the trans-European rail system. OJ L 328, 7.12.2013
CCS	Commission Decision 2012/88/EU of 25 January 2012 on the technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system. OJ L 51, 23.2.2012	Commission Decision (EU) 2015/14 of 5 January 2015 amending Decision 2012/88/EU on the technical specification for interoperability relating to the control-command and signalling subsystems of the trans-European rail system. OJ L 3, 7.1.2015
OPE	Commission Decision 2012/757/EU of 14 November 2012 concerning the technical specification for interoperability relating to the 'operation and traffic management' subsystem of the rail system in the European Union and amending Decision 2007/756/EC. OJ L 345, 15.12.2012	
WAG	Commission Regulation (EU) No 321/2013 of 13 March 2013 concerning the technical specification for interoperability relating to the subsystem 'rolling stock — freight wagons' of the rail system in the European Union and repealing Decision 2006/861/EC. OJ L 104, 12.4.2013	Commission Regulation (EU) No 1236/2013 of 2 December 2013 concerning the technical specification for interoperability relating to the subsystem 'rolling stock — freight wagons' of the rail system in the European Union and amending Regulation (EU) No 321/2013. OJ L 322, 3.12.2013. Commission Regulation (EU) 2015/924 of 8 June 2015 amending Regulation (EU) No 321/2013 concerning the technical specification for interoperability relating to the 'rolling stock — freight wagons' subsystem of the rail system in the European Union. OJ L 150, 17.6.2015
INF	Commission Regulation (EU) No 1299/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'infrastructure' subsystem of the rail system in the European Union – enters into force on the twentieth day following that of its publication in the OJ, applies from 1 January 2015. OJ L 356, 12.12.2014	
ENE	Commission Regulation (EU) No 1301/2014 of 18 November 2014 on the technical specifications for interoperability relating to the 'energy' subsystem of the rail system in the Union. OJ L 356, 12.12.2014	
LOC&PAS	Commission Regulation (EU) No 1302/2014 of 18 November 2014 concerning a technical specification for interoperability relating to the 'rolling stock – locomotives and passenger rolling stock' subsystem of the rail system in the European Union. OJ L 356, 12.12.2014	
SRT	Commission Regulation (EU) No 1303/2014 of 18 November 2014 concerning the technical specification for interoperability relating to 'safety in railway tunnels' of the rail system of the European Union. OJ L 356, 12.12.2014	
PRM	Commission Regulation (EU) No 1300/2014 of 18 November 2014 on the technical specifications for interoperability relating to accessibility of the Union's rail system for persons with disabilities and persons with reduced mobility. OJ L 356, 12.12.2014	
NOI	Commission Regulation (EU) No 1304/2014 of 26 November 2014 on the technical specification for interoperability relating to the subsystem 'rolling stock — noise' amending Decision 2008/232/EC and repealing Decision 2011/229/EU. OJ L 356, 12.12.2014	
TAF	Commission Regulation (EU) No 1305/2014 of 11 December 2014 on the technical specification for interoperability relating to the telematics applications for freight subsystem of the rail system in the European Union and repealing the Regulation (EC) No 62/2006. OJ L 356, 12.12.2014	

the Community legislation aimed at improving the competitive position of the railway sector by enhancing the level of interoperability of railway systems and at developing a common approach to safety on the European railway system, in order to contribute to creating a European railway area without frontiers and guaranteeing a high level of safety [6, Art. 1]. The Agency provides the technical expertise for the Commission in the field of railway interoperability and safety.

The main tasks of the Agency include drafting the legal acts that are later being adopted by the Commission in form of the Commission's decisions or regulations. Another important role of the Agency is to issue opinions and advices on request of the Commission and of the authorities concerned in the Member States, as provided for in the Agency Regulation. It should be underlined however that the European Railway Agency has no any decision making power. The legal acts, drafted by the Agency, constitute recommendations addressed to the Commission. Further

process, leading to the eventual adoption of these documents as official legal acts, remains in hands and under sole responsibility of the Commission.

The Agency commenced its activity from 1st January 2005, and since then it has gradually taken over the duties of AEIF, concerning further development of the technical specifications for interoperability. Although the revision of the high speed TSIs and drafting other TSIs adopted in 2008 was still in hands of AEIF, since 2005 further development of TSIs was one of the main tasks of the European Railway Agency.

The first significant milestone in development of the legal framework for interoperability was achieved by the Agency in 2011, when the set of TSIs related to the trans-European conventional rail system has been adopted by the European Commission. These specifications concerned the following conventional rail subsystems, not yet covered by the TSIs: energy (CR ENE), infrastructure (CR INF), and rolling stock – locomotives and pas-

senger vehicles (CR LOC&PAS). In addition, the TSIs related to operation and traffic management (CR OPE), and noise (CR NOI) have been revised, and a new TSI concerning telematics applications for passenger (TAP) services has been issued. All these TSIs, published in 2011, have been developed by the European Railway Agency in close cooperation and participation of the representatives from the stakeholders' organisations (so-called representative bodies – RBs) and national safety authorities (NSAs).

