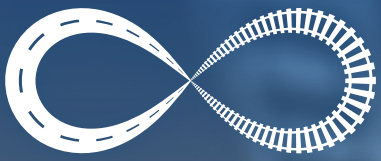

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Road and Rail Infrastructure V

Stjepan Lakušić – EDITOR

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OVERVIEW ON THE MAIN RAILWAY LINKS IN SOUTHEAST EUROPE

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Abstract

The TEN-T Orient/East-Med Corridor (OEM) connects Hamburg and Athens via the Southeastern member states of the European Union (EU). Significant investments were done along the corridor and further investments are targeted by the European Union for future. However, rail transport infrastructure and offer remain on a low level in the Southeastern corridor sections. From a European perspective, the development of the Orient/East-Med Corridor is of a particular importance to enhance European cohesion between Western and Southeastern member states. Nowadays other countries' foreign interests are focused on the region, as well. These interests call for a European strategy on the future corridor development in Southeast Europe. Before such a strategy can be developed, a clear overview on the current railway infrastructure is necessary. This paper gives an overview on the main railway links in Southeast Europe, including the EU as well as the non-EU member states. The overview contains information on the number of tracks and the fulfilment of the TEN-T technical parameters for track infrastructure. Likewise, projected upgrade measures are included in the overview. In addition, information on train management and operating in the area is provided. The overview clarifies, that a modern railway transport corridor will be available along the TEN-T Rhine-Danube Corridor in few years from Austria via Hungary and Romania to the Black Sea. Also, completion will be reached on the OEM Corridor's east-west section across Bulgaria and the national north-south section in Greece. However, beyond 2030 the infrastructure will remain inadequate along the OEM north-south section Romania-Bulgaria-Greece. To ensure the operability of the mentioned corridor, simpler, but feasible modernizations should be realized here. In return, a full integration of the Western Balkans into the TEN-T network may be a useful element for efficient long-distance transports to Southeast Europe. A European strategy taking these findings into account, can open a chance for a more successful corridor development and the avoidance of alternative global influence in Southeastern Europe.

Keywords: Trans European Transport Networks, Southeastern Europe, Orient/East-Med Corridor, railway infrastructure, train management and operating

1 Introduction

The investments into the main railway lines are generally seen as an important tool for boosting non-polluting transportation, on the one hand, and fostering European cohesion on the other. For a successful completion of a pan-European railway network, the investments of the European Union (EU) are focused on nine Core Network Corridors. This network shall be completed until 2030, while additional comprehensive corridors should meet their operation until 2050 [1]. In 2014, for each of the nine Core Network Corridors comprehensive corridor studies were undertaken, giving a profound basis of the state of the existing railway infrastructure. In

addition, to facilitate a more productive corridor development, the European Commission (EC) appointed in 2014 a Corridor Coordinator to each corridor [1]. For every corridor, a work plan of the respective Corridor Coordinator includes the following: 1) identifying critical issues, 2) setting development objectives, and 3) suggesting project lists. By successfully promoting the development of nine Core Network Corridors, the EC intends to create a core network for Europe. From a European perspective, the development of the Orient/East-Med (OEM) Corridor is of a particular importance for enhancing European cohesion with the Southeastern member states, especially as nowadays other countries' foreign interests – e.g., of China and Russia – are focused on the region, as well. Hence, for a successful European strategy on the future corridor development, a clear overview on the current railway infrastructure and ongoing upgrade projects is necessary. In order to address the previous aim properly, it is important not to overlook the ongoing developments around the OEM Corridor. Hence, the territorial scope, i.e. the research perimeter of the paper is extended in comparison to the official EU documents covering the OEM. More precisely, in addition to the corridor studies at hand, this paper aims at broader overview on the main railway network in Southeast Europe, including the EU as well as the non-EU member states. To gain a profound overview, the current compliance of the Southeast European railway network with the TEN-T technical parameters is examined. First, the state of the railway infrastructure in the area is elucidated, while, in view of the future rail infrastructure development, ongoing upgrade projects are included in the overview, too. Second, the train management and operating possibilities are analysed. Based on the analysis of the railway technical parameters in Southeast Europe, the concluding remarks provide a critical assessment of the current bottlenecks.

