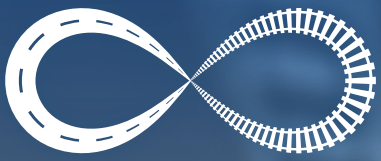

CETRA 2018

5th International Conference on Road and Rail Infrastructure
17–19 May 2018, Zadar, Croatia

Road and Rail Infrastructure V

Stjepan Lakušić – EDITOR

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ERTMS DEPLOYMENT PARADIGM WITH A SPECIAL REVIEW OF APPLIED EU DIRECTIVES

Božica Radoš
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Abstract

The European Railway Traffic Management System (ERTMS) aims at replacing the different national train control and command systems in Europe. ERTMS consist of ETCS, the European Train Control System (an automatic train protection system (ATP) aiming to replace the existing national ATP-systems) and GSM-R, a radio system for providing voice and data communication between the track and the train, based on standard GSM using frequencies specifically reserved for rail application with certain specific and advanced functions. When choosing an introduction strategy for ERTMS, a paradigm of quality long-term introduction and upgrading is introduced. Given the current state of the infrastructure, of the country's GDP and the possibility of EU funding, the question arises as to which technology and level of technology to choose? This paper will explain the correlation between EU directives and guidelines for their introduction, as well as the barriers that arise in view of the necessary infrastructure interventions. The deployment of ERTMS will enable the creation of an integrated European railway system and increase European railway's competitiveness. ERTMS concepts, operating rules, definition of the national values, migration, education and training, etc. seem to be underestimated by local authorities, which generally delegate full projects without feeling part of the solution. In some cases, operators and rail infrastructure managers are just unable to participate. Also, differences between the ERTMS standards and the local customer requirements can be problematic.

Keywords: ERTMS, ITS, deployment paradigm, EU Directives

1 Introduction

Intelligent Transport Systems (ITS) can significantly contribute to a cleaner, safer and more efficient transport system. ERTMS as a system i.e. solution is one of them. ITS can make transport safer, more efficient and more sustainable by applying various information and communication technologies to all modes of passenger and freight transport. Moreover, the integration of existing technologies can create new services. ITS systems are key to support jobs and growth in the transport sector. In order to be effective, the roll-out of ITS needs to be coherent and properly coordinated across the sector, covering the different modes and all the Regional Participants of the region. The cumulative impact of low utilisation rates of available infrastructure and low conversion efficiency and sub-optimal resources has resulted in uncompetitive transport costs (in many cases cross-subsidised by inadequate environmental protection) and transport interconnections that are insufficient to support the free flow of goods and people.

1.1 ERTMS

ERTMS ("European Rail Traffic Management System") is a major industrial project being implemented by Europe, a project which will serve to make rail transport safer and more competitive. Over the last years, ERTMS has become a trending topic when talking about European Railways. ERTMS stands for 'European Railway Traffic Management System', and is the Europe a standard for the Automatic Train Protection (ATP) that allows an interoperable railway system in Europe. As an ATP, ERTMS is a safety system that enforces compliance by the train with speed restrictions and signalling status. Due to its nature and the required functions, it is a system that has to be partly installed beside the track and partly installed on board trains. ETCS is the European Train Control System promoted by the European Commission for use throughout Europe and specified for compliance with the High Speed and Conventional Interoperability Directives. The system aims to remedy the lack of standardization in the area of signalling and train control systems which constitutes one of the major obstacles to the development of international rail traffic. Unifying the multiple signalling systems in use will bring increased competitiveness, better interworking of freight and passenger rail services, stimulate the European rail equipment market, reduce costs and improve the overall quality of rail transport. ETCS is in fact an automatic train Protection system, based on cab signalling and spot and/or continuous track to train data transmission. It ensures trains operate safely at all times in providing safe movement authority directly to the driver through the cab display and in continuously monitoring the driver's actions. The result of the work of the European Commission and involved telecommunication entities was the definition of GSM for Railways (GSM-R) as a digital radio platform for railway internal voice and data communication and providing bearer functionalities for the European Train Control System (ETCS) as the common standard control-command system (CCS), [1].
The integration of GSM-R and ETCS form a communication and signalling system, the European Railway Traffic Management System (ERTMS). The present GSM-R mobile network is the output of years of collaboration between several European railway companies, the railway industry and standardization bodies. The common objective is to achieve interoperability across Europe using a single communication platform. The current GSM-R standard incorporates key functionalities and experiences of the analog radio systems used previously across Europe. The GSM-R platform provides a secure platform for voice and data communication between operational staff and the railway company. The network supports advanced features such as point-to-point voice calls, group calls, location-based connections, priority calls and pre-emption in case of an emergency. I.e. these functionalities significantly improve communication, col-laboration, and security aspects across operational railway staff. As part of the ERTMS standard GSM-R carries the signalling information directly to the train on-board signalling unit, enabling higher train speeds and traffic density with a high level of safety.

