EUSAIR Transport MasterPlan

Volume 5

Rail Transport and related Intermodality

Contents

This Volume is part of the *Transport Masterplan of the Adriatic-Ionian Region*, elaborated by the *EUSAIR Facility Point* with the technical assistance of *PTSCLAS*, *TPS Pro* and *Systematica*, with the collaboration of *Tplan Consulting*, under the supervision of *Prof. Pierluigi Coppola* (Politecnico di Milano). Credits for reviewing and editing goes to *Dr. Francesco de Fabiis* (Politecnico di Milano).

The Masterplan includes the following volumes:

Volume 1 – Executive Summary

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Introduction on the European Railway Network

The Trans-European Transport Network (TEN-T) policy addresses the implementation and development of a Europe-wide network of railway lines, roads, inland waterways, maritime shipping routes, ports, airports and railroad terminals. The ultimate objective is to close gaps, remove bottlenecks and technical barriers, as well as to strengthen social, economic and territorial cohesion in the EU. The current TEN-T policy is based on Regulation (EU) No 1315/2013[1].

Besides the construction of new physical infrastructure, the TEN-T policy supports the application of innovation, new technologies and digital solutions to all modes of transport. The objective is improved use of infrastructure, reduced environmental impact of transport, enhanced energy efficiency and increased safety.

The EU Regulation 1315/2013 which defined the trans-European transport network TEN-T, provides for the creation of a network structured on two levels for the development of the international network:

- The Core Network: a core network at EU level (to be implemented by 2030) which includes the parts of the global network that are of the highest strategic importance for the purpose of achieving the objectives for the development of the trans-European transport network. Its implementation is based on a "corridor approach.
- The Comprehensive Network: a global network (to be implemented by 2050) which aims to ensure full coverage of the EU territory and accessibility to all regions.

The backbone of the Core Network is represented by nine Core Network Corridors, which were identified to streamline and facilitate the coordinated development of the Core Network. Two horizontal priorities, the European Rail Traffic Management System (ERTMS) and Motorways of the Sea complement these.

In December 2021, as part of the "Efficient and Green Mobility Package", the European Commission published its proposal for a revision of the TEN-T Regulation 1315/2013, aimed at implementing a European multimodal transport network with high standards of quality to strengthen the social, economic and territorial cohesion of the European Union whilst contributing to the creation of a single European transport area that is sustainable, efficient and resilient.

This revision responds to the need to adapt the trans-European transport network policy to the many changes that took place over the last 10 years, such as a growing demand for transport, geopolitical dynamics (expansions of the EU) and developments in transport policy (liberalization, interoperability and technological innovation).

The proposal's main innovation consists in the shift from a dual layer network – with a Central Network and Global Network – to a three-layer one organized as follow:

- Core Network – the sections of the comprehensive network with a high strategic value to be realized by 31 December 2030;

[1] Regulation (EU) No 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU Text with EEA relevance. ELI: http://data.europa.eu/eli/reg/2013/1315/2019-03-06

- Extended Core Network – the sections of the comprehensive network consisting in additional lines belonging to the European Transport Corridors (ETCs), to be realized by 31 December 2040;
- Comprehensive Network – the most extensive and consisting of all the sections of the rail network ensuring the accessibility and connectivity of all EU regions, to be completed by 31 December 2050.

Another important element is the establishment of the European Transport Corridors that are the result of the merging of the current Core Network Corridors (aimed at connecting the cities included in the core network and ensuring coordinated development of infrastructure) and the Rail Freight Corridors (RFC) and cover both the core and the extended core network.

With the aim of promoting a modal shift towards rail and make rail transport more competitive and efficient, the proposal defines two operational requirements for the European Transport Corridors, to be achieved by 2030:

- limited delay on arrival at their destination (less than 30 minutes) for at least 90% of freight trains crossing at least one border;
- an average dwelling time at border crossings (maximum 15 minutes).

Relating to the infrastructure requirements, new mandatory parameters have been included to those currently in force on the Core, the Core Extended and the Global Networks, to be implemented in accordance with their specific timelines regarding:

- ERTMS deployment on the whole TEN-T by 2040 (core network by 2030) and decommissioning of Class B systems;
- Minimum speed of 160 kilometres/hour for passenger lines;
- P400 loading gauge that allows circulation of semi-trailers on railway wagons.

Furthermore, the proposal envisages an expansion of the urban node network, with the inclusion of a further 40 Italian urban hubs in addition to the 9 already foreseen, with the obligation to adopt a Sustainable Urban Mobility Plan by 2025 and the creation of infrastructure for recharging and refueling with alternative fuels.

Finally, concerning the multimodal freight terminals, the Commission proposed to boost the logistic capacity of the TEN-T network, increasing the multimodal freight terminals from 27 to 38.

The following figure shows the TEN-T Core Network in its latest version as proposed by the European Commission, which includes the extension of the network in the Western Balkans region which are part of the Adriatic-Ionian Region.

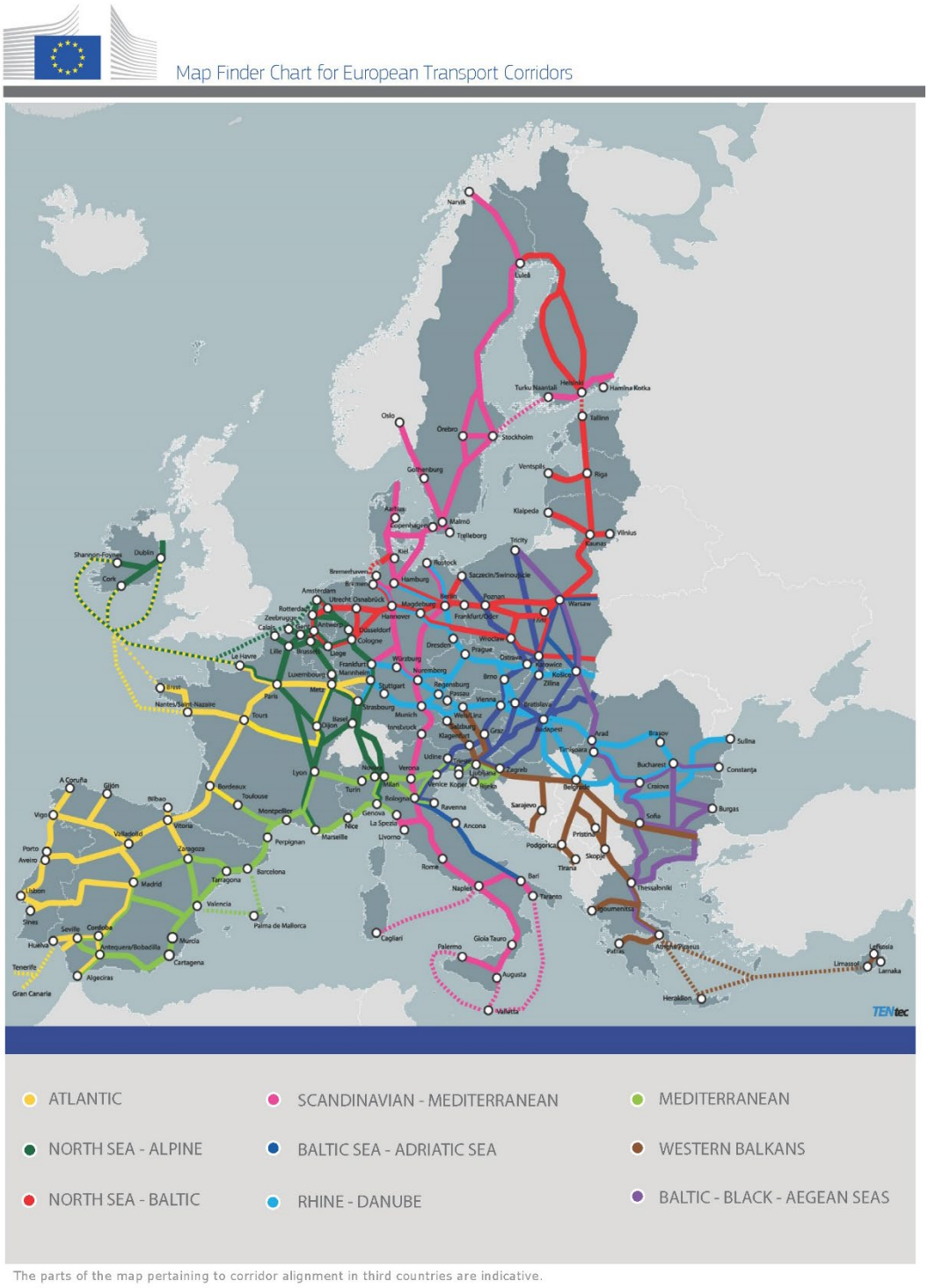

Figure 1 European Transport Corridors in its new proposed configuration. [Source: https://transport.ec.europa.eu]

The proposed extension of the TEN-T in the Western Balkans

Regulation 1315/2013 set up an ambitious timeline for achieving the relevant standards for the TEN-T Core and Comprehensive Networks by 2030 and 2050 respectively. While the same applies to the Southeast European Parties, bridging the TEN-T compliance gap should also take note of the specifics of the region, namely a history of lagging infrastructure and the limited available funding.

One of the cornerstones of the European integration path is to connect the economies of the Western Balkans more effectively with one another and with the EU, by developing a common regional transport market.

Currently, the TEN-T Regulation is undergoing a revision process, in line with the European Green Deal objectives and climate neutrality objective. This revision process represents an opportunity for deeper reflection within EUSAIR on the challenges that the Balkan countries have faced so far in the implementation of the existing TEN-T Regulation and how to better tackle them in the wider Adriatic and Ionian space.

Planning and prioritization of the indicative TEN-T extension in the Western Balkans should align to a set of already established key principles. The dual-layer nature of the TEN-T sets different priority levels for the Core and the Comprehensive network respectively. Moreover, the Economic and Investment Plan for the Western Balkans with its pre-identified Flagship Projects narrows the focus to several essential TEN-T links whose completion is deemed to yield the most significant connectivity gains for the region.

Indicative maps of trans-European transport network extended to Western Balkans are shown below. Figure 2 represents the newly proposed Western Balkans Railway Corridor and Figure 3 the newly proposed Western Balkans Roads Corridor. In both maps the following are distinguished: Core network, extended Core network and comprehensive network.

Figure 2 Indicative trans-European (TEN-T) extension of Comprehensive and Core Railway network to the Western Balkans Region[2]

[2] Source: Draft high-level agreements within the meaning of Article 49(6) of Regulation (EU) No 1315/2013 (TEN-T Regulation) concerning adaptations of the indicative map of the transport infrastructure network for road, railway and inland waterways of the Western Balkans, 25 April 2023

Figure 3 Indicative trans-European (TEN-T) extension of Comprehensive and Core Road network to the Western Balkans Region[3]

[3] Source: Draft high-level agreements within the meaning of Article 49(6) of Regulation (EU) No 1315/2013 (TEN-T Regulation) concerning adaptations of the indicative map of the transport infrastructure network for road, railway and inland waterways of the Western Balkans, 25 April 2023

The proposed extension set the following key policy objectives[4] for the Western Balkans and indeed for the Adriatic-Ionian regions ad part of it:

- **Enhancing connectivity within the Western Balkans and with the European Union**: Developing fast high-quality connections among the Southeast European Partners and with the European Union will ensure closer ties between the parties, accelerate economic integration, boost investment, speed up convergence and help bridge the prosperity gap. Existing bottlenecks and missing links will therefore remain among the key matters to be addressed with priority in the coming years.
- **Improving accessibility and mobility on the TEN-T Network**: Improved accessibility supports balanced territorial development by ensuring better access to markets for remote and backward regions. Increased mobility results in tangible economic benefits such as travel time savings, shortens physical distances and creates new links and opportunities for people and business. While accessibility and mobility are generally regarded as potentially competing (if not opposed) transport policy objectives, the characteristics of the transportation system in the Western Balkans require a smart balance being achieved between both.
- **Building the transport of the future. Towards a smart, sustainable, green, safe and resilient TEN-T network.** This objective is divided into three policy line: 1) Green and sustainable network: TEN-T development should align itself properly to such policy changes, ensuring synergy with the objectives and flagships of the Sustainable and Smart Mobility Strategy for the Western Balkans by promoting actions that would support a modal shift towards more environmental-friendly modes of transport and the decarbonization of road transport. 2) Smart Network: action required include smart & digital elements in all major investments to be implemented on the TEN-T network and small-scale interventions targeting specifically smart solutions that would help increase the network's efficiency and reach the full potential of intermodality.

[4] "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022

1 Railways and intermodal transport characteristics in EUSAIR countries

1.1 Albania

1.1.1 Rail network overview

The Albanian HSH [5] railway network extends for 420km all in single track with standard gauge of 1435mm and approximately 100km secondary lines in stations and industrial branches. The line length decreased in the last years due to some closings and the network lost more than 200 km. So far there are no double track section on the entire corridor.

The network is not electrified, and all trains are hauled by Czech-built ČKD diesel-electric locomotives.

Due to the morphology of the territory, most of the trucks show relevant slopes:

- 350 km belong to a flat area with a slope 9‰.
- 30 km located in a hilly area with a slope 13 ‰.
- 40 km in a mountainous area with slope 18‰.

Even if the line gradient is a so critical issue for passenger services, it can represent a real problem freight market need especially for long and heavy trains.

Figure 4 HSH rail network in Albania [Source: Wikipedia.org]

The Albanian railway network is a radial system that extends starting from Durres city, where the biggest port of Albania is located, and it goes further into 3 directions. In northern Albania the network serves Shkodra city and further on at Bajza railway border station, which is the only station that connects the Albanian railway network with the European railway network. In Southern Albania the network serves Vlora city where Vlora maritime harbour is ranked the second as per its importance. In Eastern Albania the network serves Pogradec city nearby which it is located Lin station that is a rail connecting option of the Albanian railway network with the Macedonian railway network.

[5] Hekurudha Shqiptare (HSH, Albanian Railways) is the public railway transport company, state-owned until 2000, and subsequently a public company with entirely state capital.

The connection of Northern railway network of Albania through Bajza rail border station with Montenegrin railway network through Podgorica rail station of Montenegro, and further on with Belgrade rail station of Serbia, allow the connection with the European railway network.

The maximum speed is low all over the network and never exceed 55 km/h for passenger trains and 45 km/h for freight trains.

Signalization system on the entire railway network is made by interlocking systems. Back in the 80s for about 30% of the Albanian railway network the signalling system based on command-control system was implemented, however it is entirely outdated and never re-activated.

According to Albanian Railways S.A. (HSH S.A), the inventory of wagons of Freight business unit does not fulfil international requirements and it is therefore dedicated only to freight domestic transport representing a serious constrain in developing international traffics.

The proposal for the extension of the Tran European Transport Networks (formalised in the Regulation (EU) 2016/758 which amends annex III of Regulation (EU) 1315/2013) plan extension of the Mediterranean Core Network Corridor in the territory of Albany and goes from the Montenegro Border in Hani Hotit passing through Shkoder, Vore, and the urban node of Tirana up to the Core port of Durres. The entire alignment is characterized by single track railway sections which presents very poor-quality conditions, especially from the Montenegro border to Tirane.

According to the Study on Mediterranean TEN-T Core Network Corridor European Commission), the lack of investments generated safety problems, especially with respect to several level crossing which have not been secured with barriers. Furthermore, signalling is virtually out of operation and the system is secured by written notes on arrivals and departures of trains at the stations.

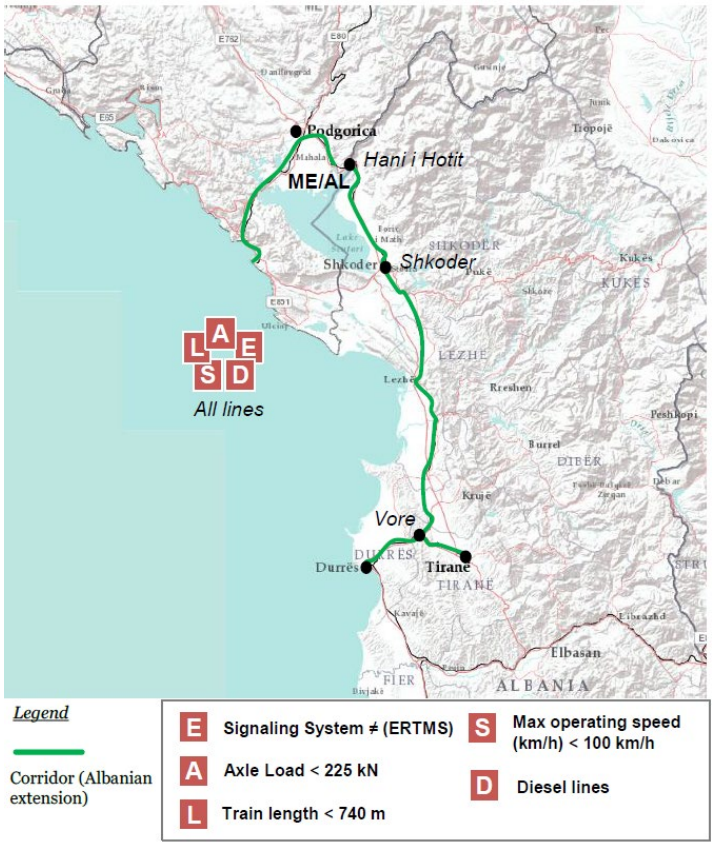

Figure 5 Mediterranean Core Network Corridor in Albania: railway [Source: Study on Mediterranean TEN-T Core Network Corridor 2nd Phase, European Commission]

In terms of compliance with TEN-T standards (Regulation (EU) no. 1316/2013), the only technical parameter compliant to the European requirements is the track gauge, while the entire alignment has diesel traction, with maximum admissible train length of about 270-300 meters, the axle load allows 20,0 tons and the maximum operating speed is, on average, 30 km/h from Hani Hotit to Vore and between 50 km/h and 70 km/h on the stretch linking the Albanian capital to the Core port of Durres.

Table 1 Characteristics of the rail network belonging to the Mediterranean corridor.

SECTIONS	INTEROPERABILITY OF ALBANIAN RAILWAY SECTIONS
Hani i Hotit-Shkoder	Single track section, designed with Standard track gauge (1435 mm) Low technical standards compared to EU requirements: • Diesel traction • Maximum admissible train length is about 300 m. • Maximum operating speed is about 30 km/h • Maximum admissible axle load 200kN • ERTMS still not implemented
Shkoder-Vore	Single track section, designed with Standard track gauge (1435 mm) Low technical standards compared to EU requirements: • Diesel traction • Maximum admissible train length is about 300 m. • Maximum operating speed is about 40 km/h • Maximum admissible axle load 200kN • ERTMS still not implemented
Tirana-Vore	Single track section, designed with Standard track gauge (1435 mm) Low technical standards compared to EU requirements: • Diesel traction • Maximum admissible train length is about 270 m. • Maximum operating speed is about 60 km/h • Maximum admissible axle load 200kN • ERTMS still not implemented
Vore-Durres	Single track section, designed with Standard track gauge (1435 mm) Low technical standards compared to EU requirements: • Diesel traction • Maximum admissible train length is about 270 m. • Maximum operating speed is about 60 km/h • Maximum admissible axle load 200kN • ERTMS still not implemented

1.1.2 Main rail intermodal freight terminals

Currently, the Port of Durres is the most important maritime and rail terminal in Albania and one of the most important in SEETO (South-East European Transport Observatory) Area and represent the single main intermodal terminal in Albania. According to the Second Five Years Review of the Albanian National Transport Plan integration intermodal performance of Durres shall be improved significantly.

1.1.3 Rail traffic volumes (passengers and freight) and characteristics

Passengers transport is concentrated over main cities of Albania in the coastal part and in the South-eastern part. According to national company HSH, the travel time of passenger's trains between the cities is quite high and this represent a limit to the use of railway service compared to private transport.

The HSH passenger system presently consists of the following lines:

- Shkodër–Vorë railway – from Shkodër County via Durrës, Rrogozhinë, Fier to Vlorë
- Rrogozhinë – Elbasan

The services available in 2019 are listed below:

- four trains per day (two trains in each direction) between Durres and Kashar (due to the lack of rail line between Kashar and Tirana, this is the closest train station to the capital), two of these (one train in each direction) run between Elbasan and Kashar via Durres.
- four trains per day (two trains in each direction) between Durres and Elbasan, two of these (one train in each direction) run between Elbasan and Kashar via Durres.

The following Table 2 shows data about rail freight transport in Albania. From 2015 to 2019, the total tonnage has been increasing. According to the UNECE database, Albania does not export any good by rail.

Table 2. Carriage of goods by rail by Type of transport [Source: UNECE Transport Division Database, https://w3.unece.org/PXWeb2015/pxweb/en/STAT]

	2015	2016	2017	2018	2019
Total					
Tonnes carried (1000s)					
Albania	..	76	150	199	708
Tonne-kilometres (millions)					
Albania	23	9	25	20	43
National					
Tonnes carried (1000s)					
Albania	..	38	37	114	611
Tonne-kilometres (millions)					
Albania	..	3	3	8	24
International, loaded					
Tonnes carried (1000s)					
Albania	..	0	0	0	0
Tonne-kilometres (millions)					
Albania	..	0	0	0	0
International, unloaded					
Tonnes carried (1000s)					
Albania	..	38	113	85	97
Tonne-kilometres (millions)					
Albania	..	9	23	16	19
Transit by rail throughout					
Tonnes carried (1000s)					
Albania	..	..	..	0	..
Tonne-kilometres (millions)					
Albania	..	..	..	0	..

1.1.4 Border checkpoints infrastructural and operative characteristics

Due to the state of the railway infrastructure system and the non-compliance with most of the international standards in terms of interoperability of the lines, entry into the Albanian territory for freight wagons is not always possible.

To support the international trade with Montenegro, the Albanian Railways signed an agreement to transport goods from the border crossing point of Tuzi in Montenegro to the Bajza border station in Albania and further to the entire Albanian railway network.

The only Albania's international rail link is Podgorica–Shkodër railway, a cross-border line connecting Albania and Montenegro, used for freight-purposes only. The line connects to Belgrade–Bar railway and Nikšić–Podgorica railway in Podgorica and Shkodër–Vorë railway in Shkodër. Podgorica–Shkodër is a 63.5 km (39 mi) long standard gauge railway, of which 34 km (21 mi) runs through Albania and the remaining 29.5 km (18 mi) through Montenegro. Like other railways throughout Albania, the railway is not electrified. The line's last station in Albania is the Bajzë Rail Station.

1.1.5 ERTMS implementation

ERTMS ("European Rail Traffic Management System") is the European standard for the Automatic Train Protection (ATP) and command and control systems, it is a safety system that enforces compliance from trains with speed restrictions and signalling status. Due to its nature and the required functions, at present this system is partly installed trackside and partly installed onboard.

The Albanian railway network is planned to be heavily implemented and plans also aim to provide a strategic framework for the ITS such as ERTMS, however there are no ERTMS in operation throughout the entire network.

1.1.6 Key issues

This paragraph presents in short terms the most relevant issues related to the Albanian railway system, highlighted by the analysis carried out on the rail network by type of impact.

Table 3 Albania: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
ALBANIA	All lines are single track					■
	All lines are not electrified (only diesel traction)	■			■	
	Maximum speed between 50km/h to 70 km/h					■
	Axle load < 20tons on the entire network	■				■
	Gradients are quite relevant in some sections	■				■
	ERTMS not implemented on the entire network	■	■			■
	Very limited number of lines and network length (420km)			■		■

1.2 Bosnia and Herzegovina

1.2.1 Rail network overview

The railway network extends for about 1,000 km-long of which 609km belong to the Federation of Bosnia and Herzegovina of which only 440km are electrified. The entire network is single track and standard gauge (1435mm). Due to the peculiar institutional framework, in Bosnia and Herzegovina (BH) two different rail companies operate:

- **Republika Srpska Railways** (ŽRS), which operates in Republika Srpska and manage four railway lines:
  - Doboj-Banja Luka (electrified)
  - Doboj-Maglaj (electrified)
  - Doboj-Samac (electrified)
  - Doboj-Petrovo Novo Selo (non electrified)
- **Railways of the Federation of Bosnia and Herzegovina** (ŽFBH), which operates for the majority of the railway lines (which are located in the Federation of Bosnia and Herzegovina), of which 440km are electrified and following an extensive rehabilitation, more than 85% is classified D4 allowing maximum loads of 22.5 tons, while maximum speed is limited to 70 km/h for passenger and 50 km/h for freight trains.

Figure 6 Railway network of Bosnia and Herzegovina [Source: Wikipedia.org]

The proposal for the extension of the Tran European Transport Networks (formalized in the Regulation (EU) 2016/758 which amends annex III of Regulation (EU) 1315/2013) plan extension of the Mediterranean Core Network Corridor in the territory of Bosnia and Herzegovina correspond to the Pan European Corridor codification Vc and crosses all the Bosnian country, from North to South connecting Pan European Corridor X22 (in the North) and River Sava, with the comprehensive Seaport of Ploce (in the South).

According to the Study on Mediterranean TEN-T Core Network Corridor European Commission), the condition of this railway stretch is below satisfactory level with poor track alignment and high gradients varying from 8 ‰ (from Bosanski Samac up to Sarajevo) up to 24 ‰ (from Sarajevo up to Ploce). Moreover, the lack of maintenance caused a general reduction of the maximum allowed speed, currently between 50 km/h and 70 km/h; even though it was originally built for reaching 100 km/h. Furthermore, specific sections are characterized by further speed restriction which impose limitation from below 50 km/h. Another critical factor which generates an increase on the total cost of rail freight transport is the impossibility to run trains with a total length above 550m.