2 Compliance of the Southeast European railway network with TEN-T technical parameters

2.1 Territorial scope

The research perimeter comprises the following EU member states of Central, Eastern and Southern Europe, i.e. Slovenia and Croatia, Austria and Hungary, Romania and Bulgaria, and Greece, respectively. Additionally, the non-EU member states of the Western Balkan are included in the overview. Three TEN-T railway Core Network Corridors run through this area:

1) The Mediterranean Corridor (MED): section Italy – Slovenia / Croatia – Hungary
2) The Rhine/Danube Corridor (RDB): section Austria – Hungary – Romania
3) The Orient/East-Med Corridor (OEM): section Austria – Hungary – Romania – Bulgaria – Greece, bypassing the Western Balkans as non-EU member states area

2.2 TEN-T technical parameters

Regarding the core network railway transport infrastructure of the TEN-T, six technical core parameters are defined by the Regulation No. 1315/2013 [1]. One parameter, for instance, is the mode of traction, which shall be full electrification. The parameters including the respective required characteristic to be met until 2030 are listed in Table 1. For this paper, the TEN-T technical parameters listed in Table 1 are subdivided into:

1) Railway infrastructure, including:
   - traction
   - track gauge
   - max. line speed
   - max. axle load
   - max. train length
2) Train management and operation, focused on:
   - ERTMS (European Rail Traffic Management System)

Table 1 TEN-T railway transport infrastructure requirements

Parameter	Required characteristic
Traction	Full electrification
ERTMS: Telecommunication + Signalling	Full deployment: GSM-R +ETCS
Track gauge	1 435 mm
Max. line speed (freight lines)	≥ 100 km/h
Max. axle load (freight lines)	≥ 225 kN
Max. train length (freight lines)	Min. 740 m

2.3 Compliance of the railway infrastructure

For an easy understanding of the current situation, the overview of the railway infrastructure in the area is indicated in Figure 1. As a basis, the Southeast European main line rail network is illustrated schematically. A main feature, the degree of modernization of each section, is clearly depicted: if four out of five TEN-T technical parameters regarding the infrastructure are met, the section is designated as "modernized"; on the contrary, if less than four technical parameters are fulfilled, the respective section is designated as "not modernized". Sections that completely miss a connection or meet only one out of the five standards are marked as "crucial gaps". Such sections serve as serious bottlenecks, hindering an efficient long distance rail transport.