2 Legislative framework

Legislative framework is defined by the 4th railway package: measures to improve Europe's railways, [2]. The technical pillar of the 4th Railway Package introduces important changes concerning ERTMS. It enhances the role of the European Union Agency for Railways (ERA) as the ERTMS system authority in order to maintain, monitor and manage the corresponding subsystem requirements, including the technical specifications for the European Train Control System (ETCS) and the Global System of Mobile Communications – Railway (GSM-R). It also transfers tasks that today are carried out by the National Safety Authorities to ERA regarding authorisation of rolling stock (including ERTMS on-board subsystems) and safety certificates for Railway Undertakings. Finally, a new process has been introduced by the 4th Railway Package concerning the pre-approval of the ERA of trackside implementations. The set of measures introduced by the 4th Railway Package will lead to enhanced interoperability and compatibility

between on-board and trackside subsystems. The 4th railway package aims to remove the remaining barriers to the creation of a single European rail area. This Package of legislation would reform the EU's rail sector by encouraging competition and innovation in domestic passenger markets. It would also implement structural and technical reforms. The end result should be higher levels of safety, interoperability and reliability in the European rail network. The package consists of 6 legislative proposals from the Commission.
The European rail network is currently quite fragmented. Member States use different safety standards and technical systems. Cross-border train services, for example, have to get safety authorisation from several different national authorities and deal with several different signalling systems. This makes it complicated and expensive for new rail operators and new technical equipment to enter the rail market. By removing the remaining barriers to the single European rail area, the 4th railway package will help create a more competitive rail sector, with better connections between the EU and its neighbouring countries. The changes would also help the EU meet targets for reduced emissions and encourage increased use of rail transport, as outlined in the Commission's 2011 Transport White Paper. Proposals under the 4th railway package had four main aims:

1) Standards and approvals that work: The changes aim to cut the administrative costs for rail companies and make it easier for new operators to enter the market. The European Railway Agency (ERA) would become the single place of issue for vehicle authorisations and safety certificates for operators.
2) A structure that delivers: The proposed changes would strengthen the role of infrastructure managers – the people responsible for running tracks – ensuring they have complete operational and financial independence from train operators. Infrastructure managers would also control all areas at the heart of the rail network, such as infrastructure planning, timetabling, and daily operations and maintenance.
3) Opening domestic passenger markets: The 4th railway package included the proposal to open up domestic passenger railways to new entrants and services from December 2019. Companies would be able either to offer competing services, such as a new train service on a particular route, or to bid for public service rail contracts through tendering. The proposed changes would make competitive tendering mandatory for public service rail contracts in the EU.
4) Maintaining a skilled rail workforce: The proposals recognise the importance of attracting skilled and motivated staff to the rail sector. In particular, the changes would allow Member States to better protect workers when public service contracts are transferred to new contractors.

The legislation to tackle these issues covers technical proposals, and governance and market opening proposals. The 4th Railway Package is a set of 6 legislative texts designed to complete the single market for Rail services (Single European Railway Area). Its overarching goal is to revitalise the rail sector and make it more competitive vis-à-vis other modes of transport. It comprises two 'pillars' which have been negotiated largely in parallel:

- The 'technical pillar', which was adopted by the European Parliament and the Council in April 2016, includes:
  - Regulation (EU) 2016/796 on the European Union Agency for Railways and repealing Regulation (EC) nº 881/2004
  - Directive (EU) 2016/797 on the interoperability of the rail system within the European Union (Recast of Directive 2008/57/EC)
  - Directive (EU) 2016/798 on railway safety (Recast of Directive 2004/49/EC)
- The 'market pillar', which was adopted in December 2016, includes:
  - Regulation (EU) 2016/2338 amending Regulation (EU) 1370/2007, which deals with the award of public service contracts for domestic passenger transport services by rail ('PSO Regulation')

- Directive 2016/2370/EU amending Directive 2012/34/EU, which deals with the opening of the market of domestic passenger transport services by rail and the governance of the railway infrastructure ('Governance Directive')
- Regulation (EU) 2016/2337 repealing Regulation (EEC) 1192/69 on the normalisation of the accounts of railway undertakings

2.1 Benefits for the railway sector

ERTMS can make the railway sector more competitive. One of the aims of ERTMS is to facilitate cross-border traffic by standardizing the signalling system under just one standard, and to also reduce the technical and operational complexity of trains and wagons/carriages, [3, 4]. The traditional drawbacks of international rail traffic e.g.: different gauge, different voltage, different signalling systems at each country…) makes traffic between European states more difficult. ERTMS is intended to facilitate cross-border traffic and interoperability, at least in signalling. Regarding the European supplier industry, ERTMS is a European open standard that has promoted the European industry worldwide due to the existence of ERTMS deployment both in Europe and on other continents.