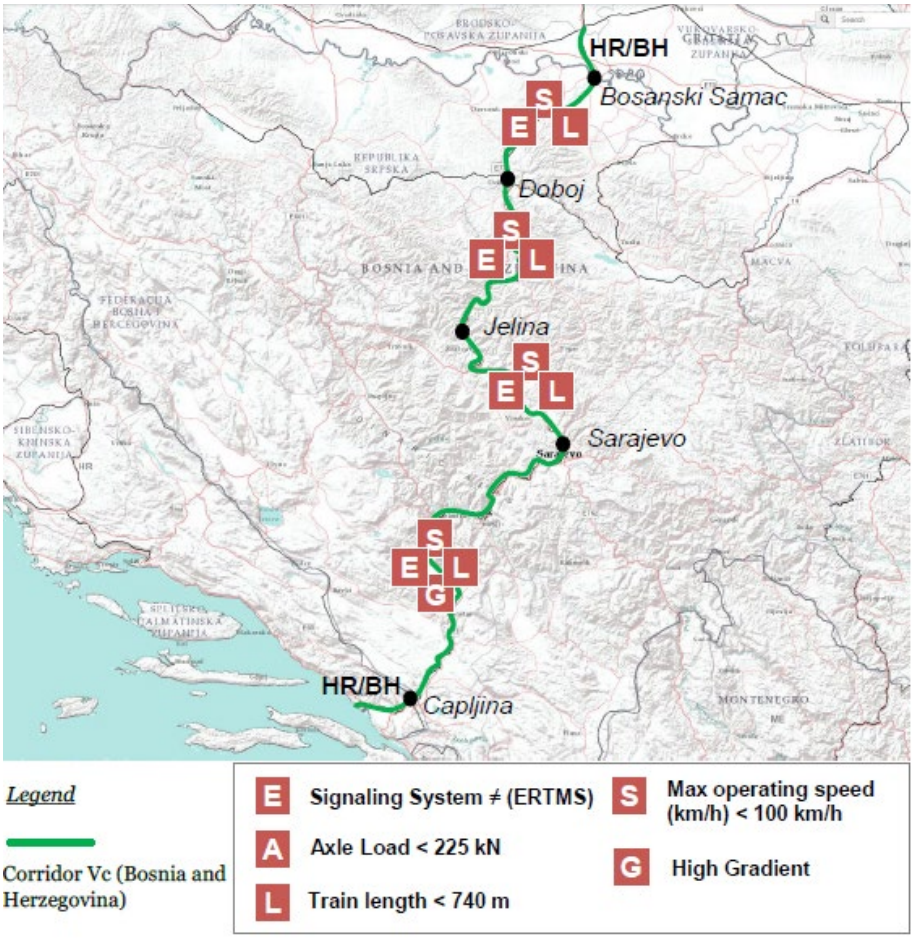

Figure 7 Mediterranean Core Network Corridor in BH: railway [Source: Study on Mediterranean TEN-T Core Network Corridor 2nd Phase, European Commission]

Table 4 Length of the rail network in Bosnia (2020)

SECTIONS	INTEROPERABILITY OF BOSNIAC RAILWAY SECTIONS
Bosanski Samac-Doboj	Single track section, electrified with admissible axle load of 22,5 tons Low technical standards compared to EU requirements: • Maximum admissible train length is about 450 m. • Maximum operating speed is about 50 km/h • ERTMS still not implemented
Doboj-Jelina	Double track section, electrified with admissible axle load of 22,5 tons Low technical standards compared to EU requirements: • Maximum admissible train length is about 500 m. • Maximum operating speed is about 50 km/h • ERTMS still not implemented
Jelina-Sarajevo	Single track section, electrified with admissible axle load of 22,5 tons Low technical standards compared to EU requirements: • Maximum admissible train length is about 500 m. • Maximum operating speed is about 50 km/h • ERTMS still not implemented
Sarajevo-Capljina	Single track section, electrified with admissible axle load of 22,5 tons Low technical standards compared to EU requirements: • Maximum admissible train length is about 500 m. • Maximum operating speed is about 50 km/h. • ERTMS still not implemented. • Gradient of about 24‰.

1.2.2 Main rail intermodal freight terminals

Even if it is a Croatian city, Ploče can be considered as a Bosnian major intermodal terminal. About a quarter of goods are forwarded by rail towards the inner Balkans via Čapljina, Mostar and Sarajevo. Other intermodal terminal in Bosnia and Herzegovina are in Sarajevo (Alipasin Most train station), in Tuzla and in Banja Luka.

1.2.3 Rail traffic volumes (passengers and freight) and characteristics

According to UNECE's 'The development of international passenger rail transport'[6], transport volumes for both passengers and freight have fallen over the last ten years, while investments in infrastructure during the same period amounted to around €2 billion. Sectoral reforms were not pursued in parallel to these investments and this meant that the full benefits of these upgrades are yet to be realised. The rail network of Bosnia and Herzegovina is only partially covered by the TEN-T network. Moreover, the complex administrative structure of Bosnia and Herzegovina and of the railway sector has had an impact on the overall provision of railway services. Participating in regional cooperation is therefore very important, in particular, through the setting up of the sub-regional Transport Community which seeks to develop the road, rail, inland waterway and maritime sectors in the region and link them to the European Union (EU) network.

[6] https://unece.org/sites/default/files/2021-03/2017835_E_cover_pdf%20web.pdf

Table 5. Railway passenger traffic by Passengers [Source: UNECE Transport Division Database, https://w3.unece.org/PXWeb2015/pxweb/en/STAT]

	2015	2016	2017	2018	2019
Total					
Number of passengers (1000s)					
Bosnia and Herzegovina	512	409	472	549	659
Passenger kilometres (millions)					
Bosnia and Herzegovina	34	23	29	40	..
National transport					
Number of passengers (1000s)					
Bosnia and Herzegovina	482	..	472	548	659
Passenger kilometres (millions)					
Bosnia and Herzegovina	31	..	29	40	55
International transport					
Number of passengers (1000s)					
Bosnia and Herzegovina	30	..	0	1	..
Passenger kilometres (millions)					
Bosnia and Herzegovina	3	..	0	0	..

Table 6. Carriage of goods by rail by Type of transport [Source: UNECE Transport Division Database, https://w3.unece.org/PXWeb2015/pxweb/en/STAT]

	2015	2016	2017	2018	2019
Total					
Tonnes carried (1000s)					
Bosnia and Herzegovina	13 677	13 156	13 254	13 512	13 538
Tonne-kilometres (millions)					
Bosnia and Herzegovina	1 285	1 143	1 116	1 178	1 260
National					
Tonnes carried (1000s)					
Bosnia and Herzegovina	8 104	..	7 649	7 190	7 075
Tonne-kilometres (millions)					
Bosnia and Herzegovina	565	..	449	424	428
International, loaded					
Tonnes carried (1000s)					
Bosnia and Herzegovina	1 428	..	2 310	2 726	2 786
Tonne-kilometres (millions)					
Bosnia and Herzegovina	138	..	455	504	557
International, unloaded					
Tonnes carried (1000s)					
Bosnia and Herzegovina	2 430	..	1 548	1 548	1 578
Tonne-kilometres (millions)					
Bosnia and Herzegovina	479	..	113	138	152
Transit by rail throughout					
Tonnes carried (1000s)					
Bosnia and Herzegovina	1 715	..	1 747	2 048	2 099
Tonne-kilometres (millions)					
Bosnia and Herzegovina	103	..	99	112	123

1.2.4 Border checkpoints infrastructural and operative characteristics

The railway network is linked to Croatia (border station in Dobrljin, Šamac, Brčko, Čapljina) and Serbia.

Permanent border crossing points with Croatia for international transport of passengers and goods in railway traffic are the following station:

1. Drenovci,

2. Volinja,

3. Ličko Dugo Polje,

4. Slavonski Šamac,

5. Metković

1. (Tuzla -) Brčko ŽFBH[7] - Gunja HŽ[8] (- Drenovci - Vinkovci): A passenger service was introduced on this route in the 2002/2003 timetable but was withdrawn by the end of the 2009/2010 timetable period. ŽFBH operates to Drenovci.
2. (Novi Grad -) Dobrljin ŽRS[9] - Volinja HŽ (- Sunja): The only passenger service [a pair of day trains between Sarajevo and Zagreb] using this crossing were withdrawn at the December 2016 Timetable change. ŽRS had operated to Volinja. Freight continues. Novi Grad was formerly named Bosanski Novi.
3. (Bihać -) Martin Brod ŽFBH - Ličko Dugo Polje HŽ (- Knin): Prior to the break-up of Yugoslavia this formed part of the principal rail route to the Adriatic ports of Zadar, Šibenik and Split. The line was electrified as far as Knin. Following the Croatian and Bosnian Wars of Independence between 1991 and 1995 the border between the two new countries crossed the line seven times between Bihać and Knin. The line was badly damaged during the war, but the track was repaired, with Martin Brod and Ličko Dugo Polje selected as the new border stations, and on 26 January 2001 a ceremonial passenger train conveying government ministers from both countries operated over the line. The line saw occasional freight traffic only, then in May 2010 HŽ closed the section south of Martin Brod owing to the poor condition of the track.
4. (Doboj -) Šamac ŽRS - Slavonski Šamac HŽ (- Strizivojna-Vrpolje): The Budapest to Sarajevo train pair ended 9 December 2012, closing this line to passenger services. ŽRS operates to Slavonski Šamac. Šamac is referred to as Bosanski Šamac in the Croatian timetable.
5. (Sarajevo -) Čapljina ŽFBH - Metković HŽ (- Ploče): After a break of nearly nine years HŽ restarted a seasonal service between Sarajevo and Ploče on 01 July 2022, running on Fridays / Saturdays / Sundays until 11 September 2022. The only service that crossed this border previously had ceased in December 2013 and all internal HŽ passenger services between Ploče and Metković ceased from 24

[7] Željeznice Federacije Bosne i Hercegovine (ŽFBH, Railways Federation of Bosnia and Herzegovina) is the railway company of the Croatian-Muslim Federation, in Bosnia. The network extends for 584 km of ordinary gauge, of which 259 km electrified at 25 kV 50 Hz.

[8] Hrvatske Željeznice (HŽ, Croatian Railways) is the national railway company of Croatia.

[9] Željeznice Republice Srpske (ŽRS, Serbian Republic Railways) is the railway company of the Serbian Republic of Bosnia and Herzegovina. It consists in four radial lines: Doboj-Banja Luka: electrified single track 110 km with antennas for Banja Luka and Novi Grad; Doboj-Maglaj: electrified double single track, 23 km; Doboj-Samac: electrified single track, 60 km; Doboj-Petrovo Novo Selo: non-electrified single track 33 km.

April 2014. There was a plan to start a Sarajevo - Ploče Talgo service in 2017 but this did not happen. HŽ operates to Čapljina.

Border crossing with Serbia:

1. (Bijeljina -) Velino Selo ŽRS - Sremska Rača Nova ŽS[10] (- Šid): ŽS operated to Bijeljina, there was no connection to the rest of the railway system of Bosnia-Herzegovina. Passenger service over the whole route from Šid to Bijeljina ceased in June 2005. Note: this crossing was available to local passport holders only.
2. (Tuzla -) Zvornik Novi ŽRS - Brasina ŽS (- Ruma): this line was built in 1978 and carries ŽS freight traffic to a large works at Zvornik Novi. The route is shown wrongly, or not at all, on many maps, and runs from Rasputnica [= junction] Donja Borina, just south of Brasina on the Ruma - Zvornik Grad line, via a cross-border river bridge to Zvornik Novi. The line onwards from Zvornik Novi towards Tuzla is of even newer construction and was physically completed in January 1992 although not open to traffic until at least 1999 as a consequence of war in that region.
3. (Višegrad -) Vardište - Mokra Gora (- Šargan Vitasi): 760mm gauge. The former narrow-gauge main line from Sarajevo to Beograd closed in 1974. This cross-border section of the Šargan Eight tourist railway opened in 2010. The main tourist service runs between Mokra Gora and Šargan Vitasi within Serbia. Because of the need to arrange in advance for border control officials the cross-border section between Mokra Gora and Višegrad used to be covered only by chartered trains, however a scheduled service started operating during 2022 on weekends between 28th August and 30th October and this is repeated for 2023 across the same date range.
4. (Požega -) Jablanica ŽS - Štrpci ŽRS - Rača ŽS (- Podgorica): The line crosses the border twice, with one station within Bosnia-Herzegovina at Štrpci. ŽS operates all trains.

1.2.5 ERTMS implementation

ERTMS ("European Rail Traffic Management System") is the European standard for the Automatic Train Protection (ATP) and command and control systems, it is a safety system that enforces compliance from trains with speed restrictions and signalling status. Due to its nature and the required functions, at present this system is partly installed trackside and partly installed onboard.

There are no ERTMS deployment plan in Bosnia and Herzegovina and there are no ERTMS in operation throughout the entire network.

1.2.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out related to the Bosnian railway system, by type of impact.

[10] Železnice Srbije (ŽS, Serbian Railways) is a Serbian engineering and technical consulting company based in Belgrade, Serbia.

Table 7 Bosnia and Herzegovina: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
BOSNIA AND HERZEGOVINA	Many lines are still single-track including Corridor 'sections					
	Maximum train length is limited to 300m					
	Maximum speed between 50km/h to 70 km/h					
	ERTMS not implemented on the entire network					
	Very limited number of lines and network length (1000km)					

1.3 Montenegro

1.3.1 Rail network overview

The railway network extends for 250 km long almost all electrified at 25 kV, 50 Hz AC (225km). The network has standard gauge of 1,435mm. Maximum allowable speeds remain low and range between 50 km/h and 100 km/h while the fact that the rail lines are single track reduces their capacity and allowable frequencies of operations.

The network consists of three railway lines converging in Podgorica, which can be considered as the hub of railway national network.

Railway network of Montenegro is single line. Width of all tracks of railway network of Montenegro is 1435 mm. Railway line of Montenegro are the category D4. The name of official places of the network managed by ŽICG (Željeznica Crne Gore) the state railway company of Montenegro., their geographical location, the distance between the maximum allowed length of trains are given in the following tables.

Table 8 Distance between official places and the maximum allowed speed in line. [Source: The Network Statement 2019, https://www.zicg.me//osnovni-podaci/izjava-o-mrezi?l=en]

Name of station / section	km position	Section length (m)	Interstation distance (m)	Maximum allowed speed (km/h)
1	2	3	**4**	5
State border - Bijelo Polje - Bar				
State border	287+438,70		**9.498,80**	
State border – Bijelo Polje		9.498,80		
Bijelo Polje	296+937,50			80
Bijelo Polje - Lješnica		2.930,50		80
Lješnica	299+868			80
Lješnica - Kruševo		4.369,00		80
Kruševo	304+237			80
Kruševo - Ravna Rijeka		4.093,00		80
Ravna Rijeka	308+330			80
Ravna Rijeka - Slijepač Most		2.140,00	**24.401,21**	80
Slijepač Most	310+470			80
Slijepač Most - Mijatovo Kolo		3.163,53		80
Mijatovo Kolo	313+633,53			80
Mijatovo Kolo - Ţari		2.966,47		80
Ţari	316+600			80
Ţari - Mojkovac		4.738,71		80
Mojkovac	321+338,71			80
Mojkovac - Štitarička Rijeka		3.077,29		80
Štitarička Rijeka	324+416			80
Štitarička Rijeka - Trebaljevo		6.699,46		80
Trebaljevo	331+115,46		**19.311,26**	80
Trebaljevo - Oblutak		3.684,54		80
Oblutak	334+800			80
Oblutak - Kolašin		5.849,97		80
Kolašin	340+649,97			80
Kolašin - Padež		3.190,03		50
Padež	343+840			50
Padež - Mateševo		3.310,00		50
Mateševo	347+150			50
Mateševo - Kos		4.317,75	**18.145,28**	50
Kos	351+467,75			50
Kos - Selište		2.542,25		50
Selište	354+010			50
Selište - Trebešica		4.785,25		50
Trebešica	358+795,25			50
Trebešica - Kruševački Potok		5.694,75		50
Kruševački Potok	364+490		**46.347,79**	50
Kruševački Potok - Lutovo		5.114,39		50
Lutovo	369+604,39			50

Table 9 The maximum allowed train length. [Source: The Network Statement 2019, https://www.zicg.me//osnovni-podaci/izjava-o-mrezi?l=en]

Official places	Vehicular direction A → B (direction as per name of line)		Vehicular direction B → A (direction opposite name of line)	
	Maximum allowed train length [m]	The longest train acceptance tracks	Maximum allowed train length [m]	The longest train acceptance tracks
1	2	3	4	5
DG - Bijelo Polje - Bar				
Bijelo Polje	694	3. 4. and 5.	694	3. 4. and 5.
Kruševo	657	2. and 3.	669	2. and 3.
Mijatovo Kolo	553	2. and 3.	556	2. and 3.
Mojkovac	505	2. 3. and 4.	506	2. , 3. and 4.
Trebaljevo	573	1.and 2.	572	1.and 2.
Kolašin	601	3. and 4.	601	3. and 4.
Kos	592	2. and 3.	594	2. and
Trebešica	578	3. and	577	3. and 4.
Lutovo	532	2. and 3.	532	2. and 3.
Bratonoţiéi	508	2. and 3.	509	2. and 3.
Bioče	510	1.and 2.	507	1.and 2.
Podgorica	665	4. 5. 6. 7.and 8.	635	3. 4. 5. 6. 7.and 8.
Golubovci	589	2. 3. and 4.	598	2. 3. and 4.
Zeta	595	2. and 3.	594	2. and 3.
Virpazar	698	2. 3. and 4.	687	2. 3. and 4.
Sutomore	569	2. i 3.	590	2. and 3.
Bar	700	1. 2. and 3.	700	1. 2. and 3.
Nikšić - Podgorica				
Nikšić	610	2.	467	2.
Ostrog (STO)	532	3.	532	3.
Danilovgrad	537	1.2.3.	537	1.2.3.
Spuţ	620	3.	620	3.

Valid technical norms of the ŽICG network are the following: allowed axle load on all railway lines is 22,5 t per exle, allowed load per meter on all railway lines is 8 t, gauge on the railway network in Montenegro is GB (UIC leaflet 506). Relevant gradients and resistances per sections are given in Table 10, power supply - single phase system - 25 kV, 50 Hz.

Table 10 The paramount gradients and line resistances. [Source: The Network Statement 2019, https://www.zicg.me//osnovni-podaci/izjava-o-mrezi?l=en]

Route section	Vehicular distance A → B			Vehicular distance B →		
	Paramount gradient		Paramount line resistance [daN/t]	Paramount gradient		Paramount line resistance [daN/t]
	Incline [~]	Decline [~]		Incline [~]	Decline [~]	
1	2	3	4	5	6	7
1. State border - Bijelo Polje - Bar						
State border – Bijelo Polje	8	5	8	5	8	5
Bijelo Polje - Kruševo	18	6	19	6	18	7
Kruševo - Mijatovo Kolo	18	0	19	0	18	0
Mijatovo Kolo - Mojkovac	16	10	19	10	16	12
Mojkovac - Trebaljevo	18	0	19	0	18	0
Trebaljevo - Kolašin	17	2	18	2	17	3
Kolašin - Kos	2	17	3	17	2	20
Kos - Trebešica	0	24	0	24	0	26
Trebešica - Lutovo	0	24	0	24	0	26
Lutovo - Bratonoţiéi	0	24	0	24	0	26
Bratonožići - Bioče	0	24	0	24	0	25
Bioče - Podgorica	2	25	4	25	2	25
Podgorica - Golubovci	0	6	0	6	0	6
Golubovci - Morača	0	1	0	1	0	1
Morača - Zeta	0	1	0	1	0	2
Zeta - Vranjina	0	1	0	1	0	1
Vranjina - Virpazar	1	2	2	2	1	3
Virpazar - Crmnica	8	0	8	0	8	0
Crmnica - Sutomore	4	3	5	3	4	4
Sutomore - Bar	0	8	0	8	0	8
2. Nikšić - Podgorica						
Nikšić – Ostrog	0	3	0	3	0	3
Ostrog - Danilovgrad	1	25	2	25	1	26
Danilovgrad - Spuž	8	7	8	7	8	7
Spuž - Podgorica	7	6	8	6	7	7
3. Podgorica – Tuzi – State border						
Podgorica – Tuzi	6	7	6	7	6	8
Tuzi – State border	6	7	7	7	6	7

Trains operation, including signaling, regulation, receipt and dispatch of trains, communication regarding the train's operation on the railway network, is managed by the signaling and safety devices and telecommunications facilities.

Managing and regulation of traffic on Bijelo Polje – Bart railway line and Podgorica – Tuzi railway line is realized via electrical relay system "SIMENS – EI"with inter-station distance control based on axles counter principles.

On railway line Niksic – Podgorica, management and regulation of traffic is carried out by remote control management system with signal boxes ESA -11 with control the inter station system through electronic sensors, located in the station Podgorica.

Railway line Bijelo Polje – Bar is equipped by rail dispatching devices, "Siemens'' production and by three dispatching command centrals in Podgorica in order to make communication between transport personnel.

In the railway line Nikšić – Podgorica, the railway stations have been equipped by rail dispatching devices of Slovak production "Inoma comp"and they can work in local and telecommand system as well (this relates to official communications as weel as for train announcement).

Figure 8 The Montenegro Rail Network [Source: Preparation of Transport Development Strategy – Montenegro, Ministry of Transport and Maritime Affairs of Montenegro]

Bar–Vrbnica (border with Serbia), with a length of 168.16 km is the backbone of the Montenegrin railway system, open for passenger and cargo transport. The maximum allowable axle weight is 22.5 t (UIC track class D). This line is part of the international railway line Belgrade–Bar (South-East European Transport Observatory - SEETO Route 4) connects the port of Bar with trans-European corridors VII and X and is one of the most important transportation routes for the economy of Montenegro. The roughness of the

Montenegrin territory appears from the profile of the Bar-Vrbnica railway: the line features the highest railway viaduct in Europe (the Mala Rijeka viaduct) and the 6.2 km long Sozina tunnel and about one-third of the Montenegrin part of line is in a tunnel or on a viaduct.

Podgorica–Tuzi-border with Albania (to Shkodër and Tirana), length 24.70 km, only used for cargo transport and not electrified. Due to the conditions of the line, the maximum speed was reduced from 80 km/h to 60 km/h. There are plans to reconstruct the railway and introduce passenger traffic between Montenegro and Albania.

Podgorica–Nikšić, length 55.90 km was thoroughly reconstructed and electrified in 2006-2012 so passenger transport was established. Operating speeds on the Nikšić-Podgorica line range between 75 km/h and 100 km/h.

There are no railway connections with Montenegro's northern regions as well as with Bosnia and Herzegovina, while the railway connection with Albania needs major upgrade on both sides of the border to be able to handle passenger traffic.

The proposal for the extension of the Tran European Transport Networks (formalized in the Regulation (EU) 2016/758 which amends annex III of Regulation (EU) 1315/2013) plan extension of the Mediterranean Core Network Corridor in the territory of Montenegro. The Montenegrin railway sections included in the possible extension of the Mediterranean CNC could be divided into two different stretches, the first one linking Podgorica to Albania, passing through Tuzi border station, and the second one connecting the Montenegrin Capital to the port of Bar, currently classified as Core Seaport.

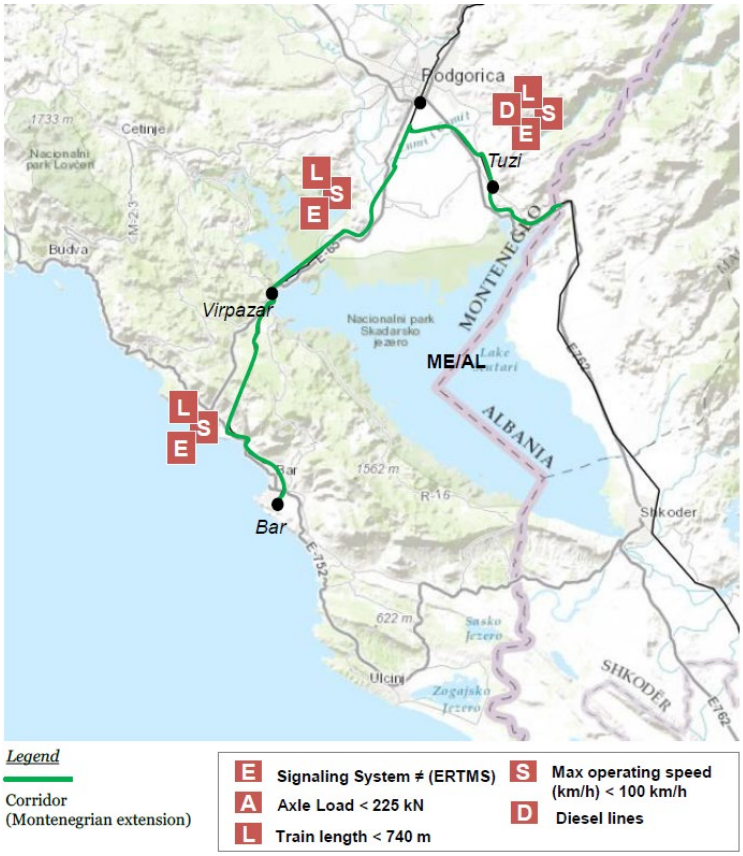

Figure 9 Mediterranean Core Network Corridor in Montenegro: railway [Source: Study on Mediterranean TEN-T Core Network Corridor 2nd Phase, European Commission]

According to the Study on Mediterranean TEN-T Core Network Corridor European Commission), The entire alignment is characterized by single track railway sections, with maximum permissible axle load of 225 kN and track gauge compliant to the European standards (UIC 1435 mm.). Montenegrin rail stations do not have adequate overtaking length sections to handle 740 m long freight trains.

On the other hand, the interoperability of these railway links is limited by the lack of compliance with the requirements defined by Regulation (EU) no. 1316/2013 with respect to other technical parameters relevant

for ensuring competitiveness of freight railway transport services. In this regard, it should be noted that these sections are characterized by diesel traction with maximum operating speed limited to 60-80 km/h, allowing to run trains not longer than 300-500 meters.

To date there are no railway connection between Montenegro and Bosnia and Herzegovina, which represent interruption of the MED Corridor.

Table 11 Length of the rail network in Montenegro (2020)

Sections	Interoperability of Montenegrin railway sections
Podgorica-Tuzi	Single track section, designed with Standard track gauge (1435 mm), with maximum axle load of 225 kN Low technical standards compared to EU requirements: • Diesel traction • Maximum admissible train length is about 500 m. • Maximum operating speed is about 60 km/h • ERTMS still not implemented
Podgorica-Virpazar	Single electrified track section, designed with Standard track gauge (1435 mm), with maximum axle load of 225 kN Low technical standards compared to EU requirements: • Maximum admissible train length is about 300 m. • Maximum operating speed is about 80 km/h • ERTMS still not implemented
Virpazar-Bar	Single electrified track section, designed with Standard track gauge (1435 mm), with maximum axle load of 225 kN Low technical standards compared to EU requirements: • Maximum admissible train length is about 300 m. • Maximum operating speed is about 80 km/h • ERTMS still not implemented

1.3.2 Main rail Intermodal freight terminals

The port of Bar is in the southern part of Montenegrin coast. It can be considered as the main intermodal terminal in Montenegro. Bar is a part of core seaport network and the extension of the Trans-European transport network (TEN-T) to the countries of the Western Balkans.