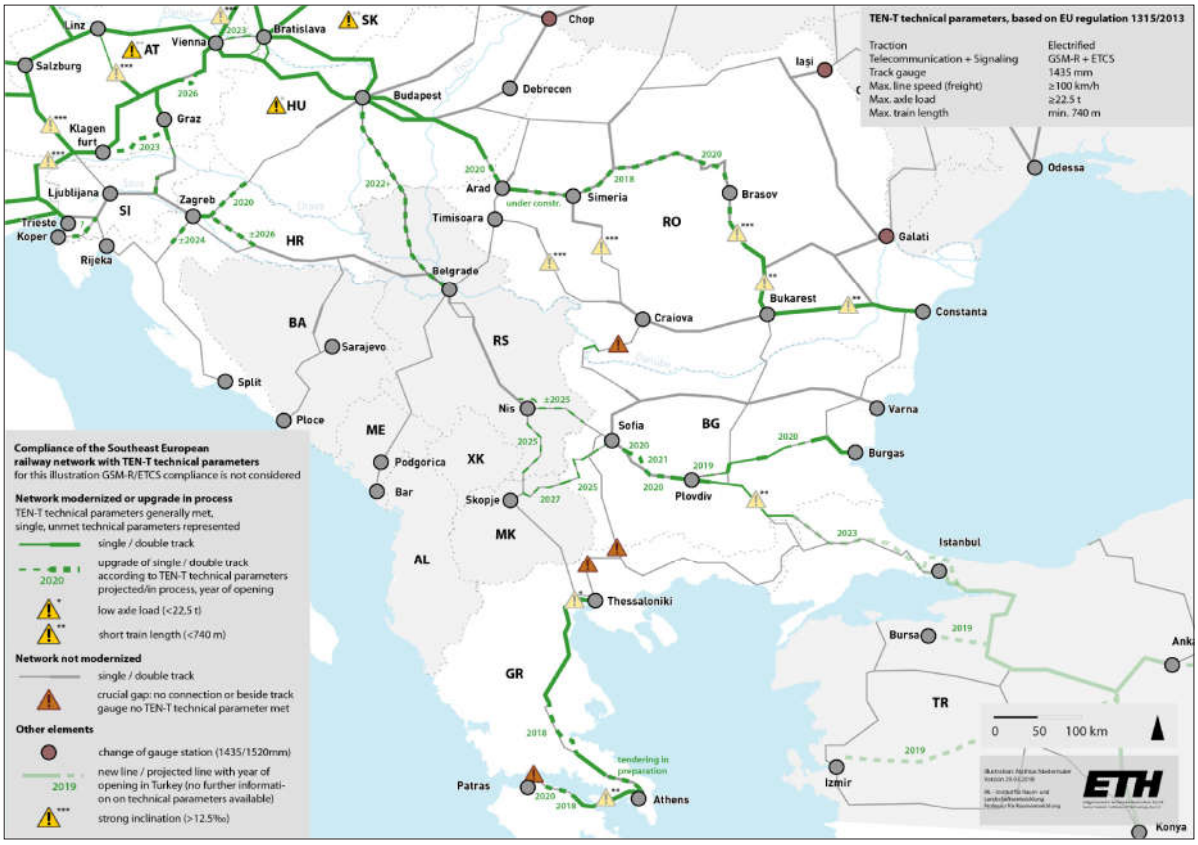

Figure 1 Compliance of the Southeast European railway network with the TEN-T technical parameters for infrastructure, based on [2-9]

The overview clarifies that the extent of capable railway transport infrastructure is still highly limited in Southeast Europe today. Measured against the TEN-T technical parameters for railway infrastructure, only the railway networks of Austria, Slovenia and Hungary currently

shape a net of modern railway infrastructure. Until 2026, the increase in compliance through the projects under construction in Austria, Hungary, Slovenia and Croatia is expected.
Upgraded linear railway infrastructure emerges currently in Romania and Bulgaria in east-west direction. Observing from the north-south direction, the railway infrastructure is modernized in Greece. What is common to all the three cases is that the modernization happens along the major national transport axis. The missing upgrade projects along these lines are planned to be completed in 2021. The completion of the Hungarian-Romanian border section and the east-west axis in Romania at the same time, finally brings to completion a modernized rail transport line from Austria via Hungary and Romania to Constanta at the Black Sea – part of the TEN-T Rhine-Danube Corridor.
Apart of these modernized lines, serious shortcomings in the infrastructure predominate widely. Although the Orient/East-Med (OEM) railway link was physically made passable by the opening of the Danube bridge Calafat-Vidin in 2013, outdated sections impede transportation along the corridor. The Romanian section from Arad via Timisoara to Craiova lacks solid modernization in terms of line speed, axle load and max. train length. The attaching section Craiova – Bulgarian border near Calafat as a crucial gap along the corridor does not comply with any of the TEN-T technical parameters beside its track gauge.
On the Bulgarian side, the sections Vidin–Sofia and Radomir–Bulgarian/Greek border are in need of rehabilitation. A further crucial gap are the Greek sections of the corridor between the Bulgarian/Greek border, Strymonas and further on to Thessaloniki, as well as the final kilometres of the OEM Corridor in the urban area of Patras. Besides an ongoing upgrade in Bulgaria along the section Sofia–Radomir, there are currently no upgrades under construction.
In addition to previously illustrated shortcomings in the EU member states, the Balkan transit route still lacks basic modernization – the route does not comply with several TEN-T technical parameters and features serious restrictions regarding line speed, axle load and train length: on large sections for example line speed is limited to 70-80 km/h. Therefore, the mentioned sections are considered to be the crucial bottlenecks for the integral development of the entire area of Southeastern Europe.

2.4 Compliance of the train management and operation – ERTMS

The parameter of ERTMS (European Rail Traffic Management System) consists of two important technical components: ETCS (European Train Control System) and GSM-R (Global System for Mobile Communications – Rail). The availability of valuable information on the prevalence and future deployment of ERTMS is, however, limited. To solve this issue, the EC required from the EU member states to: “draw up National Implementation Plans, describing their actions to comply with the TSI 2016/919 [...] and [...] setting out the steps to be followed for the implementation of fully interoperable ‘control-command and signalling’ subsystems. The National Implementation Plans shall be sent to the Commission before 5 July 2017 and shall be updated at least every 5 years” [10]. Despite this effort by the EC, the information included in the National Implementation Plans have a different level of detail [11]. For Greece, Hungary and Romania no National Implementation Plans are yet available at all, as well as for the non-EU member states of the Western Balkan, which are naturally not obliged to submit respective implementation plans. Due to these restrictions, no valuable overview map could be created for ERTMS prevalence and future implementation. Alternatively, a brief summary is given in Table 2.
The overview table on the implementation of ERTMS elucidates, that current prevalence of ERTMS in Southeast Europe is limited. Until 2030, full availability of ETCS on the Core Network Corridors is only expected for Austria. For the other states, availability can be expected until 2030 only section-wise. According to the train management and operation, the Southeast European railway does not, and also will not soon, comply with Regulation 1315/2013.