2.2 Benefits for the Railway Undertakings

ERTMS is the harmonised European signalling system, i.e. its deployment will mean the removal of 'signal borders'. Railway projects will therefore be able to run everywhere on the European Network equipped with ERTMS with only one signalling system onboard, as opposed to the current situation where several ATP onboard systems are necessary. This would also impact driver training expenditure or time loss at borders due to formalities. As an example, to illustrate the advantages, passengers using the high-speed train between Paris and Brussels do not know that up to seven signalling systems need to be installed, there by generating additional costs and increasing the risks of breakdowns, delays, etc. ERTMS is intended to remove these problems, or simply the possibility of them occurring. An easier and quicker certification and approval process for onboard equipment, [5].

2.3 Benefits for society

In many cases, as far as safety is concerned, ERTMS can provide a higher safety level than the current ATP system. ERTMS allows a more competitive rail sector, and this means a gradual shift to rail is expected instead of other methods of transport. This will benefit the environment and decarbonisation; the railway is one of the greenest transport methods.

3 Paradigm of quality long-term introduction of ERTMS

Implementation of ERTMS presupposes the installation of its ETCS and GSM-R components. application with certain specific and advanced functions. When choosing an introduction strategy for ERTMS, a paradigm of quality long-term introduction and upgrading is introduced. Given the current state of the infrastructure, of the country's GDP and the possibility of EU funding, the question arises as to which technology and level of technology to choose? any country may decide which level is more suitable, however the basis for implementation is a clear situation regarding legislative part. It is of great significance that during the decision process to be aware of the [1] Goals, which can be achieved by implementing ERTMS, as presented in the figure below.

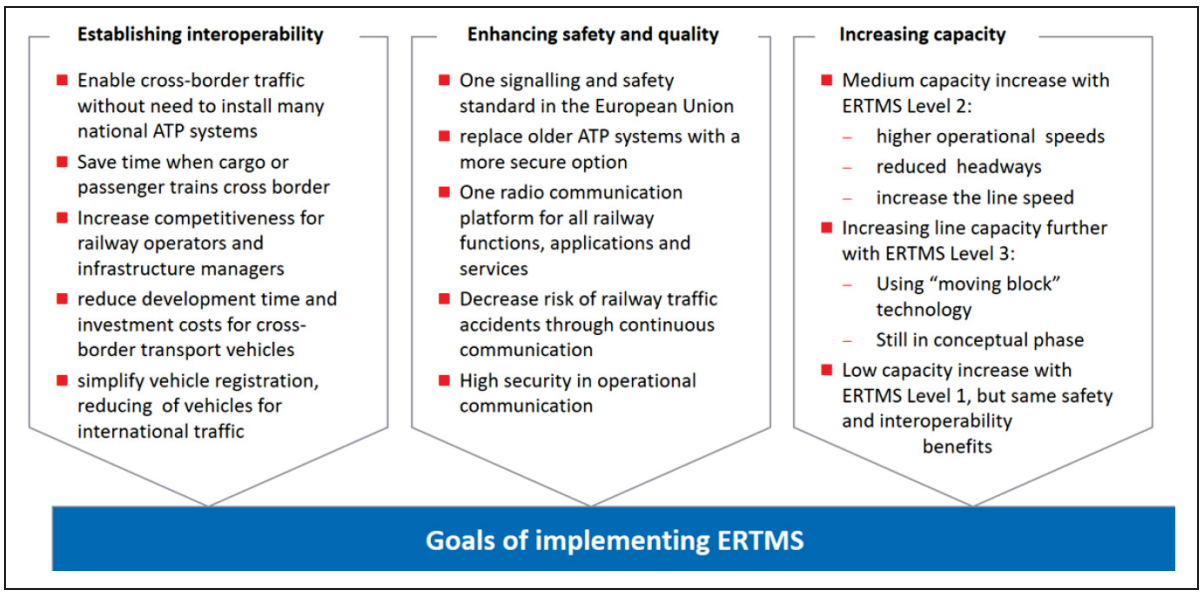

Figure 1 Goals of implementing ERTMS, Study of implementing ERTMS in Croatia, 2016

Regarding decision making, some important things have to be taken into the consideration: the situation regarding neighbouring countries regarding connection, sources of financing (EU funds prioritised for the Core/ Comprehensive networks), development plans, currently ongoing projects, connection with important nodes (sea- and river- ports), etc. Also, to be able to introduce Level 2 precondition is to have a GSM-R network prepared and ready. Simplified decision tree for introducing ERTMS i.e ETCS and GSM-R is given in the figure below:

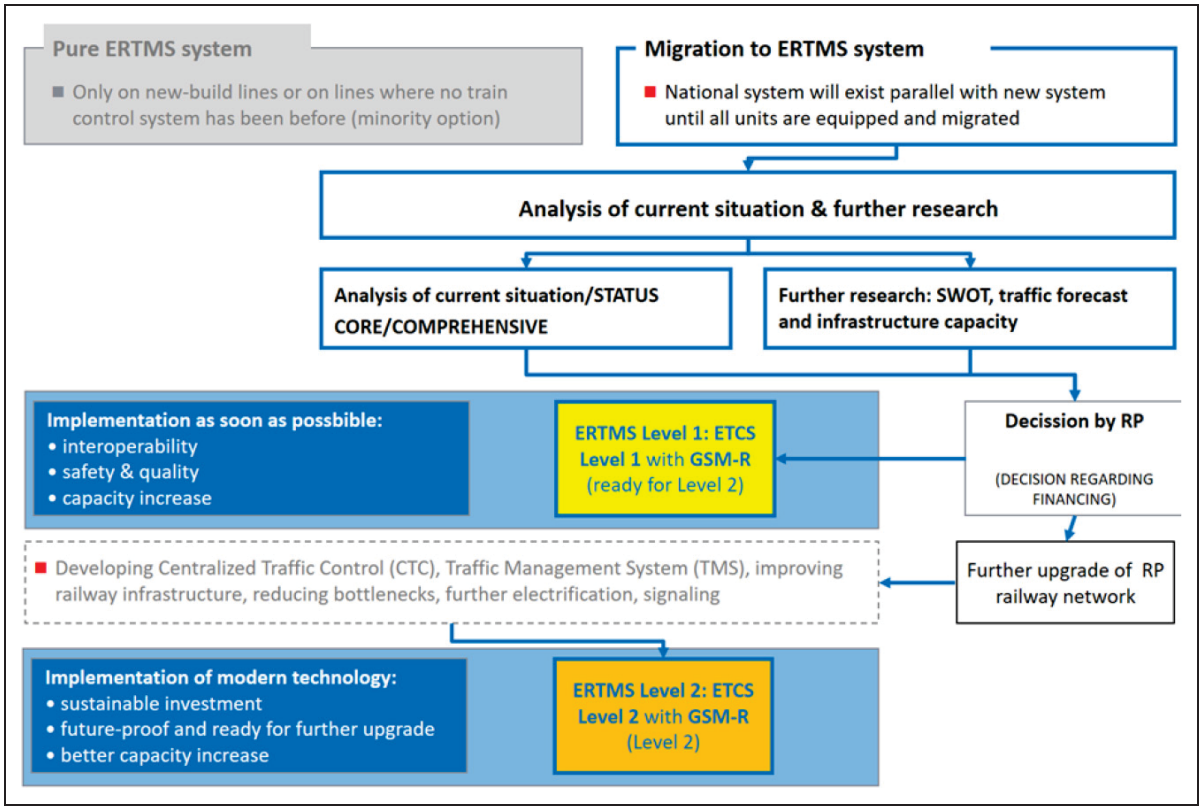

Figure 2 Simplified decision tree for introducing ERTMS i.e ETCS and GSM-R Study of implementing ERTMS in Croatia, 2016

Regarding decision making, [6] some important things have to be taken into the consideration: the situation regarding neighbouring countries regarding connection, sources of financing

[1] (EU funds prioritised for the Core/ Comprehensive networks), development plans, currently ongoing projects, connection with important nodes (sea- and river- ports), etc. Also, to be able to introduce Level 2 precondition is to have a GSM-R network prepared and ready. Evan thou, it has to be noted, based on studies made, that ETCS can cause a reduction of capacity if is only applied on the existing block schema. ETCS Level 2, on the other side can, if it is installed with optimised block section show significantly higher capacity [7].

4 Conclusion

ERTMS implementation as a system will result in numerous advantages: it will contribute to the harmonization of safety systems of railway lines in Europe (LEU, signalling marks, balise, RBC and Euroloop) and of trains (EVC, interface driver-machine, balise, odometer) and it will increase the overall availability of the railway traffic infrastructure.
Final decision regarding level of implementation is always, on the end in hands of benefiters. Real question is related the aims of development of the rail grid, and also related to the financial part. Network analysis will show currently status and is the sufficient capacity for planned traffic load, but it will also show if the status of railway line's infrastructure is, on individual sections, insufficient. This significantly influences the capacity itself (reducing speed of traffic and creating bottlenecks on corridor railway lines). Given the current state of the SS device, and the inability to repair it, after analyses of overall status, and closed financial part (from benefitor itself of from EU fonds, or others) decision to implement the ERTMS is on a benefiters side.

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