Currently, the port of Bar is hindered by inefficient connection with the railway network and the pier and passenger terminal expansion lack as well on capacity.

In the last years, there was the privatization of a part of the Port of Bar (Port of Adria) with respect to cargo transhipment and containers, while privatization of the remaining part of the port (Luka Bar), which deals with transhipment of bulk, dangerous, liquid, Ro-Ro [11]cargo and passenger traffic, was halted.

[11] Roll-on/roll-off (RORO or ro-ro) ships are cargo ships designed to carry wheeled cargo, such as cars, motorcycles, trucks, semi-trailer trucks, buses, trailers, and railroad cars, that are driven on and off the ship on their own wheels or using a platform vehicle, such as a self-propelled modular transporter.

Port of Bar JSC possesses:

- a Grain Terminal, with a 30,000 tons capacity silo and a 250 m long closed transport conveyor belt, running parallel and directly along the railway lines, designed for loading/unloading of grain to/from the silo.
- a General Cargo terminal with closed storage and cold storage areas.
- a Ro–Ro terminal designed to accept, store and dispatch Ro–Ro cargo units (complete road trucks or units of truck-trailers and semitrailers).
- a Passenger Terminal with five berths for passenger ships and ferryboats, as well as terminal for liquid cargo for the reception and dispatch of oil and oil derivatives.

1.3.3 Rail traffic volumes (passengers and freight)

Due to the network status, the only passenger services run on the Bar–Vrbnica and Podgorica–Nikšić lines. There are three service categories:

- local (trains call at all stations),
- fast (trains call at selected stations)
- international (Bar-Podgorica-Beograd Intercity line) trains.

As regards rail traffic, according to the National Institute of Statistics (Monstat) the total of passenger was 927 thousand in 2017, 992 thousand in 2018 and 986 thousand in 2019.

Rail freight transport felt up and down in the last years: 988 thousand tons in 2015, 1395 thousand tons in 2016, 1,603 thousand tons in 2017, 967 thousand tons in 2018, 1,132 thousand tons in 2019.

1.3.4 Border checkpoints infrastructural and operative characteristics

According to Transport Development Strategy of Montenegro 2019-2035, given the organizational conditions of international passenger rail transport between neighbouring countries (whereas every operator may accept passengers at precisely designated stations, while charging of train tickets is conducted by Montenegrin staff), there are rather possibilities for making profit by operators from neighbouring countries by operating within the Montenegro national network.

Public transportation agreement signed between state representatives and transport operators stipulate reimbursements for local trains, to satisfy public interest for transport routes which are not economically sustainable.

Main rail border crossing points are the following:

- Railway station Bijelo Polje, at border with Serbia, for passengers and freight purpose
- Railway station Tuzi, at border with Albania, for freight purpose

Below are the existing lines in detail.

Border Crossings with Albania:

- (Shkodër -) Bajzë HSH[12] (- Hani i Hotit HSH) - Tuzi ŽCG [13](- Podgorica): There is no station at the Hani i Hotit border crossing, border controls being carried out at either Tuzi or Bajzë. As in October 2019, the main freight traffic was scrap metal from Albania to Montenegro. More recently however the line in Albania has been subject to severe speed and weight restrictions and on the Montenegrin side, has been reported to look very rusty, so traffic is assumed currently to be negligible.

Border Crossings with Serbia:

- (Podgorica -) Bijelo Polje ŽCG - Vrbnica ŽS[14] (- Požega): ŽS operates to Bijelo Polje. From the 2015/2016 timetable period only the through Beograd - Bar services have run across the border.

1.3.5 ERTMS implementation

ERTMS ("European Rail Traffic Management System") is the European standard for the Automatic Train Protection (ATP) and command and control systems, it is a safety system that enforces compliance from trains with speed restrictions and signalling status. Due to its nature and the required functions, at present this system is partly installed trackside and partly installed onboard.

Montenegro has implemented EUs Interoperability Directive in its legislation. However, a dedicated ERTMS strategy does not yet exist and there are no ERTMS in operation throughout the entire network. Current deployment of ERTMS optical fibre has been installed along the Bar –Podgorica –Bijelo Polje line. Also, in railway station Podgorica, the installation of ECTS (European Train Control System) level 1[15] equipment is planned. The ETCS, one of two ERTMS system, is a train control standard, based on in-cab equipment able to supervise train movements and to stop it according to the permitted speed at each line section, along with calculation and supervision of the maximum train speed at all times. Information is received from the ETCS equipment beside the track (balises or radio) depending on the operation level. The driver's response is continuously monitored, and if necessary, the emergency brakes would be taken under control.

1.3.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out related to the Montenegrin railway system, by type of impact.

[12] Hekurudha Shqiptare (HSH, Albanian Railways) is the public railway transport company, state-owned until 2000, and subsequently a public company with entirely state capital.

[13] Željeznica Crne Gore (ŽCG, railways of Montenegro) is the state railway company of Montenegro. It operates all 331km of the country's rail network.

[14] Železnice Srbije (ŽS, Serbian Railways) is a Serbian engineering and technical consulting company based in Belgrade, Serbia.

[15] "Level 1 involves continuous supervision of train movement (the onboard computer is continuously supervising the maximum permitted speed and calculating the braking curve to the end of movement authority) while non-continuous communication occurs between train and trackside, generally through Eurobalises. Lineside signals are necessary. Train detection and train integrity checks (the train is complete and has not been accidentally split) are performed by the trackside equipment beyond the scope of ERTMS." [Source: https://transport.ec.europa.eu/transport-modes/rail/ertms/how-does-it-work/etcs-levels-and-modes_en]

Table 12 Montenegro: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
MONTENEGRO	All lines are single-track including Corridor 'sections					■
	Maximum train length is limited to 500m (many section <300m)	■				■
	Maximum speed between 50km/h to 100 km/h					■
	ERTMS not implemented on the entire network	■	■			■
	Very limited number of lines (only three lines converging in the Capital Podgorica) and network length (250km)			■		■
	Some sections are not electrified including the Corridor 'section Podgorica-Tuzi	■			■	

1.4 Serbia

1.4.1 Rail network overview

The Serbian railway system consists of 3,739 km of rails of which 295 km is double track (7.9% of the network). The electrified part of the network (electrification: 25 kV AC, 50 Hz) consist of 1,280 km of line (33.6% of the network), partially in double track (294km) and most of it still in single track (984 km). The network has standard gauge of 1435mm for the entire extension.

The main lines overlap the Pan-European rail Corridor X, which goes through Austria, Hungary, Croatia, Serbia and continue to the south crossing North Macedonia, Bulgaria and Greece. In Serbia the Corridor extends for 872 km, which represent 23% of the overall Serbian network.

The core of the network is the capital Beograd. In 2018, a new through central station known as 'Prokop' was opened in place of the former terminal station. The new station represents an important step towards the reorganization of railways in Beograd. The new station is served both by domestic and international trains.

Railway signals provide signals by means of which railway staff can mutually communicate in a fast and reliable way about train operation, shunting, permitted and forbidden running via a certain location, the track condition, the need for speed restriction, etc. Some signals are used for preserving of personal safety of railway staff and other persons. Signalling Regulations (Regulations No. 1, published in the "Official Gazette of ZJZ" No. 4/96) are applicable regarding the use of signals and signal identification with corresponding amendments, corrections and interpretations.

On IZS network, all main arterial routes are equipped with fully centralized electrical relay signalling & interlocking equipment, as follows:

- Belgrade-Nis-Presevo: Siemens SpDrS-64/JZ track circuit system
- Belgrade Resnik-Vrbnica: Siemens SpDrS-64/JZ axle counter system

- Belgrade-Sid: Siemens SpDrS-64/JZ track circuit system
- Indjija-Subotica: Westinghouse track circuit system

The main arterial routes Sid-Belgrade-Nis-Presevo and Belgrade-Vrbnica are included in the system of remote traffic control and supervision – remote control centre (manufactured by Westinghouse). There are three remote control centres - in Belgrade, Pozega and Nis. Based on this device 3 remote control centres were built in Bekgrade, Nis and Pozega with total of 140 controlled stations.

Dimitrovgrad Station (the railway line Nis-Dimitrovgrad-State border) is equipped with electronic signalling & interlocking device Simis-W with Iltis control & supervision system manufactured by Siemens.

Stations Belgrade Centre, Pancevo Glavna and Cuprija are equiped with electronic signalling & interlocking devices.

Other lines are equipped with the above stated interlocking types, but there is no continuity as regards one system of interlocking.

The following table shows the railway network section and some of the main characteristics.

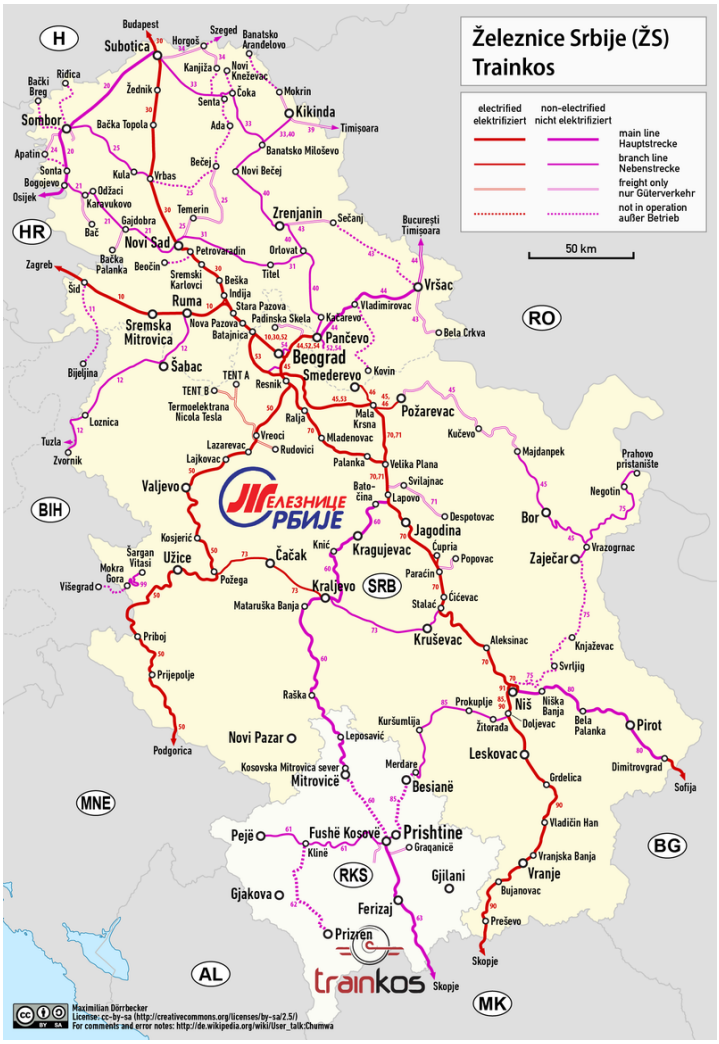

Figure 10 Serbian railway network. [Source: Wikipedia.org]

Table 13 Rail network in Serbia (2020)

RAILWAYS	LENGTH	TRACKS	ELECTRIFICATION
Belgrade – Ruma – Border with Croatia near Šid	120 km	2	yes
Belgrade – Niš – Border with North Macedonia near Preševo	398 km	1/2	yes
Belgrade – Mala Krsna – Velika Plana	102 km	1	yes
Belgrade – Novi Sad – Border with Hungary near Subotica	183 km	1/2	yes
Niš – Border with Bulgaria near Dimitrovgrad	104 km	1	no
Belgrade – Pančevo – Border with Romania near Vršac	102 km	1/2	partially
Belgrade – Valjevo – Užice – Border with Montenegro near Prijepolje	299 km	1	yes
Lapovo – Kragujevac – Kraljevo – Boundary line with Kosovo & Metohija near Rudnica	153 km	1	no
Subotica – Sombor – Border with Croatia near Bogojevo	87 km	1	no

The proposal for the extension of the Tran European Transport Networks (formalized in the Regulation (EU) 2016/758 which amends annex III of Regulation (EU) 1315/2013) plan extension of the Mediterranean Core Network Corridor in the territory of Serbia between Sid to Belgrade with a total length of about 110 km, entirely electrified (25 Kv, 50 Hz) with an axle load of 22,5 tons per axis. This stretch is operated by passenger and freight services, with higher traffic flows from Stara Pazova Station up to Belgrade, about 1.6 pax/year and 4.9 tons/year in 2016.

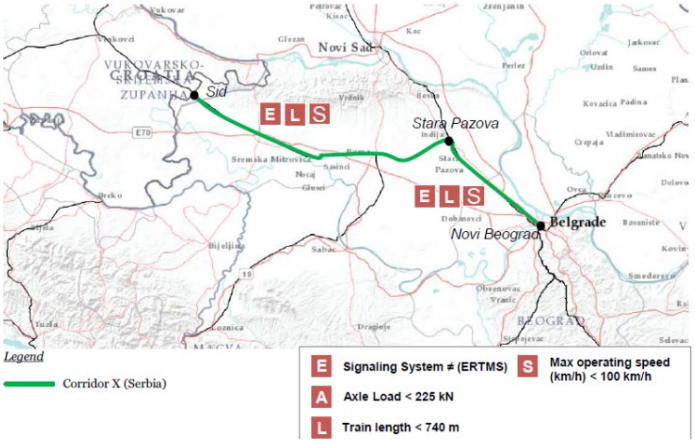

Figure 11 Mediterranean Core Network Corridor in Serbia: railway [Source: Study on Mediterranean TEN-T Core Network Corridor 2nd Phase, European Commission]

According to the Study on Mediterranean TEN-T Core Network Corridor European Commission), the main critical issues, regards the lack of maintenance which caused a reduction of the performance of the railway line. Therefore, the maximum allowed speed (50km/h) is currently highly below the originally designed one (120km/h). Other bottlenecks refer to the low quality of the signaling system (ERTMS still not deployed) and the impossibility to run trains with a total length above 500m.

Table 14 Interoperability of Serbian railway sections (2020)

SECTIONS	INTEROPERABILITY OF SERBIAN RAILWAY SECTIONS
Sid-Stara Pazova	Low technical standards compared to EU requirements: • The maximum admissible speed is about 50 km/h. • Maximum admissible train length is about 500 m. • ERTMS still not implemented
Stara Pazova-Novi Beograd	Low technical standards compared to EU requirements: • The maximum admissible speed is about 50 km/h. • Maximum admissible train length is about 500 m. • ERTMS still not implemented. • Lack of capacity foreseen in 2030 (REBIS Study)

1.4.2 Main rail intermodal freight terminals

According to the 2019 Network statement of Serbian railways, on the public railway network there is only one intermodal transport terminal located within the Belgrade Marshalling Yard, until the reconstruction of station Belgrade Marshalling Yard and the construction of terminal ŽIT within station tracks. The riverports with rail connections and open for international traffic are in Beograd, Novi Sad, Pancevo, Prahovo, Smederevo Senta. There are also some freight train formation yards, where trains may be split or joined: Novi Sad, Ranžirna, Beograd Ranžirna, Lapovo Ranžirna and Niš Ranžirna. Beside marshalling and distribution yards, train formation can be performed in other stations depending on available capacities of stations and planned volume of traffic.

The term ''freight terminals'' on the railway network operated by Serbian Railways Infrastructure (IŽS), means all the railway service points used for freight operations where loading and unloading as well as transhipment operations are carried out. The following types of terminals are distinguished: stations and transport

forwarding, terminals for intermodal freight transport, port terminals. Combined transport on railway network can be performed at terminals for combined transport and at port terminals.

Table 15 Stations connected to freight terminals. [Source: Infrastructure of Serbian Railways JSC, Network Statement 2021]

n.	Railway station connected to the terminal	Freight terminal for combined transport
1	Beograd Ranžirna (Belgrade Marshalling Yard)	ŽIT Beograd
2	Beograd Donji Grad	Luka (Port) Beograd
3	Surčin	Nelt
4	Novi Sad Ranžirna (Novi Sad Marshalling Yard)	Luka (Port) NoviSad
5	Pančevo Varoš	Luka (Port) Dunav
6	Smederevo	Luka (Port) Smederevo
7	Prahovo Pristanište	Luka (Port) Prahovo
8	Senta	Luka (Port) Senta
9	Sremska Mitrovica	Luka (Port) Leget
10	Šabac	Luka (Port) Zorka Šabac

1.4.3 Rail traffic volumes (passengers and freight) and characteristics

Since August 2015, three state companies have been operating on the railway market:

- Serbian Railways Infrastructure JSC - public railway infrastructure asset management company.
- Serbia Train JSC – the national rail passenger transport company.
- Serbia Cargo JSC - the national rail freight transport company. Beside these companies, several private freight operators run on Serbian railways.

Several train categories run in Servia, in particular:

- Eurocity: international express trains running on main lines and calling at main cities.
- Brzi: domestic and international express trains running on main lines and calling at main cities.
- Intercity: domestic express trains running on the main lines and calling at main cities.
- Putnički voz: Regional trains running on all the lines and calling at all the stations.

The following Table 16 shows data of passenger transport and freight transport as available by the UNECE Transport Database.

Table 16. Railway passenger traffic by Passengers, Topic, Country and Year [Source: UNECE Transport Division Database]

	2015	2017	2019
Total			
Number of passengers (1000s)			
Serbia	6 258	5 638	5 062
Passenger kilometres (millions)			
Serbia	509	377	347
National transport			
Number of passengers (1000s)			
Serbia	5 908	5 346	4 763
Passenger kilometres (millions)			
Serbia	432	319	281
International transport			
Number of passengers (1000s)			
Serbia	350	292	299
Passenger kilometres (millions)			
Serbia	77	58	66

Table 17. Goods transported by rail in Serbia, 2016-2019. [Source: SERBIA RAILWAY SECTOR MODERNIZATION - SRSM Environmental and Social Management Framework for Serbia - ESMF]

International traffic	2016		2017		2018		2019	
	000 tons	%	000 tons	%	000 tons	%	000 tons	%
Containers	1,122	8.9	1,090	8.8	1,374	11.5	1,115	13.9
Empty wagons	2,338	18.6	2,174	17.6	2,073	17.3	1,300	16.2
Cereals, products of the milling industry, grains, seeds and fruits	345	2.7	394	3.2	344	2.9	356	4.4
Oil and its derivatives	1,270	10.1	1,004	8.1	799	6.7	435	5.4
Vehicles	244	1.9	181	1.5	124	1	70	0.9
Metals	1,469	11.7	1,713	13.9	2,010	16.8	1,389	17.3
Bulk cargo, ore and minerals	3,349	26.6	3,142	25.4	2,864	23.9	2,077	25.9
Chemicals	1,520	12.1	1,710	13.8	1,489	12.4	797	9.9
Sugar, residues and waste from the food industry, etc.	369	2.9	383	3.1	375	3.1	143	1.8
Wood, cellulose, paper	331	2.6	265	2.1	284	2.4	185	2.3
Building Materials	97	0.8	82	0.7	99	0.8	35	0.4
Others	149	1.2	223	1.8	128	1.1	130	1.6
Total	**12,602**	**100**	**12,361**	**100**	**11,962**	**100**	**8,032**	**100**

1.4.4 Border checkpoints infrastructural and operative characteristics

Serbian rail network is connected to all the neighbouring countries. Lack of interoperability, immigration policy and customs procedures are some of the main reasons that impede the efficient transport of people and goods between countries. This problem can be overcome by bilateral agreements between states, which would enable reduction of dwell time at the border crossings by using the integrated (joint) border procedures. Bilateral agreements have been signed with Montenegro and Republic of North Macedonia, but they are still not being used in practice because the station buildings are not adapted for such purposes. There is also bilateral agreement with Republic of Bulgaria which does not functioning because of Bulgarian side. Serbia has an intention of establishing a common border station with integrated procedures with all neighbouring countries. Below are the existing lines in detail.

Border crossing with Bosnia and Herzegovina:

1. (Bijeljina -) Velino Selo ŽRS[16] - Sremska Rača Nova ŽS[17] (- Šid): ŽS operated to Bijeljina, there was no connection to the rest of the railway system of Bosnia-Herzegovina. Passenger service over the whole route from Šid to Bijeljina ceased in June 2005. Note: this crossing was available to local passport holders only.
2. (Tuzla -) Zvornik Novi ŽRS - Brasina ŽS (- Ruma): this line was built in 1978 and carries ŽS freight traffic to a large works at Zvornik Novi. The route is shown wrongly, or not at all, on many maps, and runs from Rasputnica [= junction] Donja Borina, just south of Brasina on the Ruma - Zvornik Grad line, via a cross-border river bridge to Zvornik Novi. The line onwards from Zvornik Novi towards Tuzla is of even newer construction and was physically completed in January 1992 although not open to traffic until at least 1999 as a consequence of war in that region.
3. (Višegrad -) Vardište - Mokra Gora (- Šargan Vitasi): 760mm gauge. The former narrow-gauge main line from Sarajevo to Beograd closed in 1974. This cross-border section of the Šargan Eight tourist railway opened in 2010. The main tourist service runs between Mokra Gora and Šargan Vitasi within Serbia. Because of the need to arrange in advance for border control officials the cross-border section between Mokra Gora and Višegrad used to be covered only by chartered trains, however a scheduled service started operating during 2022 on weekends between 28th August and 30th October and this is repeated for 2023 across the same date range.
4. (Požega -) Jablanica ŽS - Štrpci ŽRS - Rača ŽS (- Podgorica): The line crosses the border twice, with one station within Bosnia-Herzegovina at Štrpci. ŽS operates all trains.

Border Crossings with Bulgaria:

1. (Sofia -) Kalotina BDŽ [18]- Dimitrovgrad ŽS (- Niš): BDŽ works generally trains to/from Dimitrovgrad, the present limit of electrification on this route. The train runs once or twice per week in each

[16] Željeznice Republice Srpske (ŽRS, Serbian Republic Railways) is the railway company of the Serbian Republic of Bosnia and Herzegovina. It consists in four radial lines: Doboj-Banja Luka: electrified single track 110 km with antennas for Banja Luka and Novi Grad; Doboj-Maglaj: electrified double single track, 23 km; Doboj-Samac: electrified single track, 60 km; Doboj-Petrovo Novo Selo: non-electrified single track 33 km.

[17] Železnice Srbije (ŽS, Serbian Railways) is a Serbian engineering and technical consulting company based in Belgrade, Serbia.

[18] Bălgarski dăržavni železnici (BDŽ, Bulgarian State Railways) is the state railway company of Bulgaria, it is the main passenger and freight railway operator in the country.

direction between Villach (Austria) and Edirne (Turkey), between May and November. Foot passenger bookings may also be made.

Border Crossings with Croatia:

1. (Dalj -) Erdut HŽ[19] - Bogojevo ŽS: The bridge over the river Danube was damaged in 1999 and was not repaired until 2006. Freight services via this route restarted in summer 2008 and passenger services on 14 December 2015.
2. (Vinkovci -) Tovarnik HŽ - Šid ŽS (- Beograd): HŽ normally works to Šid. The service from at least the 2018-2019 timetable period is one daytime pair plus a summer and Xmas/New Year overnight. Services were suspended from 16 March 2020 in response to coronavirus. The 2021-2022 timetable shows one pair of trains but with a note to the effect that they are currently not running, which is due to upgrade work taking place. The train runs once or twice per week in each direction between Villach (Austria) and Edirne (Turkey), between May and November. Foot passenger bookings may also be made.

Border Crossings with Hungary:

1. (Szeged -) Röszke MÁV[20] - Horgoš ŽS (- Subotica): Generally, MÁV works to Horgoš. The MÁV website states services were Suspended on 10 November 2015 and the track is now blocked by the border fence erected by Hungary. However, as in January 2020, modernisation work is in progress on the Serbian side of the border and the Hungarian government has requested tenders for work on its side. This includes electrification.
2. (Kiskunhalas -) Kelebia MÁV - Subotica ŽS: MÁV works to Subotica.

Border Crossings with Kosovo:

1. (Fushë-Kosovë/Kosovo Polje - Mitrovicë/Mitrovica - Zvečan -) Lešak - Rudnica ŽS (- Kraljevo): This route is used by two train pairs per day, operated by ŽS, between Kosovska Mitrovica Sever, Zvečan and Lešak (and on to Kraljevo).

Border Crossings with Montenegro:

1. (Podgorica -) Bijelo Polje ŽCG[21] - Vrbnica ŽS (- Požega): ŽS operates to Bijelo Polje. From the 2015/2016 timetable period only the through Beograd - Bar services have run across the border.

Border Crossings with North Macedonia:

2. (Skopje -) Tabanovci MŽ [22]- Preševo ŽS (- Niš): Generally, ŽS works to Tabanovci, though sometimes MŽ works to Preševo.

[19] Hrvatske Željeznice (HŽ, Croatian Railways) is the national railway company of Croatia.

[20] Magyar Államvasutak (MÁV, Hungarian State Railways) is the Hungarian national railway company, with divisions "MÁV START Zrt." (passenger services), and "Utasellátó" (onboard catering). The head office is in Budapest.

[21] Željeznica Crne Gore (ŽCG, railways of Montenegro) is the state railway company of Montenegro. It operates all 331km of the country's rail network.

[22] Makedonski Železnici (MŽ, Macedonian Railways) is the public enterprise for railways in the Republic of North Macedonia. Macedonian Railways operates 1,435 mm (4 ft 8+1⁄2 in) standard gauge rail tracks in North Macedonia and maintains 925 km (575 mi) of lines, 315 km (196 mi) of which are electrified with the 25 kV 50 Hz AC system.

1.4.5 ERTMS implementation

ERTMS ("European Rail Traffic Management System") is the European standard for the Automatic Train Protection (ATP) and command and control systems, it is a safety system that enforces compliance from trains with speed restrictions and signalling status. Due to its nature and the required functions, at present this system is partly installed trackside and partly installed onboard.

The implementation of the European Railway Traffic Management System (ERTMS) is on plan, however there are no ERTMS in operation throughout the entire network.

1.4.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out related to the Serbian railway system, by type of impact.