Table 2 Compliance of train management and operation – ERTMS, state 2017

Country	GSM-R	ETCS	Source
Austria	Under operation	Partly in service · until 2030: Deployment finalised on the entire TEN-T core network · until 2032: Advanced deployment on comprehensive network	[12]
Bulgaria	Partly under operation / in deployment	· until 2023: East-west axis Burgas/Kapikule – Sofia – Voluyak · beyond 2023: core and comprehensive network	[13]
Croatia	In deployment until 2023	· until 2032: core and comprehensive network	[14]
Greece	Partly under operation / in deployment	Partly in service · future implementation: No National Implementation Plan available	[15]
Hungary	Partly under operation / in deployment	Partly in service · future implementation: No National Implementation Plan available	-
Romania	Partly under operation / in deployment	Partly in service · future implementation: No National Implementation Plan available	-
Slovak Republic	Partly under operation / in deployment	Partly in service · until 2050: core and comprehensive network	[16]
Slovenia	Under operation	Partly in service · until 2023: core network · beyond 2050/not fully planned: comprehensive network	[17]
Western Balkans: Albania, Bosnia and Herzegovina, FYROM, Kosovo, Montenegro, Serbia	Not existing - until 2022: implementation for Subotica-Belgrade rail project in Serbia	Not existing · until 2022: implementation for Subotica-Belgrade rail project in Serbia · further implementation: No National Implementation Plans available	[3]
Turkey	Partly under operation / in deployment	Partly in service	[18]

3 Conclusions

The railway infrastructure of the Southeast European branch of the Core Network Corridors has been improved constantly, reaching now in part the targeted EU standards. Following the EU member states, the Near East gradually tries to establish stable railway connections, e.g. by implementation of numerous railway projects in Turkey or the international Kars-Tbilisi-Baku railway in Turkey, Georgia and Azerbaijan. In spite of such a convenience, the infrastructure along the southern branch of the OEM Corridor will remain inadequate until 2030, and even beyond. A few reasons behind such a situation are: the peripheral position of the outdated corridor sections, economic constraints and low transport demands – all of which prevent expensive constructions of new lines in the area.

The inadequate Southeast European branch of the OEM demands further investments, which however have to be seen in context to the development of its historic predecessor, i.e. the Balkan transit route of the Orient Express railway line: one section led across Croatia, Serbia and FYROM to Greece, while other was operating through Austria, Hungary, again via Serbia, leading to Bulgaria and Turkey. Between Budapest and Sofia, this route offers still today a 216 km shorter distance than compared to the official EU route of the OEM Corridor – passing through Romania and Bulgaria. The distance between Budapest and Thessaloniki counted along the Corridor X of the Pan-European network (est. in 1994) is even 276 km shorter than along the TEN-T OEM Corridor line via Craiova and Sofia.

Besides investing into the OEM Corridor, the full integration of the Balkan transit route into the future TEN-T development can help create a reciprocal, thus reliable rail transport network, supporting long-distance rail transport. For this purpose, further investments into the infrastructure of the cross-border regions between Serbia, Romania, Bulgaria, FYROM and Greece are deemed to be necessary. To avoid the fact of being stuck and to ensure the operability of the Southeast European railway network, simpler but feasible modernizations of the existing lines should be taken into account for future. Nowadays, we witness numerous global tendencies for the development of the area – e.g., Chinese investments into the Budapest-Belgrade section under the “One Belt, One Road” initiative, Russian support in maintaining

the Belgrade-Bar/Corridor XI connecting Serbia and Montenegro, etc.. Therefore, a European strategy based on responsible and cohesive approach could open a chance for a successful continuation of the railway network upgrade, in the same time minimizing alternative non-European influence in Southeastern Europe.

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