Technical specification for interoperability for the entire railway system

As already mentioned, in 2008 the European Parliament and the Council have adopted the new interoperability directive. The Directive of the European Parliament and of the Council 2008/57/EC of 17 June 2008 on the interoperability of the rail system within the Community has replaced the previous directives related to high speed and conventional trans-European railway systems and merged their provisions into one single directive. Moreover, the new directive extended its scope to the entire railway system (with some exceptions possible). One of the provisions of the new interoperability directive concerned future extension of the TSIs scope to the entire European railway system, as the earlier TSIs only covered the trans-European rail system, i.e. the lines within TEN-T network.

In 2010 the Agency has received a new mandate (Commission Decision of 29.4.2010) for extending the scope of TSIs, according to article 8(2) of the new interoperability directive 2008/57/EC. The mandate also provided for possible merge of the high speed and conventional rail TSIs into one common TSI for each subsystem (e.g. INF, ENE, CCS). Four years of hard work by the Agency's staff and experts from the representative bodies and national safety authorities resulted in publication by the end of 2014 of ten new TSIs with their scope extended to the entire European railway system. Where appropriate, the new TSIs merge provisions for the conventional and high speed system. In fact, with the new TSIs the notion of 'high speed' and 'conventional' rail is not applicable any more, and the specific requirements depend, where necessary, directly on the speed. It seems to be obvious that certain parameter need to be stricter for higher speed, but this does not depend any more on the classification to the 'high speed' or 'conventional' rail, but on the speed for which a given parameter is supposed to apply.

The TSIs applicable as of 1 January 2015 are listed below, and they are also shown in figure 3.

Hence the complete set of TSIs is now in force. But the work is not finished. Life is on-going, new technical solutions appear, new needs emerge, return of experience provides feedback about how the TSIs are being implemented and used in everyday activity of the railway undertakings, infrastructure managers, manufacturers and service providers, and also state authorities in charge of the national railway systems. The railway world is continuously changing, and the TSIs need to follow these changes. Therefore the Agency keeps an eye on this evolution and will review all the emerging needs and proposals having in mind the next revision and update of the specifications, when needed.

In order to make implementation and use of the TSIs easier, the Agency has developed a TSI Application Guide. The Guide consists of the general part, describing the overall principles and procedures, and the specific guides, each related to the specific TSI. The Readers are invited to visit the Agency's website www.era.europa.eu, where the Application Guide can be found, as well as many other useful information related to the TSIs and, more generally, to all activities of the European Railway Agency.

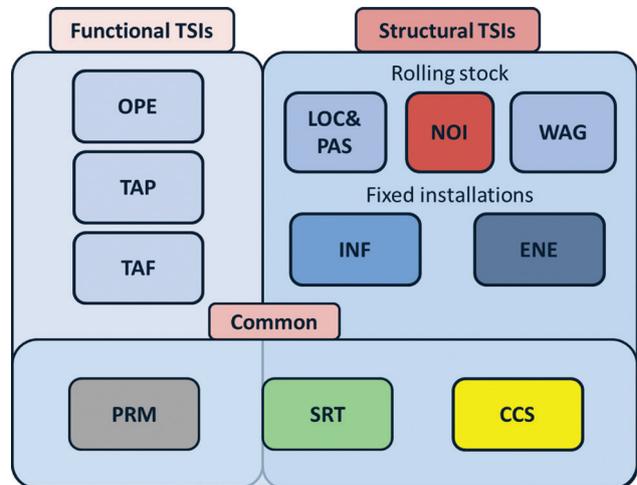


Fig. 3. The TSIs applicable as from 1 January 2015 (ERA)

References:

1. Council Directive 96/48/EC of 23 July 1996 on the interoperability of the trans-European high-speed rail system. OJ L 235, 17.9.1996.
2. Directive 2001/16/EC of the European Parliament and of the Council of 19 March 2001 on the interoperability of the trans-European conventional rail system. OJ L 110, 20.4.2001.
3. Directive 2004/50/EC of the European Parliament and of the Council of 29 April 2004 amending Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system. OJ L 220, 21.6.2004.
4. Commission Directive 2007/32/EC of 1 June 2007 amending Annex VI to Council Directive 96/48/EC on the interoperability of the trans-European high-speed rail system and Annex VI to Directive 2001/16/EC of the European Parliament and of the Council on the interoperability of the trans-European conventional rail system. OJ L 141, 2.6.2007.
5. Directive 2008/57/EC of the European Parliament and of the Council of 17 June 2008 on the interoperability of the rail system within the Community. OJ L 191, 18.7.2008.
6. Regulation (EC) No 881/2004 of the European Parliament and of the Council of 29 April 2004 establishing a European railway agency (Agency Regulation). OJ L 220, 21.6.2004.
7. Regulation (EC) No 1335/2008 of the European Parliament and of the Council of 16 December 2008 amending Regulation (EC) No 881/2004 establishing a European Railway Agency (Agency Regulation). OJ L 354, 31.12.2008.



Andrzej Harassek

Andrzej Harassek, since 2006 an Adviser in the Interoperability Unit of the European Railway Agency, and currently a head of Fixed Installation sector.

Andrzej Harassek was graduated in 1978 from Warsaw Technical University as an engineer in transport and traffic control. He has performed various positions in the Polish State Railways (PKP) signalling and telecommunication department, including the position of deputy head of the Signalling and Telecommunication Department in the PKP General Directorate. Among other duties, he worked on the international co-operation issues in the field of signalling and telecommunication, in particular in relation to the ERTMS/ETCS project. Since 2001, he took the position of head of the PHARE and ISPA Implementation Unit.