Table 18 Serbia: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
SERBIA	Just 7.9% of the network is double track					
	Maximum train length is limited to 500m					
	Maximum speed is limited to 50km/h in almost all sections					
	ERTMS not implemented on the entire network					
	Just 33.6% of the network is electrified					
	Some sections are not electrified including the Corridor 'section Podgorica-Tuzi					

1.5 Croatia

1.5.1 Rail network overview

The Croatian railway network extends for about 2,600 km representing one of longer in the Adriatic-Ionian regions, especially if compared to the Balkan countries, however, 90% is single track and only 36% is electrified (970 km with 25 kV - 50 Hz electrification system and 3 km with 3 kV electrification system).

According to the Transport Development Strategy of the Republic of Croatia, the morphology of the Croatian territory, which makes difficult to build close to the coastal area, together with the high degree of completion of the motorway network and the existence of several international airports reduce the competitiveness of rail service with other means and services.

According to National statistics, 31% of the network allow a maximum speed between 40 to 60 km/h, 20% speeds between 60 to 80km/h and 21% up to 100km/h. There is also section of high speed with maximum speed of 160km/h, but these are less than 10% of the network.

Part of the network suffer not to have good level of services and capacity, in particular the Istrian peninsula and the Dalmatia:

- section Pula – Buzet is not electrified and has single-track with no direct connection with the rest of Croatian network (the only way is a 'bypass' through Slovenia).
- Lika railway line (Lička pruga) is the only rail connection between the city of Zagreb and the city of Split and between Zagreb and the Dalmatian counties, furthermore the connection is not electrified and has single track.
- the port of Ploče does not have a direct connection to the Croatian railway network, however it is connected to it via Bosnia and Herzegovina.

Safety and signalling devices and means of telecommunication are used to operate train traffic, including signalling, control, reception and dispatch of trains, as well as communication in connection with train traffic on the railway network. Railway signals serve for signalling by means of which railway staff is able to mutually communicate in a fast and reliable way about train operation, shunting, forbidden and permitted running through a specific place, conditions on the line and the need for speed reduction. The Ordinance on Signals, Signalling Signs and Signalling Markings in Railway Traffic applies with respect to the use of signals and signalling marks. In accordance with the provisions of the Ordinance on Signals, Signalling Signs and Signalling Markings in Railway Traffic, the following exceptions are in force:

- permanent and portable signals and signalling markings are built in on the left side of the track in relation to the running direction, as follows:

Table 19 Permanent and portable signals and signalling markings. [Source: 2021 Network Statement, HŽ Infrastruktura]

Line	Station	Signal	Km position
M201 State border - Botovo - Dugo Selo		AB signal 061	13+841
M202 Zagreb Gk - Rijeka		AB signal 711	584+355
M602 Škrljevo - Bakar	Šoići	Entry signal B	6+366
	Šoići	Repeating signal PB	6+769
	Šoići	PS B	7+366
M603 Sušak - Rijeka Brajdica	Rijeka Brajdica	Entry signal A	1+844
		Distant signal repeater PpA	1+704

- Stations in which the "Shunting limit" signal is not installed are Zagreb Rk Station in M402 Sava – Zagreb Klara line.
- Stations where the signalling sign "Departure" as a circle of lighted green bulbs on the exit signal may be used for passenger trains dispatch are Zagreb Klara Station in M502 Zagreb Gk – Sisak – Novska line.
- Stations and level crossings where the distance between the control light signal and the level crossing is less than required are:

Table 20 Defective level crossing. [Source: 2021 Network Statement, HŽ Infrastruktura]

Line	Departure station	Level Crossing	km	Signal	Distance from level crossing [m]
L201 Varaždin - Golubovec	Golubovec	Novi Golubovec	33+685	KS2	33
L202 Hum-Lug – Gornja Stubica	Gornja Stubica	Gornja Stubica	12+477	KS2	23

Within the territory of the Republic of Croatia, Corridors belonging to the TEN-T network are defined according to the Decision on the Classification of Railroads of the Government of the Republic of Croatia (OG no.03/14):

- RH1. TEN-T core and comprehensive network (Pan European Corridor X), Salzburg –Thessaloniki.
- RH2. TEN-T Mediterranean corridor (Pan-European corridor Vb), Budapest –Rijeka.
- RH3. TEN-T comprehensive network (Pan European corridor Vc), Budapest –Ploče.

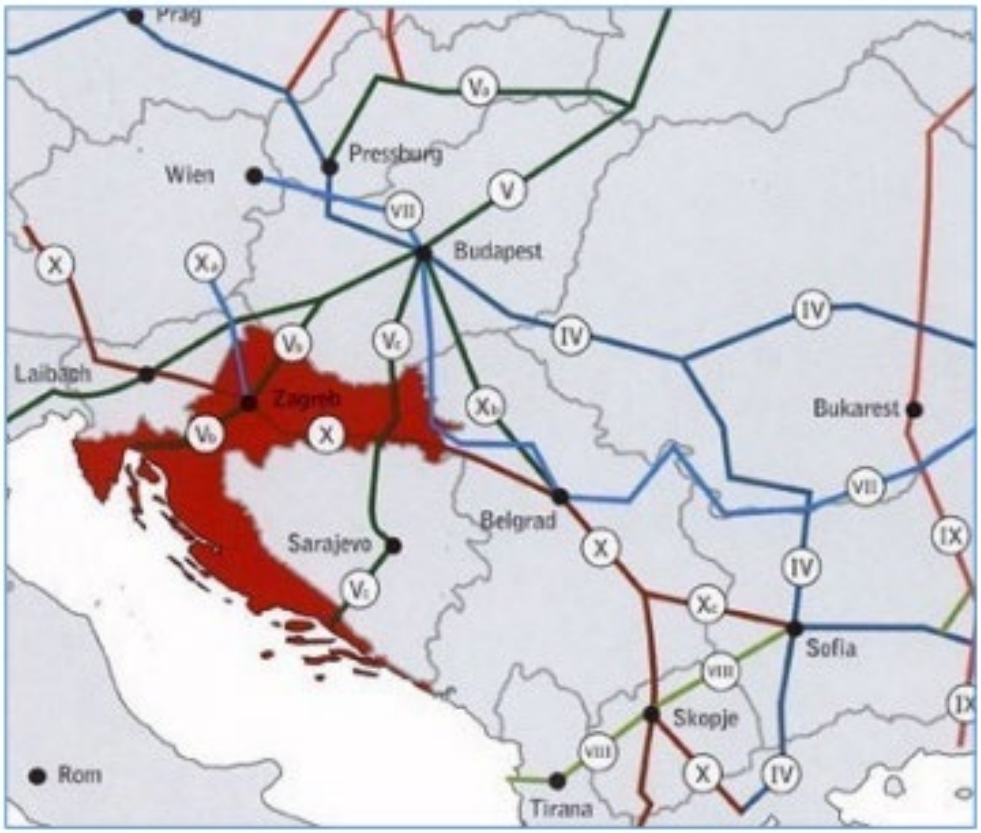

Figure 12 Map of international corridors. [Source: Transport Development Strategy of the Republic of Croatia (2017 – 2030)]

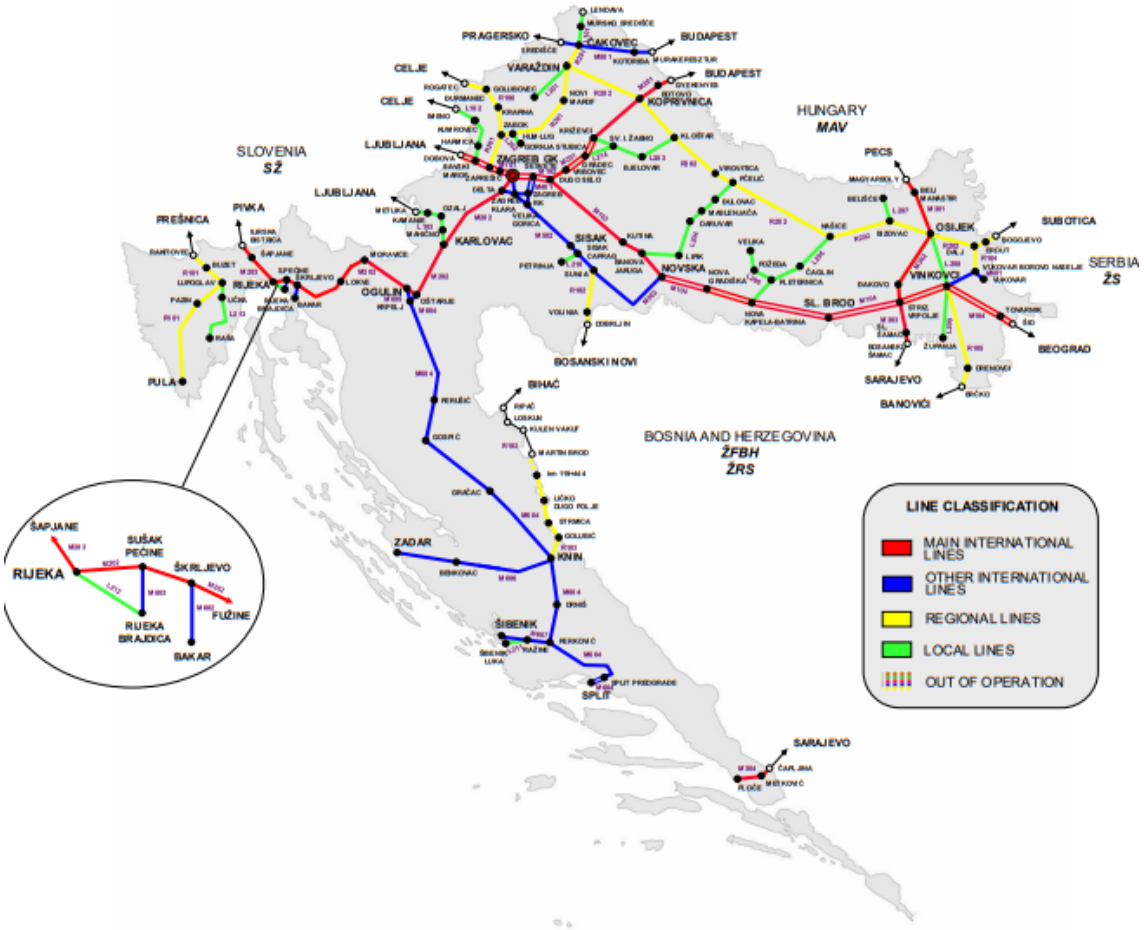

Figure 13 The Croatian Rail [Source: Croatian railway Infrastructure Ltd., Network Statement 2020, 2021]

The proposal for the extension of the Tran European Transport Networks (formalized in the Regulation (EU) 2016/758 which amends annex III of Regulation (EU) 1315/2013) plan extension of the Mediterranean Core Network Corridor in the territory of Croatia linking Zagreb to the Serbian Cross border (corresponding to the Pan European Corridor RH 1) with a total length of about 310 kilometres of double track line (except for the sections: Dugo Selo - Novska and Vrpolje-Slavonski Samac), entirely electrified (25 Kv, 50 Hz) with an axle load of 22,5 tons per axis.

According to the Study on Mediterranean TEN-T Core Network Corridor European Commission), The main limitation along this railway line is mainly related to the maximum admissible train length (not longer than 500m) as well as the several speed restrictions which hinder the smooth functioning of the corridor.

Table 21 Length of the rail network in Croatia (2020)

SECTIONS	INTEROPERABILITY OF CROATIAN RAILWAY SECTIONS
Zagreb-Dugo Selo	Double track line, electrified with axle load of 22,5 tons per axis Low technical standards compared to EU requirements: • Maximum admissible train length is about 525 m. • Maximum operating speed is about 50 km/h • ERTMS still not implemented

SECTIONS	INTEROPERABILITY OF CROATIAN RAILWAY SECTIONS
Dugo Selo-Vrpolje	Single track line up to Novska and equipped with double track from Novska to Vrpolje, entirely electrified with axle load of 22,5 tons per axis Low technical standards compared to EU requirements: • Maximum admissible train length is about 450 m. • Maximum operating speed is about 50 km/h • ERTMS still not implemented
Vrpolje-Slavonski Samak (HR/BA Cross border)	Single track line, electrified with axle load of 22,5 tons per axis Low technical standards compared to EU requirements: • Maximum admissible train length is about 650 m. • Maximum operating speed is about 45 km/h • ERTMS still not implemented
Vrpolje-Vikonvci-Tovarnik	Double track line, electrified with axle load of 22,5 tons per axis. With regard to the signalling system, ERTMS level 1 is in operation. Low technical standards compared to EU requirements: • Maximum admissible train length is about 585 m. from Vrpolje to Vikonvci and 700 from Vikonvci to Tovarnik • Maximum operating speed is about 95 km/h

1.5.2 Main rail intermodal freight terminals

Thanks to its position and geographic layout, Croatia has some important logistical terminals located in Zagreb and in the coastal cities.

The Port of Rijeka is the third Croatian most populated city and the country's main seaport with several terminals. The port is connected to both Motorways (A7 and A8) and railways (line codes M203, M602, M603).

The Port of Split is the largest passenger port in Adriatic Sea and the third in Mediterranean. Due to the lack of good rail connections (the M604 line is non electrified, single tracked and winding) the freight transport cannot be suitably handled by trains.

The Port of Ploče hosts the second biggest freight seaport in Croatia. About a quarter of goods are forwarded by rail, and the main destinations are the inner Balkan regions (mainly Bosnia and Herzegovina and Serbia).

Other important intermodal terminals are the riverports, in particular the Osijek Port is located on the Drava River and has been classified as a TEN-T comprehensive port. The traffic of goods and passengers in the port is increasing. The Osijek port has a great opportunity to become an intermodal logistic center due to the large port area and excellent potential from the point of view of the road and rail connections with the hinterland (both in Croatia and abroad).

The Slavonski Brod Port is located on the Sava River and has been classified as a TEN-T core port. The potential of Slavonski Brod, which is of particular importance for BIH, is largely dependent on the development of navigability of the Sava River in BiH and Serbia and/or on the construction of the Danube -Sava canal through Slavonia. Reliability and safety of navigation on the river Sava are crucial factors which influence the attractiveness of the port. The main goods transported are trans-shipment of crude oil together with general cargo. The current tendency shows that the crude oil traffic is decreasing, even though the general cargo is

increasing. The port area Slavonski Brod is closely linked to international road and rail corridors (X and Vc) and is situated on the border with Bosnia and Herzegovina. Due to that, this port is also becoming an intermodal node.

The Sisak Port is located on the Sava River and has been classified as a TEN-T comprehensive port. Reliability and safety of navigation on the river Sava are crucial factors which influence the attractiveness of the port. It is based on three locations: in the town Sisak on the river Kupa, on a location next the settlement Crnac on the river Sava, and in Galdovo on the River Sava. The potential of Sisak is largely dependent on the development of navigability of the Sava River in Bosnia and Herzegovina and Serbia and/or on the construction of the Danube -Sava canal through Slavonia. A new port of Sisak is planned south of the Crnac settlement. Cargo transport in the port is mainly related to the Sisak oil refinery, i.e., transportation of crude oil.

The Vukovar Port is located on the Danube River and has been classified as a TEN-T core port. Vukovar is an inland port that can service class 5 vessels. It has a VIc class of navigability. The traffic of goods and passengers in the port is increasing.

1.5.3 Rail traffic volumes (passengers and freight) and characteristics

The following Tables present the data of rail traffic in Croatia, both passengers and freight made available by the Croatian statistical office.[23]

Table 22. Transport of passengers and passengers-km [Source: Croatian Bureau of Statistics]

DRŽAVNI ZAVOD ZA STATISTIKU REPUBLIKE HRVATSKE / CROATIAN BUREAU OF STATISTICS		2010.	2011.	2012.	2013.	2014.	2015.	2016.	2017.	2018.	2019.
Ukupno[1)]	*Total [1)]*										
prevezeni putnici, tis.	*Passengers carried, '000*	140.350	117.548	94.397	93.139	90.815	88.810	86.791	85.889	85.020	84.096
putnički kilometri, mil.	*Passenger-kilometres, mln*	7.029	6.805	6.406	6.408	6.562	6.390	6.940	7.273	7.037	7.417
Željeznički prijevoz	*Railway transport*										
prevezeni putnici, tis.	*Passengers carried, '000*	69.564	49.983	27.669	24.265	21.926	21.683	20.742	19.832	20.271	19.854
putnički kilometri, mil.	*Passenger-kilometres, mln*	1.742	1.486	1.104	948	927	951	836	745	756	734
Cestovni prijevoz	*Road transport*										
prevezeni putnici, tis.	*Passengers carried, '000*	56.419	52.561	52.293	54.292	54.000	52.126	50.423	49.561	47.704	46.831
putnički kilometri, mil.	*Passenger-kilometres, mln*	3.284	3.145	3.249	3.507	3.648	3.377	3.802	4.150	3.843	4.022
Pomorski i obalni prijevoz	*Seawater and coastal transport*										
prevezeni putnici, tis.	*Passengers carried, '000*	12.506	12.926	12.474	12.770	13.029	13.082	13.525	14.315	14.821	15.142
putnički kilometri, mil.	*Passenger-kilometres, mln*	493	583	602	613	621	624	652	702	725	873
Zračni prijevoz	*Air transport*										
prevezeni putnici, tis.	*Passengers carried, '000*	1.861	2.078	1.961	1.812	1.860	1.919	2.102	2.181	2.224	2.270
putnički kilometri, mil.	*Passenger-kilometres, mln*	1.510	1.591	1.451	1.340	1.366	1.438	1.649	1.676	1.713	1.788

[23] https://web.dzs.hr

Table 23 Transport of goods and tons-km [Source: Croatian Bureau of Statistics]

DRŽAVNI ZAVOD ZA STATISTIKU REPUBLIKE HRVATSKE / CROATIAN BUREAU OF STATISTICS		2010.	2011.	2012.	2013.	2014.	2015.	2016.	2017.	2018.	2019.
Ukupno	*Total*										
prevezena roba, tis. t	*Goods carried, '000 t*	128.572	125.064	109.691	111.102	104.282	106.537	113.090	114.855	118.260	122.970
tonski kilometri, mil.	*Tonne-kilometres, mln*	175.910	168.326	137.921	140.036	120.700	136.627	128.569	124.764	124.394	119.053
Željeznički prijevoz	*Railway transport*										
prevezena roba, tis. t	*Goods carried, '000 t*	12.203	11.794	11.088	10.661	10.389	9.939	9.985	12.178	13.444	14.449
tonski kilometri, mil.	*Tonne-kilometres, mln*	2.618	2.438	2.332	2.086	2.119	2.183	2.160	2.592	2.743	2.911
Cestovni prijevoz	*Road transport*										
prevezena roba, tis. t	*Goods carried, '000 t*	74.967	74.645	65.439	67.500	66.146	66.491	72.503	72.329	73.997	81.110
tonski kilometri, mil.	*Tonne-kilometres, mln*	8.780	8.926	8.649	9.133	9.381	10.439	11.337	11.833	12.635	12.477
Cjevovodni transport	*Transport via pipelines*										
transportirano nafte i plina, tis. t	*Oil and gas transported, '000 t*	8.936	7.772	6.878	7.617	6.918	8.162	8.970	10.192	10.790	8.298
tonski kilometri, mil.	*Tonne-kilometres, mln*	1.703	1.477	1.216	1.485	1.447	1.740	1.921	2.111	2.315	1.675
Pomorski i obalni prijevoz	*Sea water and coastal transport*										
prevezena roba, tis. t	*Goods carried, '000 t*	31.948	30.348	25.636	24.744	20.335	21.376	20.951	19.579	19.435	18.296
tonski kilometri, mil.	*Tonne-kilometres, mln*	162.751	155.437	125.678	127.283	107.709	122.223	113.103	108.193	106.655	101.937
Prijevoz na unutarnjim vodnim putovima[1)]	*Inland waterway transport[1)]*										
prevezena roba, tis. t	*Goods carried, '000 t*	515	502	646	577	491	566	678	574	592	815
tonski kilometri, mil.	*Tonne-kilometres, mln*	56	46	43	47	42	40	45	34	44	51
Zračni prijevoz	*Air transport*										
prevezena roba, tis. t	*Goods carried, '000 t*	3	3	4	3	3	3	3	2	2	2
tonski kilometri, mil.	*Tonne-kilometres, mln*	2	2	3	2	2	2	2	2	2	2

1.5.4 Border checkpoints infrastructural and operative characteristics

Some Croatian railway lines are connected to the neighbouring countries through the following cross-border sections:

- Slovenia: 7 cross-border lines (line codes R101, M203, L103, M101, L102, R106, M501).
- Hungary: 3 cross-border lines (line codes M501, M201, M301).
- Serbia: 2 cross-border lines (line codes R104, M104).
- Bosnia and Herzegovina: 5 cross-border lines (line codes R105, M303, R102, R103, M304).

Line codes are illustrated in following figures.

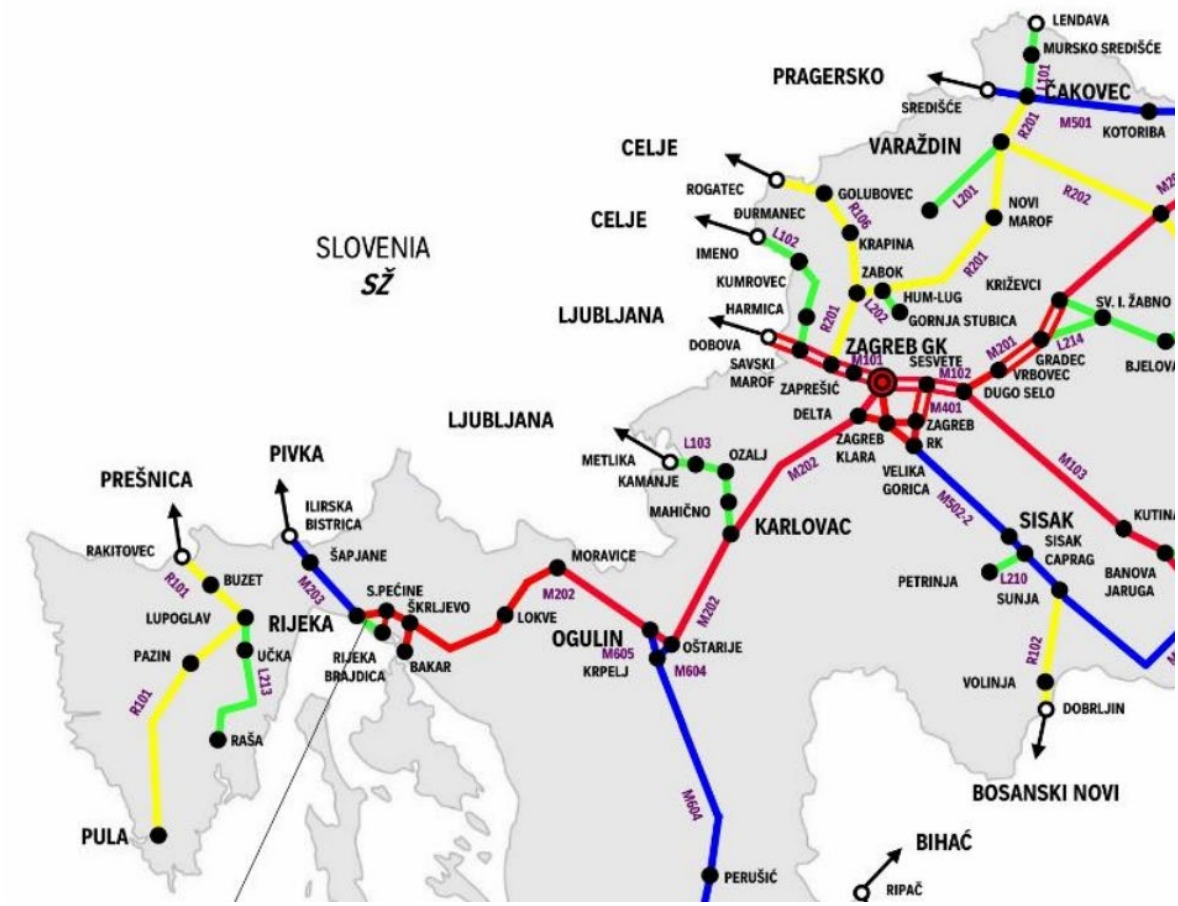

Figure 14 Slovenia border section. [Source: Network Statement, HŽ Infrastruktura]

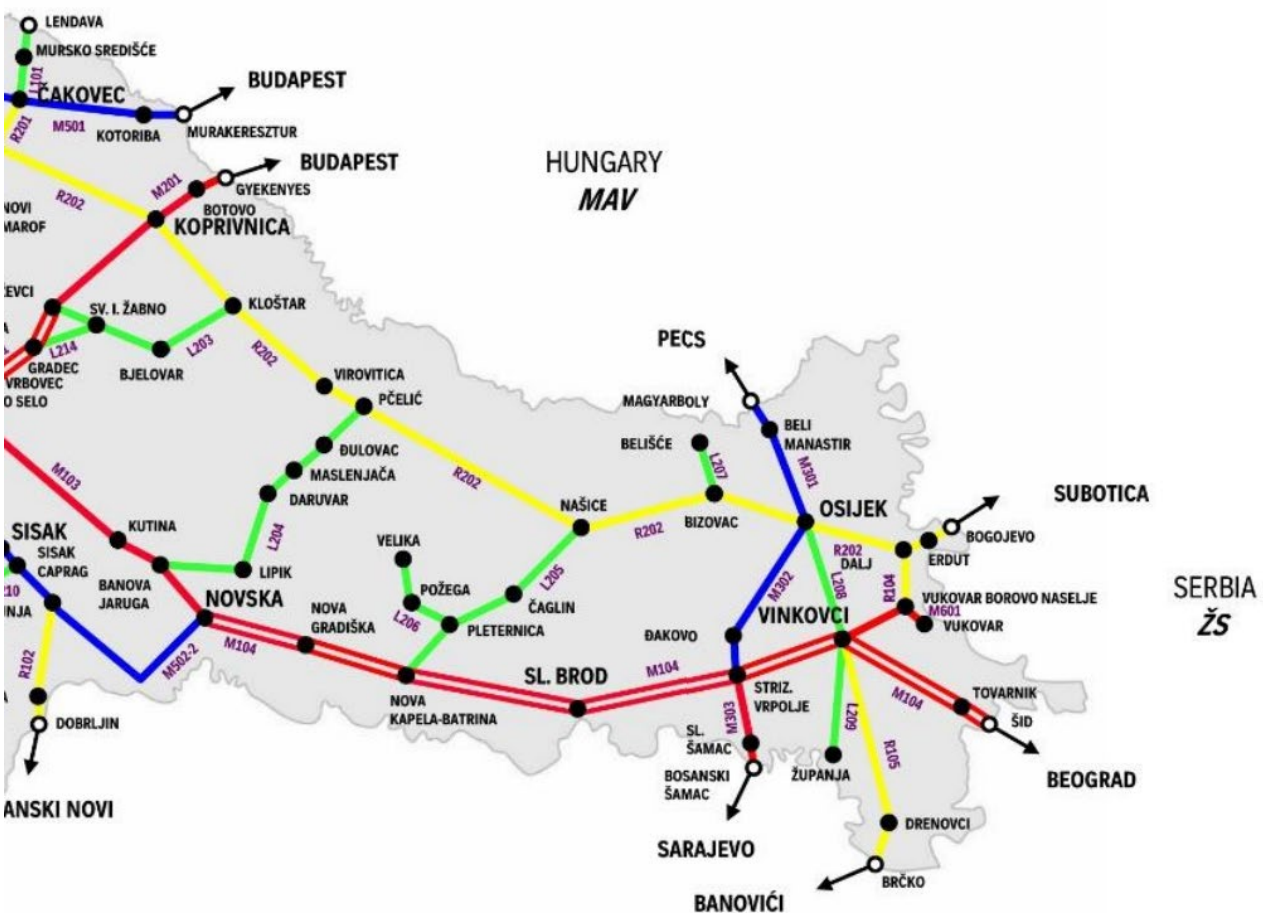

Figure 15 Hungary border section. [Source: Network Statement, HŽ Infrastruktura]

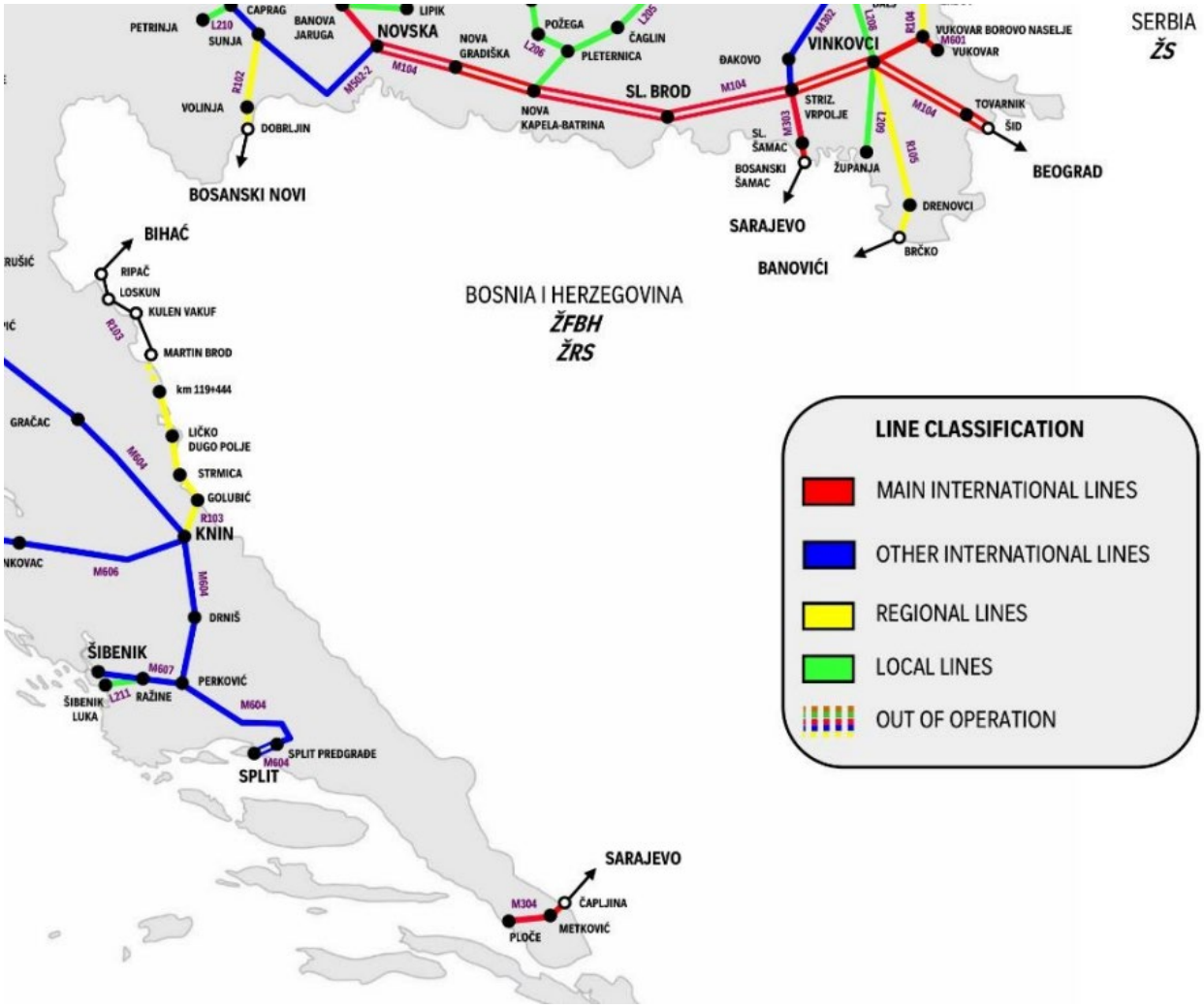

Figure 16 Bosnia and Herzegovina border section. [Source: Network Statement, HŽ Infrastruktura]

These lines are run both by passenger and freight trains.

Freight traffic has a clear international component as it connects Adriatic ports with the continent. All ports are connected to the railway network which is in poor condition, according to both accessibility and infrastructures.

The freight railway traffic is predominantly transit, as Adriatic ports serve as an entry-point for international cargo to Middle European markets. To increase intermodal maritime-rail traffic a logistic intermodal platforms network has to be developed by building up these platforms at ports sites and at the main consumer centres. This is needed to involve the supply chain roots through the Croatian ports competing with other ports in the area. Below are the existing lines in detail.

Border crossing with Bosnia and Herzegovina:

1. (Sarajevo -) Čapljina ŽFBH[24] - Metković HŽ[25] (- Ploče): After a break of nearly nine years HŽ restarted a seasonal service between Sarajevo and Ploče on 01 July 2022, running on Fridays / Saturdays / Sundays until 11 September 2022.
2. (Novi Grad -) Dobrljin ŽRS[26] - Volinja HŽ (- Sunja): The only passenger service [a pair of day trains between Sarajevo and Zagreb] using this crossing were withdrawn at the December 2016 Timetable change. ŽRS had operated to Volinja. Freight continues. Novi Grad was formerly named Bosanski Novi.
3. (Doboj -) Šamac ŽRS - Slavonski Šamac HŽ (- Strizivojna-Vrpolje): The Budapest to Sarajevo train pair ended 9 December 2012, closing this line to passenger services. ŽRS operates to Slavonski Šamac. Šamac is referred to as Bosanski Šamac in the Croatian timetable.
4. (Tuzla -) Brčko ŽFBH - Gunja HŽ (- Drenovci - Vinkovci): A passenger service was introduced on this route in the 2002/2003 timetable but was withdrawn by the end of the 2009/2010 timetable period. ŽFBH operates to Drenovci.

Border crossing with Hungary:

1. (Čakovec -) Kotoriba HŽ - Murakeresztúr MÁV[27]: HŽ works to Murakeresztúr. Passenger services were withdrawn in the timetable commencing 9 December 2012.
2. (Koprivnica -) Botovo HŽ - Gyékényes MÁV: HŽ works to Gyékényes. Services were suspended in late Autumn 2015 due to the migrant crisis, but resumed on 8 March 2016
3. (Osijek -) Beli Manastir HŽ - Magyarbóly MÁV (- Villány): MÁV generally works to Beli Manastir. Passenger services were withdrawn from 9 December 2012 but reinstated from 14 December 2014. Owing to the migrant crisis, all cross-border services were suspended [as in April 2016] but resumed 9 December 2018.

Border crossing with Serbia:

1. (Dalj -) Erdut HŽ - Bogojevo ŽS[28]: The bridge over the river Danube was damaged in 1999 and was not repaired until 2006. Freight services via this route restarted in summer 2008 and passenger services on 14 December 2015.
2. (Vinkovci -) Tovarnik HŽ - Šid ŽS (- Beograd): HŽ normally works to Šid. The service from at least the 2018-2019 timetable period is one daytime pair plus a summer and Xmas/New Year overnight.

[24] Željeznice Federacije Bosne i Hercegovine (ŽFBH, Railways Federation of Bosnia and Herzegovina) is the railway company of the Croatian-Muslim Federation, in Bosnia. The network extends for 584 km of ordinary gauge, of which 259 km electrified at 25 kV 50 Hz.

[25] Hrvatske Željeznice (HŽ, Croatian Railways) is the national railway company of Croatia.

[26] Željeznice Republice Srpske (ŽRS, Serbian Republic Railways) is the railway company of the Serbian Republic of Bosnia and Herzegovina. It consists in four radial lines: Doboj-Banja Luka: electrified single track 110 km with antennas for Banja Luka and Novi Grad; Doboj-Maglaj: electrified double single track, 23 km; Doboj-Samac: electrified single track, 60 km; Doboj-Petrovo Novo Selo: non-electrified single track 33 km.

[27] Magyar Államvasutak (MÁV, Hungarian State Railways) is the Hungarian national railway company, with divisions "MÁV START Zrt." (passenger services), and "Utasellátó" (onboard catering). The head office is in Budapest.

[28] Železnice Srbije (ŽS, Serbian Railways) is a Serbian engineering and technical consulting company based in Belgrade, Serbia.

Services were suspended from 16 March 2020 in response to coronavirus. The 2021-2022 timetable shows one pair of trains but with a note to the effect that they are currently not running, which is due to upgrade work taking place. The train runs once or twice per week in each direction between Villach (Austria) and Edirne (Turkey), between May and November. Foot passenger bookings may also be made.

Border crossing with Slovenia:

1. (Lupoglav -) Buzet HŽ - Rakitovec SŽ[29] (- Prešnica): SŽ normally works to Buzet. In the summer a cross border working runs through to Pula - some of the time from/to Ljubljana and at other times as a connection at Hrpelje-Kozina. See Slovenia route Rakitovec - Buzet (Croatia).
2. (Rijeka -) Šapjane HŽ - Ilirska Bistrica SŽ (- Pivka): SŽ works to Šapjane. There are no longer any trains starting or terminating at Ilirska Bistrica, which were worked by HŽ throughout. There are two train pairs daily in the 2021-2022 timetable.
3. (Karlovac -) Kamanje - Bubnjarci HŽ - Rosalnice SŽ (- Metlika): HŽ works to Metlika. The service was withdrawn on 9 December 2012 but reinstated on 15 December 2013. The cross-border service was limited and did not call at Rosalnice. Although Kamanje is shown in the HŽ timetable as the border station, Croatian immigration formalities took place at Bubnjarci with Slovenian immigration formalities taking place at Metlika. HŽ suspended the cross-border service between 16 March and 22 June 2020 due to Covid travel restrictions but then services were withdrawn from 05 April 2021 and trains from Karlovac now run only as far as Bubnjarci.
4. (Zagreb -) Savski Marof HŽ - Dobova SŽ (- Zidani Most): HŽ works to Dobova. The change in electrification system here pre-dates the break-up of the former Yugoslavia.
5. (Zabok -) Đurmanec HŽ - Sveti Rok ob Sotli SŽ (- Rogatec - Stranje): SŽ works to Đurmanec. The cross-border section closed in 1994 owing to the poor condition of the infrastructure and the problems of managing the border crossing following independence and, at least in part, was probably lifted. The line has now reopened and passenger services resumed on 14 December 2014.
6. (Čakovec -) Macinec HŽ - Središče SŽ (- Ormož): SŽ works to Čakovec. The cross-border Macinec to Središče section closed to passenger services from 11 December 2010 but reopened on 14 December 2014. The border station on the Croatian side is Čakovec and passenger services crossing the border run non-stop between there and Središče.
7. (Čakovec -) Mursko Središće HŽ - Lendava SŽ: This isolated section within Slovenia is worked by HŽ. The passenger service between Mursko Središće and Lendava was withdrawn subsequent to the break-up of Yugoslavia but reinstated from 14 December 2014. HŽ suspended the cross-border service from 16 March 2020 due to Covid travel restrictions and trains from Čakovec now run only as far as Mursko Središće.

[29] Slovenske železnice (SŽ, Slovenian Railways) is the state railway company of Slovenia. The Slovenian railway system has 1229 kilometers of lines, 331 km of double track, and reaches all regions of the country.

The electrification of the network is carried out with a 3 kV DC system, (like the Italian one), and covers approximately 503 km of line. The continuation of the electrified railway line in Croatia is at 25 kV AC, this makes it necessary to replace the traction vehicles in the Slovenian city of Dobova, on the border with Croatia.

1.5.5 ERTMS implementation

ERTMS ("European Rail Traffic Management System") is the European standard for the Automatic Train Protection (ATP) and command and control systems, it is a safety system that enforces compliance from trains with speed restrictions and signalling status. Due to its nature and the required functions, at present this system is partly installed trackside and partly installed onboard.

In 2018, Croatian Government drew up the 'National Implementation Plan for Commission Regulation (EU) 2016/919 of 27 May 2016 [30]on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union'. The aim of this document is the development of the rail interoperability in Croatian network. According to the Plan, ETCS Level 1 will be installed initially in the Croatian network. Once the second ERTMS system: GSM-R (Global System for Mobile Communications - Railways), the European radio communications standard for railway operations and ETCS Level 2[31] have been installed, ETCS Level 1 will remain in use as a backup system. So far, ERTMS has been deployed only on the Croatian/Serbian cross border (from Vikonvci to Tovarnik).

1.5.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out related to the Croatian railway system, by type of impact.

Table 24 Croatia: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
CROATIA	Just 10% of the network is double track					■
	Just 36% of the network is electrified	■			■	
	Maximum speed is below 100% for the 70% of the network					■
	section Pula – Buzet has no direct connection with the rest of Croatian network			■		
	No direct connection between Croatia and port of Ploče			■		
	Maximum train length below 500m for most of the network					■
	ERTMS level 1 only implemented in the section Vrpolje-Vikonvci-Tovarnik	■	■			

[30] COMMISSION REGULATION (EU) 2016/919 of 27 May 2016 on the technical specification for interoperability relating to the 'control-command and signalling' subsystems of the rail system in the European Union. This document refers to the adoption of the technical specification for interoperability (TSI) relating to the control-command and signaling subsystems (CCS) of the rail system in the European Union. [ELI: http://data.europa.eu/eli/reg/2016/919/oj]

[31] ETCS Level 2 involves continuous supervision of train movement with constant communication via GSM-R between the train and trackside. Lineside signals are optional in this case, and train detection and train integrity checks are performed by the trackside equipment beyond the scope of ERTMS.

1.6 Slovenia

1.6.1 Rail network overview

Despite of its limited surface compared do other EUSAIR' Countries, Slovenia has a wide and capillary railway network which connects the capital city Ljubljana with all the main cities.

The railway network extends for 1209 km, it has standard gauge (1435mm) implemented on the entire network, but it is only partially electrified (610 km) and most of the network is single track (874 km).

Since its independence in 1991, public railway infrastructure in the Republic of Slovenia has not changed significant. A new line between Puconci and the Hungarian border was constructed to directly connect Slovenian and Hungarian networks.

The backbone of the network is the double-track from the Italian border to Ljubljana and continuing to Maribor/Croatian border line. Other important lines connect Ljubljana with Jesenice and, by the Karawanks tunnel, with Austria.

Thanks to its positioning on the core of Central EU, several Rail Freight Corridor Corridors run through the Slovenian railway network:

- the Rail Freight Corridor Baltic-Adriatic (RFC5)
- the Rail Freight Corridor Mediterranean (RFC6)
- the Rail Freight Corridor Amber (RFC11)

According to the information provided by the TENTec website is possible to identify the characteristics of the network part of the RFC:

- In terms of maximum axle loads, the network is all compliant with the TEN-T standards (22,5 tons) except for the sections between Ilirska Bistrica and Sapjana and betwrrn Ormoz and Sredisce ob Dravi (border with Croatia) where max axle load is 20 tons and the section between Sentilj and Spielfeld-Strass (border with Austria) where the limit is 20.4 tons.
- In terms of maximum train length most of the network is not compliant with the 740m standard and range between 500 to 600m of allowed maximum train length, while the only section which is complain with TEN-T standard is between Krsko and Zidani Most (Mediterranean Corridor), between Cirkvoce and Ormoz (Mediterranean Corridor) and between Ormoz to Hodos on the Slovenian-Hungarian border.

The following figures show the Rail Freight Corridor that cross the Slovenian rail network and the characteristic of the network based on the axle loads (compliance with the EU standard is 22,5 tons)

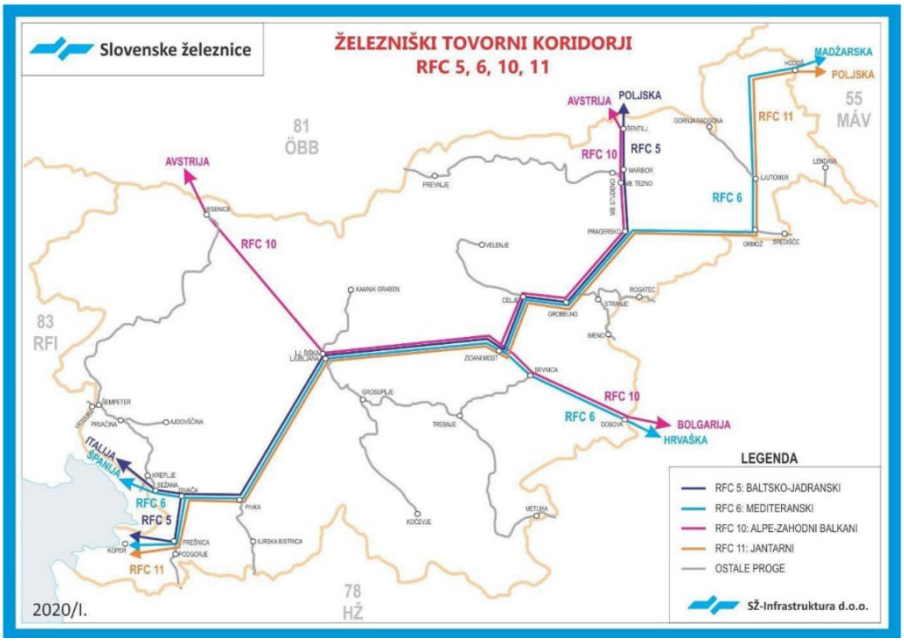

Figure 17 International railway corridors crossing Slovenia [Source: gov.si/teme/zelezniska-infrastruktura]

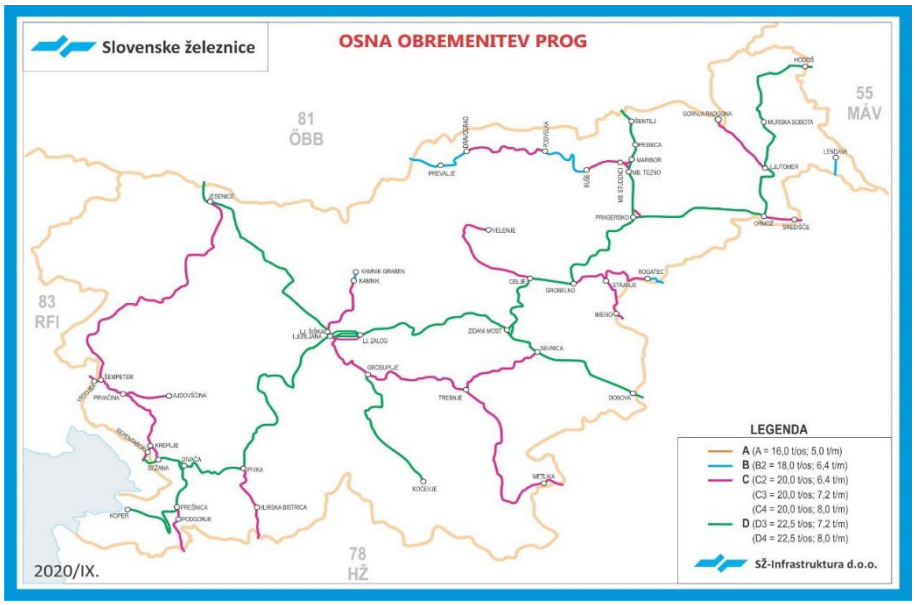

Figure 18 Line categories according to axle load [Source: gov.si/teme/zelezniska-infrastruktura]

Figure 19 Railway network in Slovenia [Source: Wikipedia.org]

1.6.2 Main rail intermodal freight terminals

Intermodal terminals and hubs are in Ljubljana, Celje, Divača, Koper, Maribor, Murska Sobota, Nova Gorica and Novo Mesto

The port of Koper, established in 1957, hosts the only freight terminals. The Port is located the northern part of the Koper Bay. The available single-track line which connects the terminals with the Slovene railway network represents a limit for increasing the volume of freights.

Ljubljana airport (Letališče Jožeta Pučnika Ljubljana) is the only Slovene airport open to international traffic, both passenger and freight.

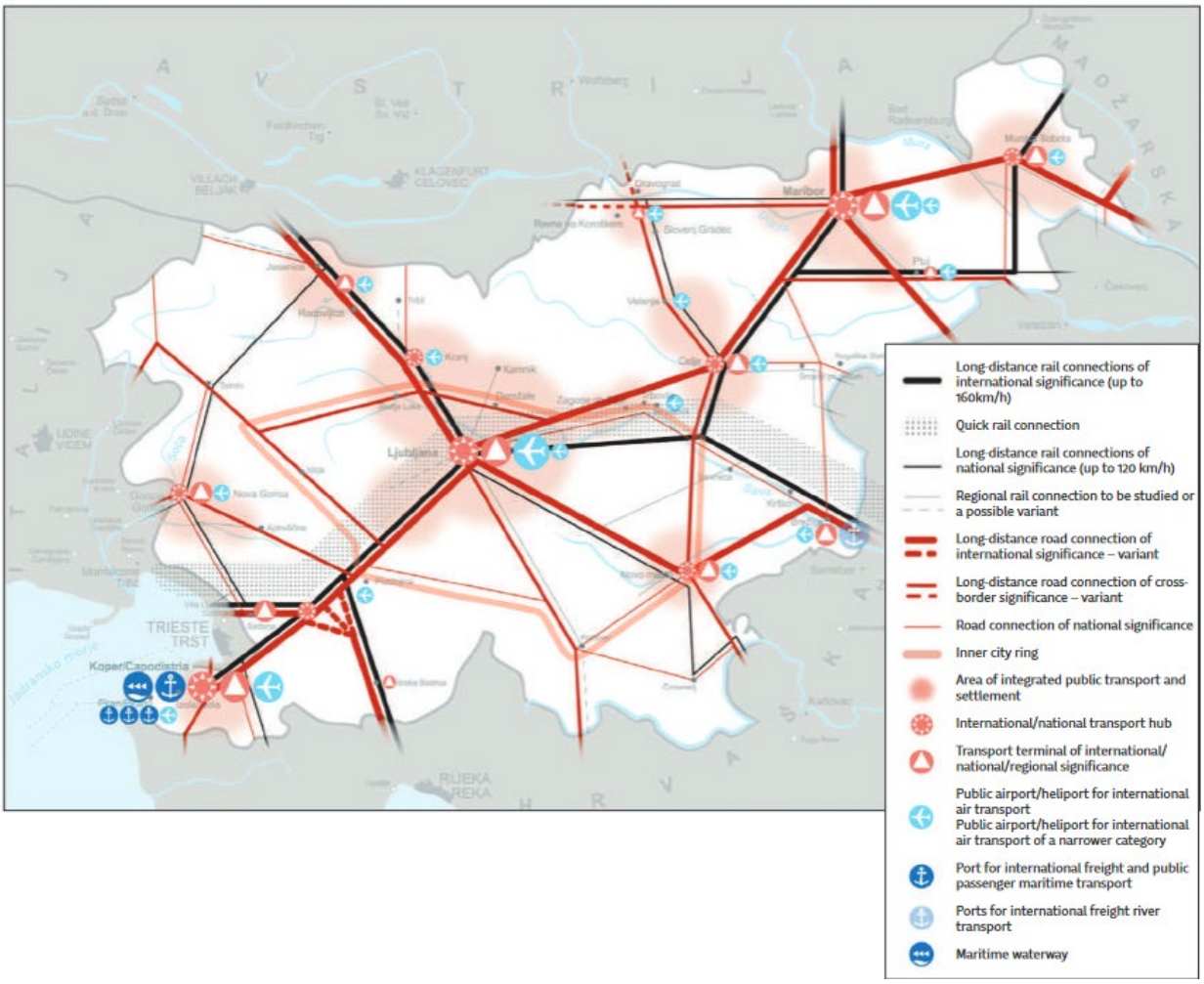

Figure 20 Spatial guidelines for developing an intermodal transport network in relation to settlements [Source: Transport Development Strategy of the Republic of Slovenia Until 2030]

1.6.3 Rail traffic volumes (passengers and freight) and characteristics

Passenger railway traffic in Slovenia benefits of different train categories. All the lines are run by local trains (potniški vlaki – LP), while for the main lines Intercity trains are also used. The Ljubljana – Maribor line is run by Intercity Slovenia (ICS) trains, high-quality tilting trains. Several diurnal and night international services between central Europe (Switzerland, Germany and Austria) and Balkans run in Slovenian network and stop in the main cities such as Ljubljana, Maribor, Celje, Kranj and Lesce (this station serves Bled Lake, the most famous tourist destination in Slovenia). Commuting trains run on international lines between Maribor and Spielfeld-Straß and between Ljubljana, the Slovenian Kras cities (Postojna, Divača, and Divača) and Italy (Trieste main station, Villa Opicina and Udine). Despite the exiting railway line, there aren't any passenger train running between the 'twin cities' Gorizia and Nova Gorica.

The following table shows the railway passenger transport by year for both domestic and international trips. National trips show a slightly decrease in the number of passengers, while cross-border traffic and international transport are increasing year by year. Data also reflect the pivotal role of Slovenia in European transport networks: more than half of international transport are transit trips.

Table 25. Railway passenger transport, Slovenia, annually [Source: stat.si]

		Passengers (1000)
2015	National/international transport - TOTAL	14,558
	National transport	13,792
	International transport - TOTAL	766
	International transport - passengers, embarked in Slovenia	162
	International transport - passengers, disembarked in Slovenia	180
	Transit	424
2016	National/international transport - TOTAL	14,008
	National transport	13,231
	International transport - TOTAL	777
	International transport - passengers, embarked in Slovenia	160
	International transport - passengers, disembarked in Slovenia	259
	Transit	358
2017	National/international transport - TOTAL	13,422
	National transport	12,592
	International transport - TOTAL	830
	International transport - passengers, embarked in Slovenia	159
	International transport - passengers, disembarked in Slovenia	252
	Transit	419
2018	National/international transport - TOTAL	13,554
	National transport	12,677
	International transport - TOTAL	877
	International transport - passengers, embarked in Slovenia	164
	International transport - passengers, disembarked in Slovenia	263
	Transit	449
2019	National/international transport - TOTAL	13,907
	National transport	12,837
	International transport - TOTAL	1,070
	International transport - passengers, embarked in Slovenia	154
	International transport - passengers, disembarked in Slovenia	269
	Transit	647

The following table show the number of passengers by country of disembarking. Croatia and Austria are preferred destination, but Italy shows a consistent growth in the last five years.

Table 26. Number of passengers in railway transport by country of disembarkation (country of embarkation is Slovenia), Slovenia, annually. Source: stat.si

	2015	2016	2017	2018	2019
Austria	51,810	48,041	41,579	38,580	36,154
Croatia	55,115	57,011	65,399	73,095	67,736
Italy	5,766	8,996	8,517	11,490	14,185
Hungary	8,092	8,047	10,165	9,312	7,145

On the other hand, looking at origin of trips, Austria shares more than 50% of total trips to Slovenia.

Table 27. Number of passengers in railway transport by country of embarkation (country of disembarkation is Slovenia), Slovenia, annually. Source: stat.si

	2015	2016	2017	2018	2019
Austria	48,522	52,746	68,472	79,922	97,151
Croatia	45,780	43,231	47,701	50,366	49,497
Italy	384	4	0	0	11,132
Hungary	9,689	11,750	12,434	11,993	11,605

The following table shows the tons of goods transported by freight services in particular international traffic shows a quite consistent growth from 2015 to 2019, while national traffic is rather constant in the same period.

Table 28. Railway goods transport, Slovenia, annually. Source: stat.si

		Tonne (1000)
2015	National / international transport - TOTAL	17,832
	National transport	2,953
	International transport - goods loaded in Slovenia	7,166
	International transport - goods unloaded in Slovenia	5,316
	Transit	2,397
2016	National / international transport - TOTAL	18,596
	National transport	2,840
	International transport - goods loaded in Slovenia	7,499
	International transport - goods unloaded in Slovenia	5,336
	Transit	2,921
2017	National / international transport - TOTAL	21,275
	National transport	3,064
	International transport - goods loaded in Slovenia	8,390
	International transport - goods unloaded in Slovenia	5,644
	Transit	4,177
2018	National / international transport - TOTAL	21,316
	National transport	3,025
	International transport - goods loaded in Slovenia	8,229
	International transport - goods unloaded in Slovenia	5,697
	Transit	4,366
2019	National / international transport - TOTAL	21,902
	National transport	3,174
	International transport - goods loaded in Slovenia	8,234
	International transport - goods unloaded in Slovenia	5,487
	Transit	5,007

1.6.4 Border checkpoints infrastructural and operative characteristics

According to the Transport Development Strategy of the Republic of Slovenia, as part of large European regions, Slovenia takes on an active role and uses its geostrategic position.

The rail checkpoints between Slovene and neighbours' networks are:

- Border with Austria: Jesenice and Šentilj cross-border stations; due to the different electrification and voltage of the Slovene and Austrian networks, a locomotive change (or a multi-voltage locomotive) is needed: Austria has 15 kV AC, 16.7 Hz; Slovenia has 3 kV DC.
- Border with Hungary: Hodoš cross-border station; due to the different electrification and voltage of the Slovene and Hungarian networks, a locomotive change (or a multi-voltage locomotive) is needed.

- Border with Croatia: Dobova and Ilirska Bistrica cross-border stations; due to the different electrification and voltage of the Slovene and Croatian networks, a locomotive change (or a multi-voltage locomotive) is needed.
- Border with Italy: Sežana cross-border station; due to the same electrification and voltage of the networks, trains can safely run the tracks.

Below are the existing lines in detail.

Border Crossings with Austria:

1. (Graz -) Spielfeld-Straß ÖBB[32] - Šentilj SŽ[33] (- Maribor): SŽ works to Spielfeld Straß. Though there are switchable tracks here, they do not seem to be used as such, with the locomotives of incoming hauled trains being shunted back to their own end of the station.
2. (Klagenfurt -) Bleiburg ÖBB - Holmec SŽ (- Dravograd): SŽ diesel railcars work to Bleiburg.
3. (Villach -) Rosenbach ÖBB - Jesenice SŽ (- Ljubljana): The change in electrification is at the midpoint of Jesenice station. The locomotives of incoming hauled trains are shunted back to their own end of the station. ÖBB works to Jesenice, with DB electric locomotives on some trains.The line was closed from 5 October 2020 for renovation work on the Karawanken Tunnel. It was scheduled to reopen on 11 July 2021, but this was postponed to 31 July.

Border crossing with Croatia:

1. (Lupoglav -) Buzet HŽ[34] - Rakitovec SŽ (- Prešnica): SŽ normally works to Buzet. In the summer a cross border working runs through to Pula - some of the time from/to Ljubljana and at other times as a connection at Hrpelje-Kozina. See Slovenia route Rakitovec - Buzet (Croatia).
2. (Rijeka -) Šapjane HŽ - Ilirska Bistrica SŽ (- Pivka): SŽ works to Šapjane. There are no longer any trains starting or terminating at Ilirska Bistrica, which were worked by HŽ throughout. There are two train pairs daily in the 2021-2022 timetable.
3. (Karlovac -) Kamanje - Bubnjarci HŽ - Rosalnice SŽ (- Metlika): HŽ works to Metlika. The service was withdrawn on 9 December 2012 but reinstated on 15 December 2013. The cross-border service was limited and did not call at Rosalnice. Although Kamanje is shown in the HŽ timetable as the border station, Croatian immigration formalities took place at Bubnjarci with Slovenian immigration formalities taking place at Metlika. HŽ suspended the cross-border service between 16 March and 22 June 2020 due to Covid travel restrictions but then services were withdrawn from 05 April 2021 and trains from Karlovac now run only as far as Bubnjarci.

[32] Österreichische Bundesbahnen (ÖBB, Austrian Federal Railways) They carry out the dual activity of railway companies responsible on the one hand for the commercial exploitation of rail transport services for passengers and goods, and on the other for the exploitation and maintenance of the Austrian national railway network. The exploited network has approximately 5,700 km of lines, of which 57% are electrified lines. The company transports approximately 188 million passengers per year.

[33] Slovenske železnice (SŽ, Slovenian Railways) is the state railway company of Slovenia. The Slovenian railway system has 1229 kilometers of lines, 331 km of double track, and reaches all regions of the country. The electrification of the network is carried out with a 3 kV DC system, (like the Italian one), and covers approximately 503 km of line. The continuation of the electrified railway line in Croatia is at 25 kV AC, this makes it necessary to replace the traction vehicles in the Slovenian city of Dobova, on the border with Croatia.

[34] Hrvatske Željeznice (HŽ, Croatian Railways) is the national railway company of Croatia.

4. (Zagreb -) Savski Marof HŽ - Dobova SŽ (- Zidani Most): HŽ works to Dobova. The change in electrification system here pre-dates the break-up of the former Yugoslavia.
5. (Zabok -) Đurmanec HŽ - Sveti Rok ob Sotli SŽ (- Rogatec - Stranje): SŽ works to Đurmanec. The cross-border section closed in 1994 owing to the poor condition of the infrastructure and the problems of managing the border crossing following independence and, at least in part, was probably lifted. The line has now reopened and passenger services resumed on 14 December 2014.
6. (Čakovec -) Macinec HŽ - Središče SŽ (- Ormož): SŽ works to Čakovec. The cross-border Macinec to Središče section closed to passenger services from 11 December 2010 but reopened on 14 December 2014. The border station on the Croatian side is Čakovec and passenger services crossing the border run non-stop between there and Središče.
7. (Čakovec -) Mursko Središće HŽ - Lendava SŽ: This isolated section within Slovenia is worked by HŽ. The passenger service between Mursko Središće and Lendava was withdrawn subsequent to the break-up of Yugoslavia but reinstated from 14 December 2014. HŽ suspended the cross-border service from 16 March 2020 due to Covid travel restrictions and trains from Čakovec now run only as far as Mursko Središće.

Border Crossings with Hungary:

1. (Zalalövő -) Bajánsenye MÁV[35] - Hodoš SŽ (- Murska Sobota): MÁV works to Hodoš and electric working probably commenced with the new timetable on 11 December 2011. As well as local services, which generally require a change of trains at Hodoš, one through Budapest - Ljubljana IC train pair runs via this route.

Border crossing with Italy:

1. Gorizia Centrale FS[36] - Vrtojba SŽ (- Nova Gorica): FS works to Nova Gorica. Freight only.
2. (Trieste -) Villa Opicina FS - Kreplje SŽ (- Nova Gorica): Freight only but clearly no traffic at as June 2019. This line is probably used only rarely, if the line via Sežana is blocked. SŽ works to Villa Opicina.
3. (Trieste -) Villa Opicina FS - Sezana SŽ (- Ljubljana): SŽ works to Villa Opicina. Five pairs of local SŽ trains between Sežana and Villa Opicina were reinstated on 5 January 2015 replacing substitute bus services, following approval for the 312 'Desiro' units by the Italian authorities. All were apparently withdrawn from 4 September 2023 leaving just the two daily FS Ljubljana - Trieste - Udine EMU pairs that commenced from 9 September 2018 and a Wien - Trieste EC that commenced in 2021. The one passenger train night pair which previously ran direct from Venezia via Villa Opicina had ceased on 11 December 2011.

1.6.5 ERTMS implementation

ERTMS ("European Rail Traffic Management System") is the European standard for the Automatic Train Protection (ATP) and command and control systems, it is a safety system that enforces compliance from trains with speed restrictions and signalling status. Due to its nature and the required functions, at present this system is partly installed trackside and partly installed onboard.

[35] Magyar Államvasutak (MÁV, Hungarian State Railways) is the Hungarian national railway company, with divisions "MÁV START Zrt." (passenger services), and "Utasellátó" (onboard catering). The head office is in Budapest.

[36] Ferrovie dello Stato Italiane (FS, Italian State Railways) they are an Italian public company that operates both in the rail transport and local public transport sectors, as well as in the freight sector.

The European Railway Traffic Management System (ERTMS, level 1) is currently in operation in the following railway axes: Sežana (Italian border) - Divača – Ljubljana – Zidani Most – Pragresko - Hodoš (Hungarian border) and Divača - Koper. The ERTMS is expected to be fully implemented the main axis of Slovene rail network which are part of European Corridors

According to the Transport Development Strategy of the Republic of Slovenia, the following rail lines will be subjected to ERTMS implementation: Ljubljana – Dobova (Croatian border), Ljubljana – Maribor, Ljubljana – Jesenice (Austrian border), Maribor – Šentilj (Austrian border), Postojna – Ilirska Bistrica – Šapjane (Croatian border).

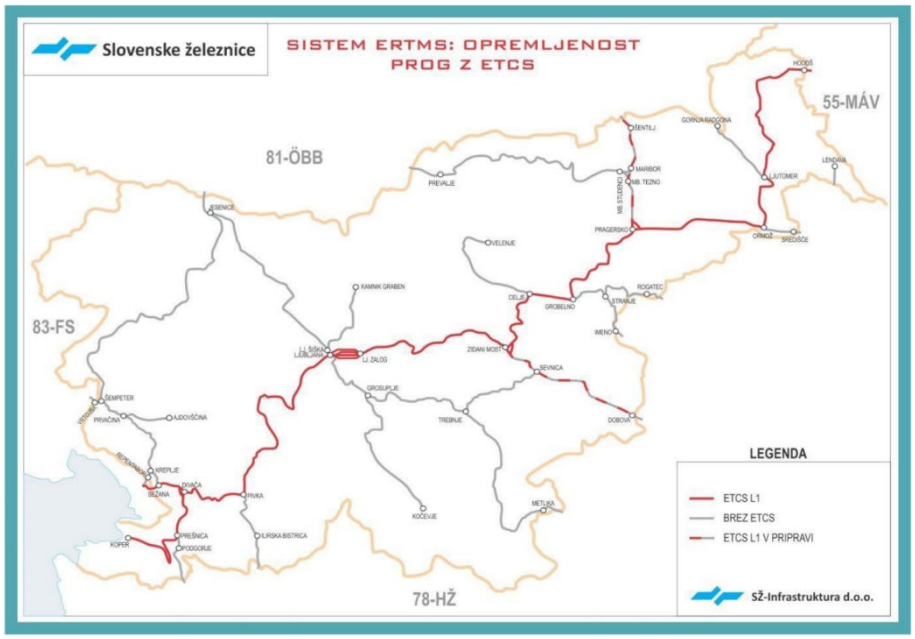

Figure 21 Lines equipped with ETCS [Source: gov.si/teme/zelezniska-infrastruktura]

1.6.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out related to the Slovenian railway system, by type of impact.

Table 29 Slovenia: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
SLOVENIA	Just 50% of the network is electrified					
	Just 27% of the network has double track					
	Maximum train length is always below 600m					
	Entering in Austria, Hungary and Croatia requires to change locomotive due to the different electrification and voltage					
	ERTMS Level 1 only partially implemented					
	Just single-track line to access the Port of Koper					

1.7 Greece

1.7.1 Rail network overview

The Greek railway network has a total length of 2,345 km with one third of the network double tracked and most of is equipped with standard-gauged: 80% of standard gauge line (Attiki, Central Greece, Thessalia, Makedonia and Thrace) and 20% of metric gauge line (part of Peloponnesus network).

Figure 22 Railway network in Greece. [Source: Wikipedia.org, Author: Chumwa]

The following tables show the length of operating lines. Even if the total length decreased (from 2,576 km, year 2005 to 2,345 km, year 2020), the double track lines have been increasing.

Table 30. Total Length of Lines Operated (km) [Source: UNECE Transport Division Database]

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Single track															
Greece	2059	2021	2042	2042	2034	2034	2032	2032	2032	1714	1716	1716	1716	1716	1651
Double track or more															
Greece	517	488	509	510	518	518	522	522	523	524	524	524	524	577	629
Total length (Single + Double)															
Greece	2576	2509	2551	2552	2552	2552	2554	2554	2238	2238	2238	2238	2238	2293	2280

Table 31. Railway density, total length of lines operated (km) per 1000 km² (Source: UNECE Transport Division Database)

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Greece	20	19	19	19	19	19	19	19	19	17	17	17	17	17	17

The main rail network consists of the following lines:

- line “Piraeus - Athens - Thessaloniki - Idomeni” through which the largest part of the total transport product is being carried, that provides railway connection with North Macedonia.
- line Thessaloniki –Promaxonas that provides railway connection with Bulgaria.
- line Ikonio (freight port of Piraeus) - Thriassio freight complex, which is connected to the main railway line Piraeus - Athens - Thessaloniki - Idomeni /Promachonas
- line “Thessaloniki - Alexandroupoli - Ormenio”, that runs along the northern part of Greece, and provides railway connection with Bulgaria and Turkey.
- line “Athens - Patras”, that connects the capital, by rail, with one of the country’s western gates to Italy and Western Europe (is currently partially upgraded to a normal gauge double line up to Egio)
- the main branches “Platy – Florina – N. Kafkasos” which provides railway connection with North Macedonia, “Palaiofarsalos- Kalambaka” and “Larissa –Volos.”
- the smaller branches “Inoi – Chalkida” and “Isthmos-Loutraki”
- suburban line which connects the Athens International Airport to the main lines Athens –Thessaloniki and Athens - Patras

The railway network is geographically divided into two regions: Central and South Greece region and Macedonia – Thrace region.

The main axis are the Piraeus (both lines from passenger and from freight port) – Plati railway (standard gauge, operating speed up to 160-200 km/h, electrification: 25kV - 50Hz AC; it is part of the Athens–Thessaloniki railway corridor) and the Athens – Patras railway (standard gauge, operating speed up to 160-200 km/h, electrification: 25 kV 50 Hz AC up to Kiato; this line is run both by regional trains and Athens commuter services called ‘Proastiakos Athens’ together with the line connecting the Athens Airport).

Other railway lines (having both 1435mm or 1000mm as track gauge) have been upgrading or are under construction.

According to the Regulation 913/2010 (EU)[37] of the European Parliament and of the Council, Freight Corridor 7 (RFC7) passes through the Greek Network. The principal routes of the corridor run between Prague, Vienna/Bratislava, Budapest and Costanta (via Bucarest) or Athens (via Vidin, Sofia and Thessaloniki).

The Orient/East-Med Corridor part of the TEN-T network, include most of Greek railway network. As well the RFC7, which overlaps part of the TEN-T network include some of the sections of the Greek railway network, especially the mail lines.

Regards the compliance of the network part of the international corridors, the network is not fully electrified, in particular sections between Palaiofarsalos and Kalambaka, between Kozani and the border with North

[37] REGULATION (EU) No 913/2010 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 22 September 2010 concerning a European rail network for competitive freight. [Source: https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:276:0022:0032:en:PDF

Macedonia in the north (Kafkasos) and also no electrified sections are available eastern to Thessaloniki up to the Turkish border in Pythio and the section Pythio – Ormenio up to Bulgarian borders (more than 600km of railway). Axle load is as well compliant for most of the main lines, while 20 tons limit is present on the norther sections which spread from Thessaloniki to North Macedonia and Bulgaria.

On the other hands, as already mentioned above, the track gauge is 1435mm on the entire network except for the Peloponnese old network where track gauge is 1000mm.

The current network suffers from a number of weaknesses:

- the railway alignment and morphology of the country with steep gradients and acute curvatures allows only low speed travel.
- with the exception of the lines of Peloponnesus and Thessaly, the network in question, is developed mainly linearly, due to the morphology of the continental Greece, thus limiting the development of railway transportation towards areas nonadjacent to the railway axis.
- the major railway axis 'Piraeus - Athens - Thessaloniki' and "Thessaloniki-Alexandroupoli-Ormenio" provide connection with the Piraeus Freight Port (Ikonio), Thessaloniki Freight Port and Alexandroupoli Freight Port. There is no connection with the other country's major commercial ports, namely the new port of Patras, Igoumenitsa and Kavala (Nea Karvali) freight port. This fact discourages the development of combined transportation in Greece.
- there are many single-track lines and a large number of levels crossings.
- rail electrification stands at a low level (although electrification is increasing) and large part of the rolling stock is obsolete.
- incompatibility between Peloponnesus's line (metric gauge) and the rest of the network (standard gauge).

Extensions of the railway network are planned:

- new line Thessaloniki- Amfipoli – Kavala Port- Toxotes (connection to the existing line Alexandroupoli - Ormenio), which is included in the list of CEF pre-Identified sections/projects along the above corridor, and is depicted in Part III.1, Annex I of the Regulation (EU) 2021/1153 (CEF Regulation) and is also depicted as a missing link.
- new line Florina – Kristallopigi that provides railway connection with Albania (Pogradec).

1.7.2 Main rail intermodal freight terminals

Greece has some important intermodal and logistical terminals. The biggest and busiest Greek seaport is located in Piraeus, close to Athens. This terminal is a multi-purpose port, both passengers (third world's passenger port) and freights (Ikonio). After a partial privatization in 2010s, the majority of freight port is owned by China COSCO Shipping, one of the world's largest container shipping companies. Piraeus seaport has a railway connection.

Seaport of Thessaloniki is an important gateway for the Balkan hinterland and south-eastern Europe. Thessaloniki seaport has a railway connection. As well as Piraeus, Thessaloniki seaport was partially privatized.

Seaport of Patras manages more than half of the foreign sea-passenger transportation in Greece and has

excellent car-ferry links with the Ionian islands and the major Adriatic ports of Italy (Ancona, Bari, Brindisi, Trieste and Venice). A railway connection from Athens up to Egio has been in operation since June 2020. The existing railway line of poor characteristics from Egio to Patras is gradually upgraded to double track standard gauge railway line.

Despite of the size of the city, Igoumenitsa hosts one of the most important Greek seaports. The port of Igoumenitsa has been developing combined transport (maritime - roads).

1.7.3 Rail traffic volumes (passengers and freight) and characteristics

Train passenger services are operated by TrainOSE a private railway company in Greece which currently operates passenger and freight trains on OSE lines. TrainOSE was acquired in September 2017 by the Italian national railway company, Ferrovie dello Stato Italiane. The company was a subsidiary of the Hellenic Railways Organisation (OSE) until 2008, when it became an independent state-owned company until its privatisation in 2017.

Freight services provided also by other companies.

Train categories are distinguished according to the number of stops, the speed and the quality of rolling stock. Domestic services are Regular trains (Κοινή αμαξοστοιχία; they call at most of the stations), Express trains (Ταχεία αμαξοστοιχία; they call at fewer stations) and Intercity trains (they run only on the main corridors). In Athens, Thessaloniki and Patra urban areas frequent suburban services (Proastiakos - Προαστιακός) run and call at all the stations. After a disruption, in 2014 international connections were re-established between Thessaloniki and some southern Balkan cities. The historic rail services “Acropolis,” “Hellas Express” and “Attica” of the 90s, traveling to Munich, have been replaced today by more flexible services to Sofia, Skopje and Belgrade, from where the passenger may travel onwards to big European cities, by connection services.

Rail transport, both for freight and passenger transport only plays a very modest role in Greece. Notwithstanding the poor attractiveness of the Greek rail system, rail transport in Greece increased in the last decade.

According to UNECE, rail passenger transport in Greece has suffered the economic crisis and the consequent service troubles (see Table 32). After some years of deep setback, the last five-years interval saw a substantial increase, both in the total number of passengers and the passenger-km. Due to the international service disruption, the number of cross-border passengers is low.

Table 32. Railway passenger traffic [Source: UNECE Transport Division Database]

	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Total															
Number of passengers (1000s)															
Greece	9 959	9 521	13 212	16 039	..	..	13 305	12 658	13 195	13 399	16 040	15 582	15 359	16 795	19 599
Passenger kilometres (millions)															
Greece	1 854	1 811	1 930	1 657	1 414	..	958	832	1 056	1 072	1 263	1 192	1 112	1 104	1 253
National transport															
Number of passengers (1000s)															
Greece	9 734	9 233	12 855	15 747	..	..	13 288	12 658	13 191	13 356	16 008	15 561	15 337	16 778	19 590
Passenger kilometres (millions)															
Greece	1 804	1 748	1 853	1 599	..	..	954	832	1 055	1 068	1 256	1 190	1 109	1 102	1 252
International transport															
Number of passengers (1000s)															
Greece	225	288	357	292	..	..	17	0	5	43	32	21	22	17	9
Passenger kilometres (millions)															
Greece	50	63	77	58	..	..	4	0	0	4	7	2	3	2	1

1.7.4 Border checkpoints infrastructural and operative characteristics

According to the National Transport Plan, international transport connectivity is more deficient and there is a relatively low level of international traffic with neighbouring countries. Rail connections to Albania do not exist. Piraeus has become more attractive with the arrival of COSCO, but customs procedures are still burdensome, and the lack of Single Windows reduces Greece's trade potential. The National Transport Plan describes different cross-border checkpoints improvements, both for road and rail connections. Below are the existing lines in detail.

Border Crossing with Bulgaria:

Service ceased as part of the discontinuance of all international services from Greece.

Border crossing with North Macedonia:

1. (Florina -) Neos Kafkasos OSE[38] - Kremenica MŽ[39] (- Bitola): This line has been out of use for several years. Formerly, OSE worked to Kremenica. Works to reopen this line were completed in April 2019, however by the end of 2022 the two governments had still not finalised the agreements required to enable services to operate.
2. (Thessaloníki -) Idomeni OSE - Gevgelija MŽ (- Skopje): OSE operates to Gevgelija. Until 21 August 2015 this route carried one daily train pair between Beograd and Thessaloníki via Skopje. The cross-

[38] Organismos Sidirodromon Ellados (OSE, Organization of the Hellenic Railways) is a holding company providing management and operation services for Greece's national railway infrastructure, headquartered in Athens.

[39] Makedonski Železnici (MŽ, Macedonian Railways) is the public enterprise for railways in the Republic of North Macedonia. Macedonian Railways operates 1,435 mm (4 ft 8+1⁄2 in) standard gauge rail tracks in North Macedonia and maintains 925 km (575 mi) of lines, 315 km (196 mi) of which are electrified with the 25 kV 50 Hz AC system.

border service from Greece was then replaced by a bus owing to the migrant crisis. However, as the Beograd - Gevgelija train service was withdrawn from 1 October 2018, there is at present no cross-border passenger service. The summer 2020 Thessaloniki to Beograd train was a bus between Thessaloniki and Gevgelija. There is no service at all as in July 2022 because of construction work on the new line between Polikastro and Idomeni and to modernise track and signalling on the entire line from Thessaloniki. This will probably not be finished until at least 2025.

Border Crossings with Turkey:

1. Píthio/Pityon OSE - Uzunköprü TCDD[40] (- Istanbul): Freight only. TCDD works to Píthio/Pityon. Interestingly, the border at this point is not in the middle of the river Evros but close to the Greek end of the bridge.

1.7.5 ERTMS implementation

According to the National Transport Plan, the current transport system has made great improvements in transport safety. For rail, the development of ERTMS would be a great step to put the country at the same level as the rest of Europe, while safety level is currently acceptable.

In particular, the national railway management company (ERGOSE) has made it a priority to install ERTMS on the basic railway axis in Greece, namely the Patras – Athens – Thessaloniki – Eidomeni / Promachonas (PATHEP) axis with the necessary branches (to the International Airport, freight port of Piraeus – Ikonio, Chalkida, Kalambaka, Volos). This axis is a section of the core TEN-T network (in accordance with Regulation 1315/2013) and a section of the Orient-East Med Corridor, the aim being to complete its modernization by 2030.

1.7.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out related to the Greek railway system, by type of impact.

Table 33 Greece: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
GREECE	Just 30% of the network has double track					■
	35% of the network (Peloponnesus) equipped with metric gauge	■				
	Morphology (steep gradients) and acute curvatures allows low speed travel for most of the secondary lines		■			■
	The new port in Patras has no connection with the main network	■		■		
	Electrification only partially implemented			■		
	ERTMS Level 1 not yet implemented	■				■
	No connection with Albania			■		

[40] TCDD Taşımacılık is a public company that handles the operations of most passenger and freight trains in Turkey. The company was established on June 14, 2016 by separating from Turkish State Railways (TCDD) to operate rail transport. The TCDD, however, continue to administer the railway infrastructure.

1.8 North Macedonia

1.8.1 Rail network overview

The total length of the railway network consists of 699 km operative lines in standard gauge (1435 mm), with an additional 226 km yard tracks, and 102 km of industrial tracks. The railway open track lines are constructed as a single-track line, and only sections belonging to Corridor X are electrified and consist of 235 km (34% of network). Additionally, 83 km length of station tracks is electrified. The system of electrification is AC 25kV - 50 Hz.

According to Draft National Transport Strategy, due to the separation into two new entities of the "Public Enterprise Macedonian Railways C.O– Skopje" in 2007, railway infrastructure and transportation are managed by two state-owned public enterprises: the Public Enterprise for Railway Infrastructure Railways of Republic of North Macedonia-Skopje (PEMRI) is the Manager of the railway infrastructure in the Republic of North Macedonia and Joint Stock Company for transport Railways of the Republic of Nort Macedonia Transport JSC - Skopje is the operator for national and international transport of passengers and goods.

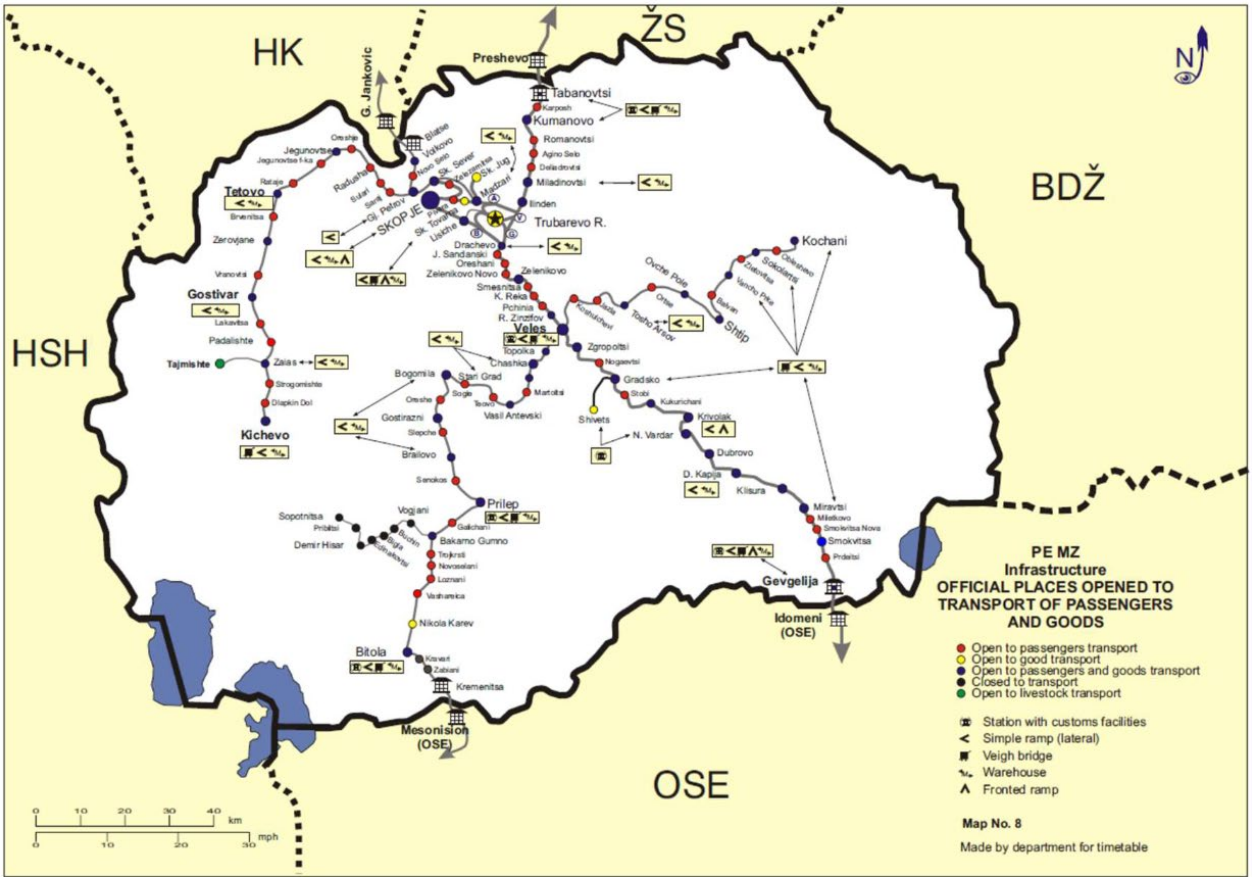

Figure 23 Official operation places for passenger and freight trains in North Macedonia [Source: Draft National Transport Strategy]

The railway network comprises the X, Xd and VIII TEN-T Corridors

The railway track on Corridor X is a single railway track which starts from Tabanovce station border with Serbia continues via Kumanovo, Skopje, Veles to Gevgelija station (border with Greece) or in total there is a

312.66 km electrified track. The alignment of this line allows a maximum speed of trains between 65 and 100 km/h. The main railway line of Corridor X is composed of the following three major sections: Tabanovce – Skopje: 49 km; Skopje – Veles: 51 km and Veles – Gevgelija: 115 km. All stations of the railway line Tabanovce – Gevgelija (Corridor X) are equipped with electro-relay signalization and safety devices. The traffic regulation is carried out by means of remote control from remote control center performed by the RC traffic controller. Between stations Tabanovce and Gevgelija there is automatic train control system (ATC). The projects for improving the signaling and telecommunication system with implementation of ETCS (European Train Control System) Level 1 and installation of GSM-R (Global System for Mobile Communications) are in progress.

The railway line along the branch of Corridor X, X-d starts from Veles, goes via Prilep, Bitola and connects to the railway network in Greece in station Kremenica. The length of this railway line is 146 km. The section between Bitola and border with Greece with a length of about 16 km is reconstructed.

Corridor VIII (from Bulgarian border via Kumanovo, Skopje, Tetovo, Kichevo, Struga to Albanian border) is in total length of 315 km, around 50% of the railway line is operational. At the moment, the Republic of North Macedonia does not have railway links with the two neighboring countries: Republic of Albania and Republic of Bulgaria. The lack of these connections is an obstacle to international trade, not only between neighboring countries, but also through this region in Eastern Europe. The existing stretch of railway line along the Corridor VIII is 152 km long between Kichevo via Skopje to Kumanovo.

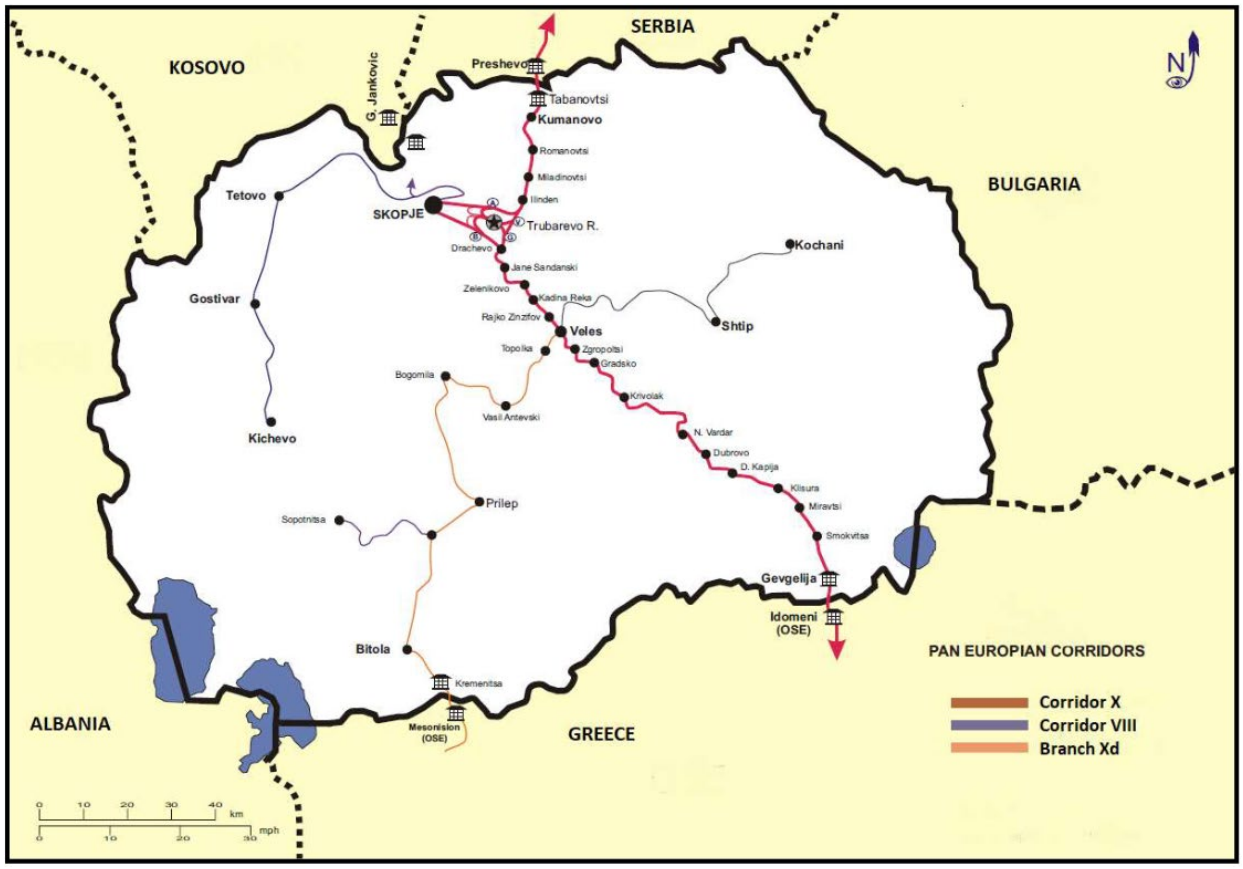

Figure 24. Railway network in North Macedonia with European Corridors [Source: Development of National Strategy for the Transport Sector - Draft National Transport Strategy]

1.8.2 Main rail intermodal freight terminals

Currently, due to the geographical conditions and the weakness of infrastructures, intermodal transport in North Macedonia is lacking in terms of infrastructure and service.

Due to the lack of terminals, North Macedonia is supplied by foreign ports such as Durres (Albania, with no direct railway connection between Durres and North Macedonia) and Thessaloniki (Greece, with rail connection). The intermodal container transport in the country is undeveloped. This transport is used only for international transport, particularly for transit of freight from Thessaloniki by the railway line along the Corridor X. The infrastructure of intermodal facilities and terminals in the country is insignificant. There is one small container terminal close to Skopje at Tovarna, near to the railway station. The terminal is equipped with one gantry crane with limited transshipment capacity. Storage area is also small. The position of the terminal is established for transport offer on the axis Belgrade-Skopje-Thessaloniki. According to the Draft National Transport Strategy, inter and multi–modality is in the early phase of development.

1.8.3 Rail traffic volumes (passengers and freight) and characteristics

The following Tables present the main data about North Macedonian rail infrastructures and services.

Table 34 Railway network and equipment. Source: Statistical Yearbook of Republic of North Macedonia. 2020

	Градежна должина на пругата Construction length of railroad	Електри-фицирани линии electrified lines	Неелектри-фицирани линии non electrified lines	Должина на колосекот Length of tracks	Локомотиви Locomotives		Моторни возови Motor trains		Патнички возен парк Rolling stock of passenger cars		Товарен возен парк Rolling stock of freight cars	
	км km	км km	км km	км km	број number	моќ во kW power in kW	број number	моќ во kW power in kW	број number	седишта seats	број number	тони носивост capacity in tonnes
2015	699	234	465	923	42	94 492	10	8 572	67	3 118	1 161	60 742
2016	683	234	449	907	42	94 492	10	8 572	67	3 118	1 161	60 742
2017	683	234	449	907	42	94 492	16	16 476	67	3 118	1 289	67 874
2018	683	234	449	907	42	94 492	16	16 476	67	3 118	1 239	65 110
2019	683	234	449	907	43	94 872	16	16 476	67	3 118	1 238	65 054

Table 35 Railway network and equipment. Source: Statistical Yearbook of Republic of North Macedonia. 2020

	Локомотивски км во илјади Locomotive-km, in '000				Бруто-тонски км во милиони Gross tonne-km, in '000.000		
	вкупно total	од тоа: возни км / of which: transportation km			вкупно total	патнички превоз passenger transport	товарен превоз freight transport
		сè all	патнички превоз passenger transport	товарен превоз freight transport			
2015	2 388	2 172	1 639	533	723	261	462
2016	2 169	1 962	1 512	450	557	184	373
2017	1 980	1 142	798	344	385	89	296
2018	2 095	1 877	1 288	589	638	154	484
2019	1 924	1 708	1 136	572	674	134	540

1.8.4 Border checkpoints infrastructural and operative characteristics

The border crossing stations are located along the Corridor X/Xd and there are 1 with Serbia (Tabanovce), 2 with Greece (Gevgelija and Kremenica, which is out of function) and 1 with Kosovo. At borders, change of locomotives and driver are necessary to run in a different country and this seriously hamper the operations and the competitiveness of the rail service.

The MoTC is making efforts to make "one stop shop" on the rail network with the neighboring countries. There are two active agreements with Serbia and Kosovo and activities for concluding similar agreement with Greece are ongoing.

Introducing a common regulatory framework that permits the licensing of multi-modal transport operators would be a challenge for the near future. Below are the existing lines in detail.

Border crossing with Greece:

1. (Florina -) Neos Kafkasos OSE[41] - Kremenica MŽ[42] (- Bitola): This line has been out of use for several years. Formerly, OSE worked to Kremenica. Works to reopen this line were completed in April 2019, however by the end of 2022 the two governments had still not finalised the agreements required to enable services to operate.
2. (Thessaloníki -) Idomeni OSE - Gevgelija MŽ (- Skopje): OSE operates to Gevgelija. Until 21 August 2015 this route carried one daily train pair between Beograd and Thessaloníki via Skopje. The cross-border service from Greece was then replaced by a bus owing to the migrant crisis. However, as the Beograd - Gevgelija train service was withdrawn from 1 October 2018, there is at present no cross-border passenger service. The summer 2020 Thessaloniki to Beograd train was a bus between Thessaloniki and Gevgelija. There is no service at all as in July 2022 because of construction work on the new line between Polikastro and Idomeni and to modernise track and signalling on the entire line from Thessaloniki. This will probably not be finished until at least 2025.

Border crossing with Kosovo:

1. (Fushë-Kosovë/Kosovo Polje -) Hani i Elezit/Đeneral Janković HK[43] - Volkovo MŽ (- Skopje): MŽ operates to Hani i Elezit/Đeneral Janković. Timetabled passenger trains resumed on 20 December 2005, initially two train pairs daily between Skopje and Prishtinë/Priština via Fushë-Kosovë/Kosovo Polje but by the December 2011 timetable had reduced to one train pair daily. Although the timetable showed this as a through train, a change between HK and MŽ operated trains was required at Hani i Elezit/Đeneral Janković. From around Autumn 2017 the MŽ part was cancelled on a regular basis, allegedly due to a locomotive shortage. It was unexpected when both HK and MŽ announced that the service would be running daily with effect from 9th March 2020, only to be suspended with

[41] Organismos Sidirodromon Ellados (OSE, Organization of the Hellenic Railways) is a holding company providing management and operation services for Greece's national railway infrastructure, headquartered in Athens.

[42] Makedonski Železnici (MŽ, Macedonian Railways) is the public enterprise for railways in the Republic of North Macedonia. Macedonian Railways operates 1,435 mm (4 ft 8+1⁄2 in) standard gauge rail tracks in North Macedonia and maintains 925 km (575 mi) of lines, 315 km (196 mi) of which are electrified with the 25 kV 50 Hz AC system.

[43] Hekurudhat e Kosovës (HK, Kosovo Railways) Kosovo railway company. The railway network is suitable for passenger service, freight service and industrial connections. The network is standard gauge, entirely single track and non-electrified.

effect from 13th March 2020 due to the Covid-19 virus. Shortly afterwards, in May 2020, work started on upgrading the line between Fushë-Kosovë/Kosovo Polje and Hani i Elezit/Đeneral Janković which was originally expected to take two years, during which time the HK service remains suspended. The trains still appear in the MŽ timetable but are reported not to be operating between Skopje and Hani i Elezit/Đeneral Janković.

Border Crossings with Serbia:

1. (Skopje -) Tabanovci MŽ - Preševo ŽS[44] (- Niš): Generally, ŽS works to Tabanovci, though sometimes MŽ works to Preševo.

1.8.5 ERTMS implementation

According to Sector Operational Programme for Transport 2014-2020 for Macedonia, the safety in the rail transport system as set in the National transport strategy remains a priority of the Government of the North Macedonia. Under the WBIF IPF 7, project studies were prepared for supply and Installation of Equipment for European Train Control System (ETCS level 1) and Global System for Mobile Communications-Railway (GSM-R) along the Corridor X. The supply and installation of ETCS level 1 is considered to be procured under the on-going projects, while the Global System for Mobile Communications-Railway (GSM-R) along the Corridor X (Tabanovce –Gevgelija) is expected to be procured in later phase for the whole railway networks in the Republic of North Macedonia, due to the fact that GSMR equipment and spare parts will be manufactured up to 2030 and will be replace with 5G technology and equipment.

1.8.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out on the rail network in North Macedonia by type of impact.

Table 36 North Macedonia: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
NORTH MACEDONIA	Just 34% of the network is electrified	■			■	
	All the network has single track					■
	There are no national terminals, the Country is supplied by the foreign port of Durres (Albania) and Thessaloniki (Greece)			■		
	No railway connection with the foreign Port of Durres (Albania)			■		
	Change of locomotives and driver are required at borders (most of)	■				
	ERTMS not implemented on the entire network	■	■			
	Intermodal container transport in the country is undeveloped.			■		

[44] Železnice Srbije (ŽS, Serbian Railways) is a Serbian engineering and technical consulting company based in Belgrade, Serbia.

1.9 Italy

1.9.1 Rail network overview

Italy is in a strategic position as four of the nine corridors of the TEN-T Core Network that are essential for increasing links between the European markets pass through Italy: the Baltic-Adriatic (blue layer in Figure 25), the Scandinavia-Mediterranean (pink layer in Figure 25), the Rhine-Alpine (orange layer in Figure 25) and the Mediterranean (green layer in Figure 25).

To reflect the growing transport flows and the evolution of TEN-T, the EU Regulation 2021/1153 [45]provided for the alignment of the Core Network corridors and the related sections identified in advance. These adjustments concern:

- The Mediterranean CNC with Ventimiglia - Genoa and La Spezia - Novara sections
- The Baltic - Adriatic CNC with the extension up to the port of Ancona

The core corridors of the TEN-T relating to Italy are shown in the following figure.

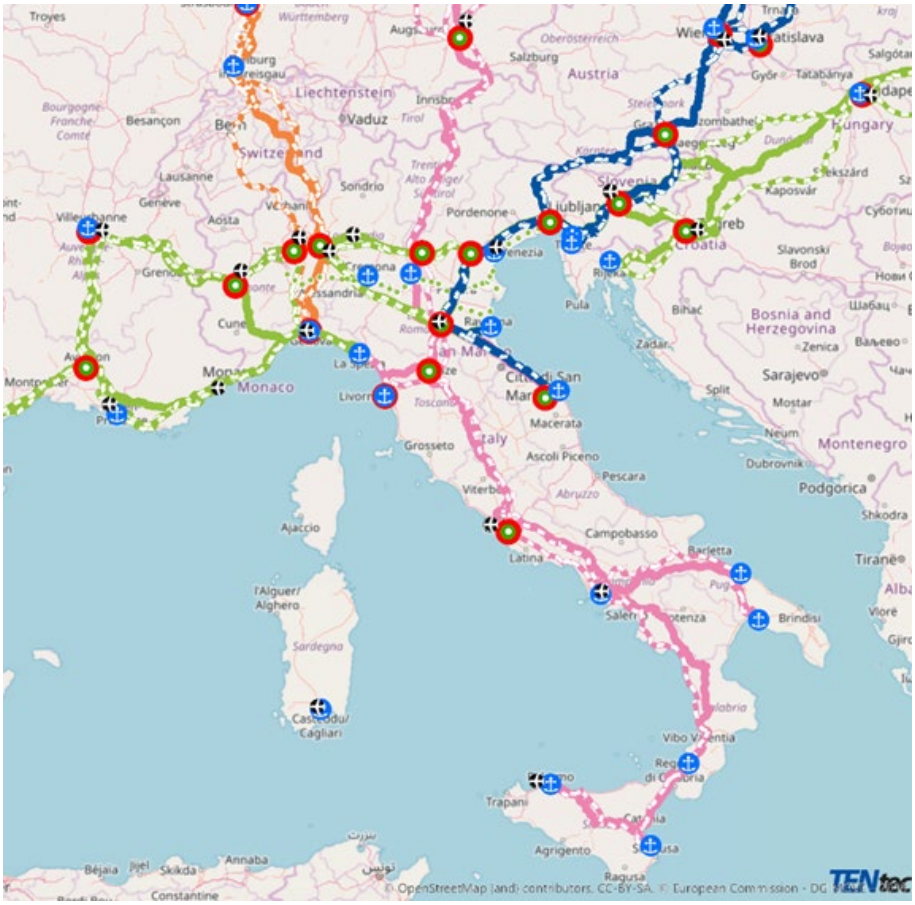

Figure 25 European TEN-T core corridors in Italy. [Source: https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map]

[45] Regulation (EU) 2021/1153 of the European Parliament and of the Council of 7 July 2021 establishing the Connecting Europe Facility and repealing Regulations (EU) No 1316/2013 and (EU) No 283/2014. [Source: http://data.europa.eu/eli/reg/2021/1153/oj]

The Mediterranean Corridor links the ports of Algeciras, Cartagena, Valencia, Tarragona and Barcelona in the Iberian Peninsula, with Hungary and the Ukrainian border, the south of France, northern Italy, Slovenia and Croatia. The Corridor has a portfolio of 527 investment projects equal to approximately 98.4 billion euros, 160 of which are monitored in Italy, where rail has 21 projects (Fora November 2019).

Included among the cross-border projects is the new Turin-Lyon line, where the main construction is the new Moncenisio base tunnel and the upgrading of the Trieste-Capodistria-Ljubljana connection which is coordinated by the Trieste-Divača rail EEIG.

The Scandinavian-Mediterranean Corridor extends from the Russian-Finnish border and from the Finnish ports of HaminaKotka, Helsinki and Turku-Naantali to Stockholm, through a “motorway of the sea", crossing southern Sweden, Denmark, Germany (connections to the ports of Bremen, Hamburg and Rostock), western Austria and Italy (connections to the ports of La Spezia, Livorno, Ancona, Bari, Taranto, Naples and Palermo) to Malta.

The Rhine-Alpine Corridor links the North Sea ports of Antwerp, Rotterdam and Amsterdam to the Italian port of Genoa crossing the Rhine valley, Basel and Milan. 310 projects have been monitored, 70 relating to Italy and 22 that we promote as RFI (Fora November 2019).

The strategic works taking place in Italy include the Third Giovi Pass project which will help strengthen the Ligurian port system’s links to the main railway lines in northern Italy and the rest of Europe and transfer important shares of road freight traffic to rail, in line with the European objectives for the environmental and social sustainability of transport.

The Baltic-Adriatic Corridor links the ports of the Baltic to those of the Adriatic, crossing Poland, the Czech Repubblic, Slovakia, Austria, Slovenia and Italy. The gateways to Italy are the Tarvisio pass on the border with Austria and the Villa Opicina pass on the border with Slovenia, arriving at the port of Ancona via Udine/Trieste-Venice-Padua and Bologna.

The Corridor has a portfolio of 502 investment projects equal to approximately 71.8 billion euros (Fora November 2019).

Italy is helping improve the European transport network with 110 projects, including 16 rail infrastructure enhancement projects promoted by RFI, both to upgrade lines from a technological standpoint by implementing the ERTMS system and to increase performance with work done on the tracks to allow trains of up to 740 m in length to operate.

Of particular importance is the cross-border project to upgrade the existing railway section between the Trieste urban node (Bivio d'Aurisina) and Divača, with the aim of promoting the development of cross-border traffic between Italy and Slovenia. To this end, the Trieste-Divača railway EEIG was established as coordinator of all the bilateral activities.

Figure 26 Italian railway network of National interest [Source: "Documento di Economia e Finanza 2017, Allegato: Connettere l'Italia: fabbisogni e progetti di infrastrutture", Ministero dell'Economia e delle Finanze]

The italian railway network to 2020 extends for approximately 20,000 km, of which 16,779 are owned by the State and managed by the state-owned company Rete Ferroviaria Italiana (RFI) which act as Infrastructure Manager. The remaining part of approximately 3.000 km is owned and managed mainly by Regional (public) and private companies. Concerning the RFI line, 12,022 are electrified and 7,619 are double tracks, while the regional and private line is almost completely in single track. Electric system is 3 kV DC on conventional lines and 25 kV AC on high-speed lines which extends for more than 1,000 km (700 km equipped with ERTMS system).

The following table summarizes the railway Infrastructure Managers which are responsible for establishing and maintaining the Italian railway infrastructure.

Table 37. Infrastructure Managers of the Italian railway network in 2020. [Source: https://www.rfi.it/it/rete/la-rete-oggi.html]

INFRASTRUCTURE MANAGER	LINE	LENGTH (KM)	OWNER
RFI	Italian network	16,779	Italian State
Ferrovie del Sud Est	Secondary line in Puglia	474	Italian State
Ferrovie Emilia Romagna	Secondary line in Emilia-Romagna	349	Emilia-Romagna Region
Ferrovienord	Secondary line in Emilia-Romagna	319	Lombardia Region
Ente Autonomo Volturno	Cumana, Circumflegrea, Circumvesuviana, Benevento-Cancello, Alifana	278	Campania Region
ARST	Secondary line in Sardegna	606	Sardegna Region
Ferrovie Appulo Lucane	Secondary line in Publia and Basilicata	184	Italian State
Umbria TPL e Mobilità	Secondary line in Umbria	157	Umbria Region
ATAC	Roma-Viterbo, Roma-Ostia, Roma-Giardinetti	139	Lazio Region
Gruppo Torinese Trasporti (GTT)	Canavesana, Torino-Ceres	117	Municipality
Italian State	Circumetnea	111	Italian State
Ferrovie del Gargano	Garganica, Foggia-Lucera	97	Private
Ferrotramviaria	Bari-Barletta, Bari-San Paolo	87	Private
Rete Ferroviaria Toscana (TFT)	Arezzo-Stia, Arezzo-Sinalunga	84	Private
Ferrovie della Calabria	Secondary line in Calabria	84	Calabria Region
Trentino Trasporti	Ferrovia Trento-Malé-Mezzana	66	Trento Province
Strutture Trasporto Alto Adige (STA)	Val Venosta, Renon	65	Bolzano Province
Sistemi Territoriali	Mestre-Adria	57	Veneto Region
Società Subalpina Imprese Ferroviarie	Domodossola-Locarno	53	Private
Azienda Mobilità e Trasporti (AMT)	Genova-Casella, Principe-Granarolo	26	Municipality
Società Ferrovie Udine-Cividale (FUC)	Udine-Cividale	15	Friuli-Venezia Giulia Region
Ferrovia Adriatico Sangritana	Sangritana	n.a.	Abruzzo Region

Lines are divided into 3 categories:

- **main lines**, characterised by high traffic and high level of quality of infrastructure, comprise all the international connection and main lines between major cities throughout the country. Fundamental lines are approximately 6,000 km long;
- **complementary lines**, which have less traffic and are responsible for connecting medium or small regional centres, these include single track and not electrified sections;

- **node junctions** linking complementary and fundamental lines mainly around metropolitan areas.

The following figure shows the national railway network classified by category.

Figure 27. Italian railway network by category in 2020 [Source: https://www.rfi.it/it/rete/la-rete-oggi.html]

As concern the infrastructure compliance with the TEN-T Regulation, 49% of the Corridor line in Italy guarantee the p/c 80 loading gauge. The following figure shows the state of the art in terms of loading gauge on the TEN-T core network.

Figure 28 Italian TEN-T core network by loading gauge. [Source: Il Piano Commerciale RFI, Business merci, 2021]

Regarding the maximum train length, the European Regulation aim to extend to 750 m long the allowed length on the TEN-T network. In Italy, the infrastructure guarantees the 750 m in a very low part of the network as shown by the figure below.

Figure 29 Italian TEN-T core network by maximum train length [Source: Il Piano Commerciale RFI, Business merci, 2021]

Regarding the axial load, the national network already guarantees a relet coverage with the D4 (22.5 t) standard, with approximately 83% of the TEN-T core network compliant as showed by the figure below.

Figure 30 Italian TEN-T core network by axle load [Source: Il Piano Commerciale RFI, Business merci, 2021]

1.9.2 Main rail intermodal freight terminals

Italy has a wide offer of rail terminals, which provide freight services capillary all over the country. These terminals are distinguished in the following categories:

- intermodal road-rail terminals located in freight villages.
- "stand-alone" intermodal road-rail terminals (that is, terminals which are not located inside freight villages or port terminals).
- intermodal rail terminals located in maritime terminals.
- simple rail yards (where a relevant quota of intermodal traffic is not operated), private rail junctions.

The following tables shows the list of urban nodes in Italy as proposed by the Revision of the TEN-T Regulation, including Rail terminals part of the Adriatic-Ionian Region

Table 38. Node of the European Network in Italy

Node	Urban node	Airport	Seaport	Internal port	Rail/Road terminal
Ancona	X	Globale	Centrale		Centrale (Iesi)
Andria	X				
Augusta			Centrale		
Bari	X	Globale	Centrale		Centrale
Bergamo	X				
Bologna	X	Centrale			Centrale
Bolzano	X	Globale			
Brescia	X				Globale
Brindisi		Globale	Globale		
Busto Arsizio - Gallarate					Globale
Campobasso	X				

Node	Urban node	Airport	Seaport	Internal port	Rail/Road terminal
Catania	X	Globale (Fontanarossa, Comiso emergency runway)	Globale		Globale
Cervignano					Centrale
Chioggia			Globale	Globale	
Civitavecchia			Centrale		
Cremona				Centrale	
Faenza					Globale
Ferrara	X				
Firenze	X	Globale			
Fiumicino			Globale		
Foggia	X	Globale			Globale (Incorornata)
Forlì	X				Globale (Forlì Cesena - Villa Selva)
Gela			Globale		
Gioia Tauro			Centrale		
Lamezia Terme		Globale			
Mantova				Centrale	Globale
Messina	X		Globale		
Milano	X	Centrale (Linate), centrale (Malpensa), centrale (Bergamo Orio al Serio)		Globale	Centrale (Smistamento), centrale (Segrate)
Milazzo			Globale		
Modena	X				
Monfalcone			Globale	Globale	
Monza	X				
Napoli	X	Centrale (Capodichino)	Centrale		Centrale (Nola), centrale (Marcianise-Maddaloni)
Orte					Globale
Ortona					Globale
Padova	X				Centrale
Palermo	X	Centrale	Centrale (Palermo, Termini Imerese terminal)		
Parma	X				Globale (Bianconese di Fontevivo), globale (Castelguelfo)

Node	Urban node	Airport	Seaport	Internal port	Rail/Road terminal
Perugia	X	Globale			
Pescara	X	Globale			Globale (Manoppello)
Piacenza	X				Globale
Pordenone					Globale
Porto Empedocle			Globale		
Porto Nogaro				Globale	
Portogruaro					Globale
Potenza	X				
Prato	X				Centrale (Prato)
Ravenna	X		Centrale	Centrale	
Reggio di Calabria	X	Globale	Globale		
Reggio Emilia	X				
Rimini	X	Globale			
Roma	X	Centrale (Fiumicino), globale (Ciampino)			Centrale (Pomezia)
Rovigo				Globale	Globale
Siracusa	X		Globale		
Taranto	X		Centrale		
Terni	X				
Trapani		Globale	Globale		
Trento	X				Globale
Treviso		Globale			
Trieste	X	Globale	Centrale	Centrale	Centrale (Fernetti)
Udine	X				
Venezia	X	Centrale	Centrale	Centrale	
Verona	X	Globale			Centrale
Vicenza	X				

In this paragraph the analysis concentrates to intermodal road-rail terminals which and is based a recent report on Rail freight transport in Italy: an analysis of combined transport connections.

The law n. 240 of 4 August 1990 [25] defines precisely what is a freight village in Italy: "*A freight village is a system of integrated structures and services aimed at the exchange of goods among different transport modes; a freight village comprises a rail yard suitable for composing or receiving complete trains and it is connected to ports, airports and to the main roads*".

Furthermore, a freight village must satisfy the following requirements:

- direct road connections with the main national road network.
- direct rail connections with the main national rail network.
- adequate road and rail connections with at least a port and/or an airport.
- location must be coherent with trans-European transport corridors.

Twenty-four freight villages are associated to UIR (Unione Interporti Riuniti): 14 are located in the north, 5 in the centre and 5 in the south. The freight terminal are the are located in the following cities: Torino, Novara, Rivalta Scrivia, Savona-Vado, Integrated Logistic Centre of Mortara, CEPIM (Parma), Bologna, Trento, Verona-Quadrante Europa, Rovigo, Padova, Portogruaro, Cervignano del Friuli, Venezia, Trieste, Prato (freight village of Central Tuscany), Livorno (Amerigo Vespucci), Jesi (freight village of the Marches), Orte (freight village of Central Italy), Val Pescara (freight village of Abruzzo), Maddaloni-Marcianise (freight village of South Europe), Nola (Campanian freight village), Bari (freight village of Puglia), Catania-Bicocca.

The following figure shows the location of the main rail terminals: red dots represent main intermodal centres; in blue rail terminals close to ports, green dots are border railway terminals.

Figure 31 Location of main rail terminal in Italy [Source: Il Piano Commerciale RFI, Business merci, 2021]

1.9.3 Rail traffic volumes (passengers and freight) and characteristics

According to most recent statistics (National Statistical Office ISTAT), in 2019, 898 million of passenger have been transported by national and international services in Italy, with 347 thousand of train-km performed and an average trip is 63 km long. Looking at freight data, 94 million of tonnes have been moved by 48 thousand of train-km (freight trains).

The following table summarized the most relevant statistics (2019-2020).

Table 39. Rail traffic volumes on the Italian rail network – year 2019 [Source: ISTAT]

RAIL TRAFFIC VOLUMES		898,472,298
Passenger	Passenger-km (thousands)	56,586,415
	Average passenger trip length (km)	63
	Passenger, train-km (thousands)	347,364
Freight	Freight trains, train-km (thousands)	48,429
	Average freight trip length (km)	226
	Freight transported (tonnes)	94,294,582
	Freight, tonn-km transported (thousands)	21,308,998

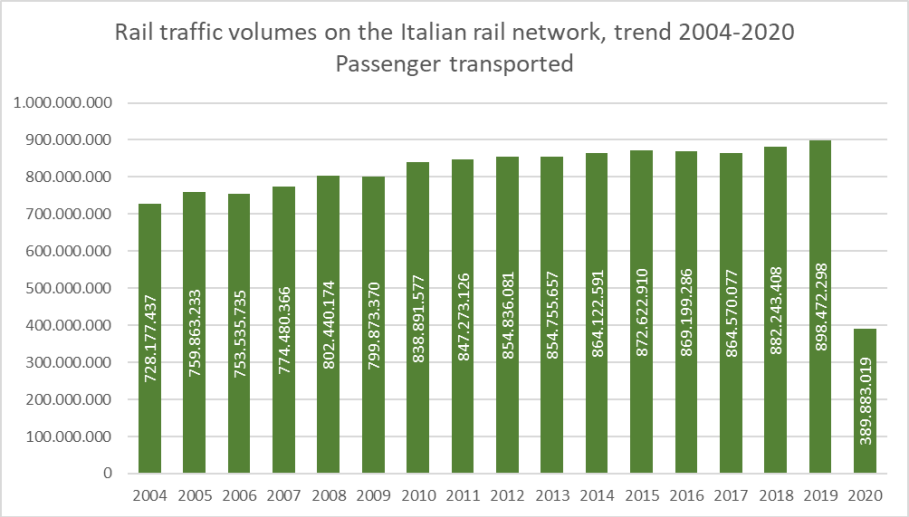

Figure 32 Rail traffic volumes on the Italian rail network, passenger transported [Source: ISTAT, 2021]

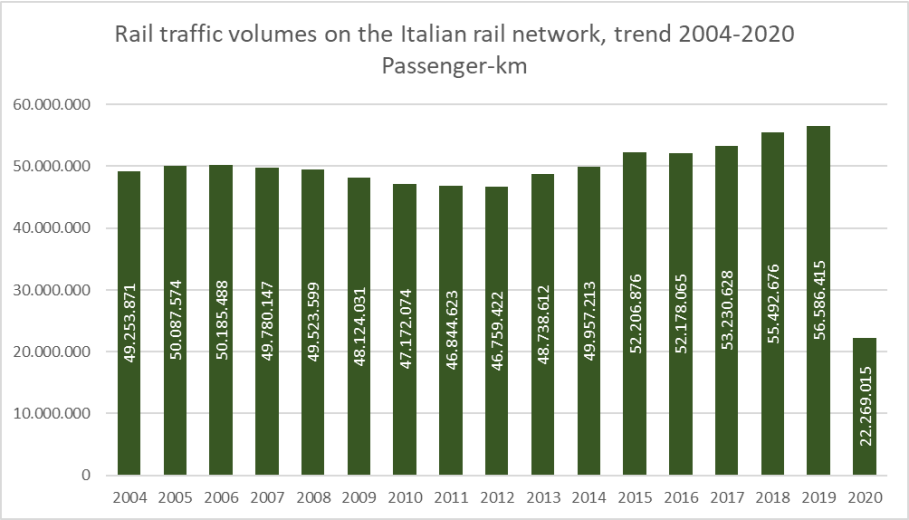

Figure 33 Rail traffic volumes on the Italian rail network, passenger-km transported [Source: ISTAT, 2021]

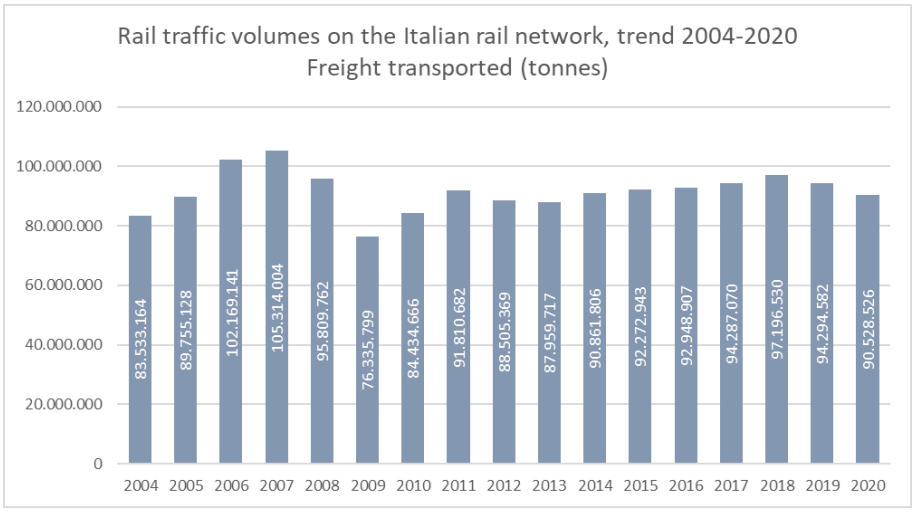

Figure 34 Rail traffic volumes on the Italian rail network, freight transported [Source: ISTAT, 2021]

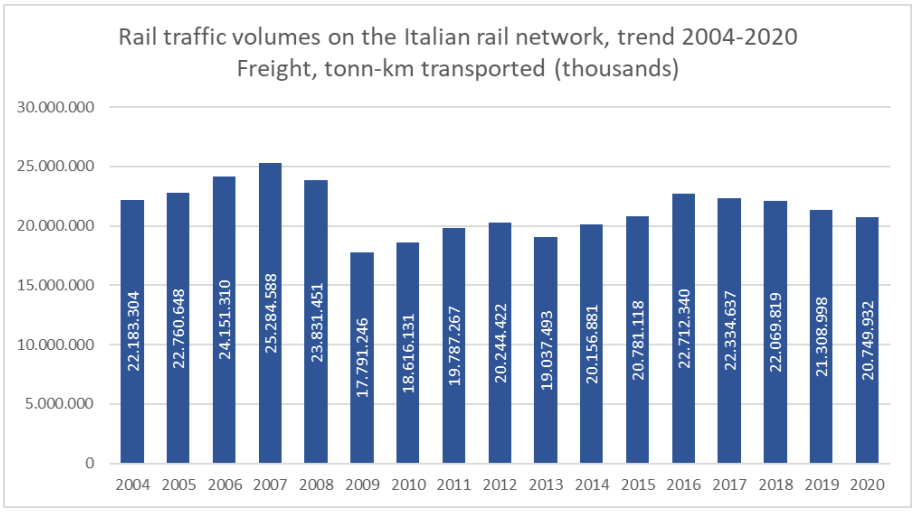

Figure 35. Rail traffic volumes on the Italian rail network, freight ton-km transported [Source: ISTAT, 2021]

Looking at the type of Intermodal Transport Unit transported, most of it is represented by containers and swap bodies followed by unaccompanied trailers and accompanied trailers.

Table 40. Rail freight traffic by Intermodal Transport Unit – year 2019

INTERMODAL TRANSPORT UNIT	TONNES	TONN-KM
Container and Swap Body	45,493,148	10,462,658
passenger-km (thousands)	11,466,688	2,154,167
Average passenger trip length (km)	3,591,442	375,721
Total	60,551,278	12,992,546

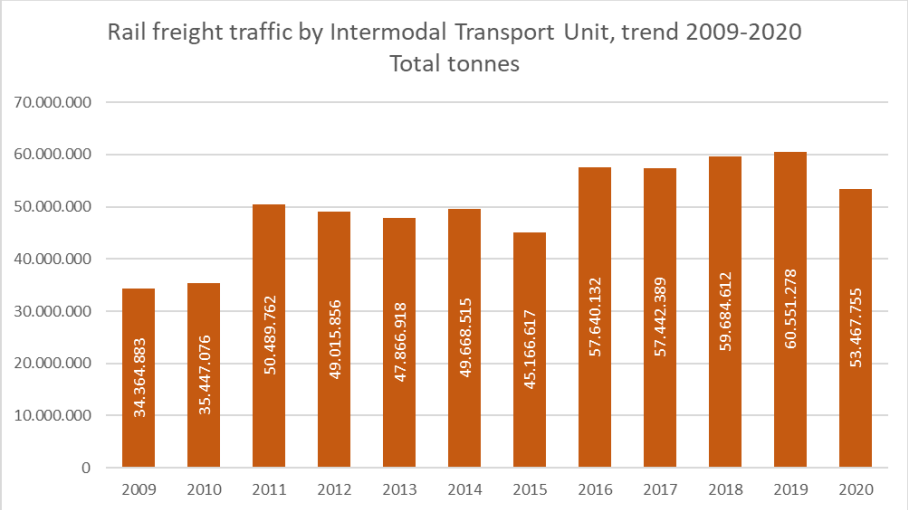

Figure 36 Rail freight traffic by intermodal transport units, total tonnes transported [Source: ISTAT, 2021]

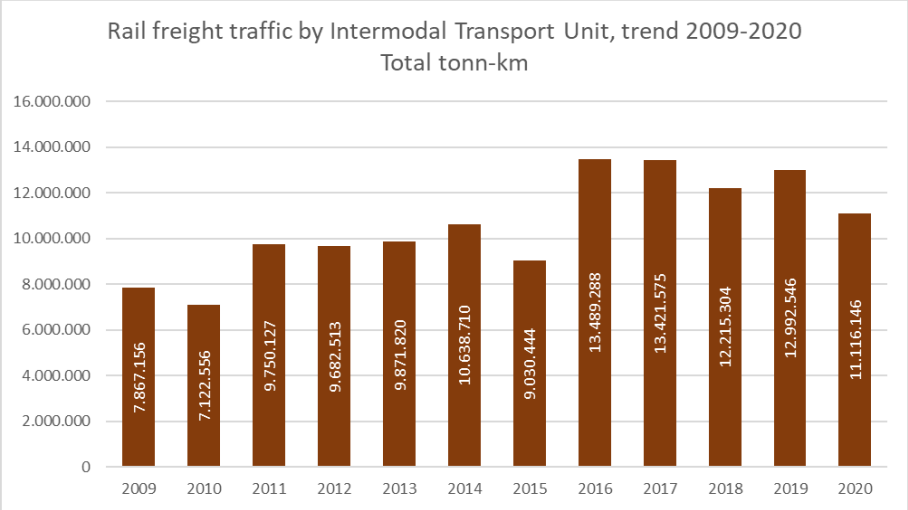

Figure 37 Rail freight traffic by intermodal transport units, total ton-km transported [Source: ISTAT, 2021]

If we look at the cross-borders traffic between Italy and the near countries, the following figure clearly show the relevance of the Brenner axis at national level and the high volume to Switzerland and Slovenia (Villa Opicina). There are more than 250 train/day between Italy and Switzerland and most of them are directed to the Gottardo base tunnel and the Simplon tunnel.

Monitoring by the Alpine Traffic Observatory combined transport is gradually superseding traditional convoys and now accounts for 53 % of all transalpine tonnage transported by rail. An increasing part of it is moved through the rolling highway involving conveying road truck carried by special trains (Ro-La trains). Rolling highway are operating between Austria (Bavaria) and Trento in Italy, in Switzerland, across the Alps for both the Gotthard and Lötschberg - Simplon route and between France and Italy through the Frejus tunnel.

Figure 38 Freight train on the Italian rail network [Source: Il Piano Commerciale RFI, Business merci, 2021]]

If we consider the whole Alpine Arc, overall, transalpine freight transport volumes decreased by -4.5% in comparison to 2019 and reached a level of 211.9 million tonnes in 2020, an increase of +32% compared to 1999 (160.6 million tonnes). In 2020, 63.7 million tonnes of the total volume were transported by rail, -6.1% less than in the previous year. The 148.2 million tonnes that crossed the Alps by road decreased by -3.8% compared to 2019, when this value had reached a new record.

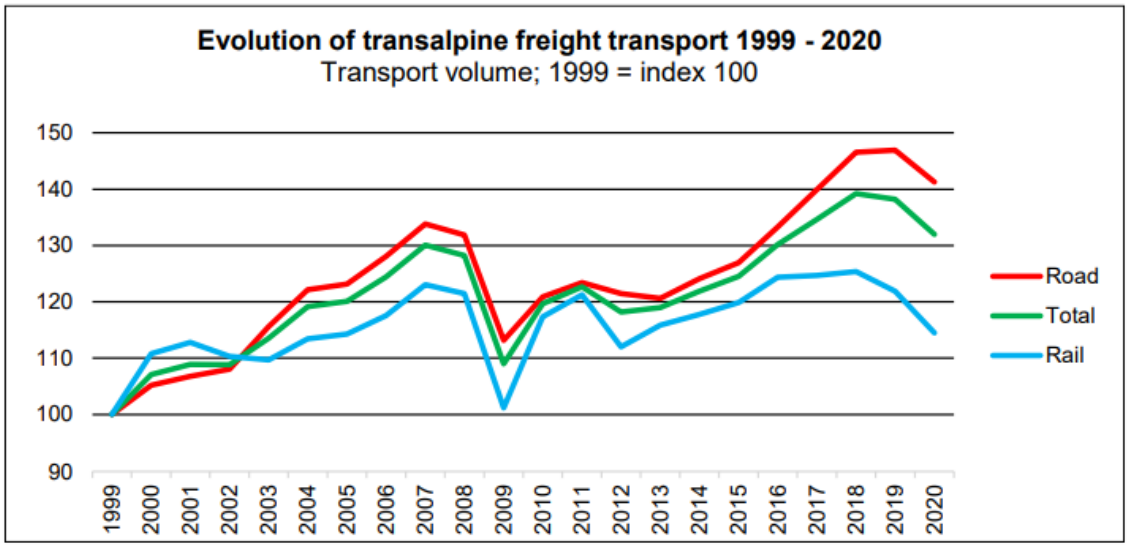

Figure 39 Evolution of transalpine freight transport [Source: Ufficio Federale dei Trasporti UFT]

1.9.4 Border checkpoints infrastructural and operative characteristics

Since all the countries bordering Italy are member of the Schengen Area, no checkpoints are present at the Italian borders. Anyway, since Switzerland is not part of the customs union, freights entering in its territory has customs operation are still necessary.

The following figure shows the entering node of the Italian network, including railway line crossing a border, ports and rail terminal.

All the line crossing the borders have homogeneous infrastructure in term of track gauge therefore it is not required to change part of the train to travel through different networks.

Figure 40 Entering point to the Italian railway network (northern Italy) [Source: Il Piano Commerciale RFI, Business merci, 2021]

One of the issues related with trains passing through more countries, is related to the language and competence of drivers. The language issues in some cases requires the change of train driver at cross border station and this can cause delays. Below are the existing lines in detail.

Border crossing with Austria:

1. (Villach -) Arnoldstein ÖBB[46] - Tarvisio Boscoverde FS[47] (- Udine): At Tarvisio Boscoverde there is a dead section in the catenary; a diesel shunting locomotive propels electric locomotives back to their end of the station.The one remaining daytime train each way between Wien and Venezia was withdrawn at the December 2009 timetable change but reinstated in December 2013. The overnight service, worked by ÖBB as far as Tarvisio Boscoverde, continued running. Two local return workings between Villach and Tarvisio operate daily with one running to and from Udine on weekdays and Trieste at weekends. This service started in June 2012 with Italian company FUC supplying the motive power and OBB the coaching stock.
2. (Villach - Lienz -) Weitlanbrunn ÖBB - Versciaco-Elmo/Vierschach-Helm FS (- San Candido/Innichen - Fortezza/Franzensfeste): The main service is Fortezza to/from Lienz worked by FS dual voltage EMUs. There are no longer through Innsbruck to Lienz trains. Additional ÖBB trains cross the border at certain times of year to terminate at San Candido/Innichen, where the supply voltage changes. Domestic Austrian tickets (issued by VVT - Verkehrsverbund Tirol) are still valid between Lienz and Innsbruck, even with a change of train at Fortezza.
3. (Innsbruck -) Brennersee ÖBB - Brenner/Brennero FS (- Fortezza/Franzensfeste): ÖBB works to Brenner/Brennero, where the supply voltage changes. There are local ÖBB trains between Innsbruck and Brenner/Brennero, and local Trenitalia trains between Brennero and Merano/Meran or Bologna Centrale. EC services run every two hours between München Hbf, Innsbruck and Bologna Centrale. There are no longer any local ÖBB trains between Innsbruck and Lienz.

Border crossing with France:

1. Modane SNCF[48] - Bardonecchia FS (- Torino): FS works to Modane, with locomotives operating at reduced power under SNCF 1500V catenary. There are plans for FS locomotives to work freight to and from St Jean de Maurienne, and both SNCF and FS have acquired dual-voltage or multi-system locomotives for use on freight between Lyon and Torino. Multi-system TGVs operate between Paris and Milano which since 15 June 2002 had been the only cross border passenger services, but Trenitalia reintroduced limited local services, initially at weekends only in Autumn 2017, and high-speed services between Milano and Paris from 18 December 2021.

[46] Österreichische Bundesbahnen (ÖBB, Austrian Federal Railways) They carry out the dual activity of railway companies responsible on the one hand for the commercial exploitation of rail transport services for passengers and goods, and on the other for the exploitation and maintenance of the Austrian national railway network. The exploited network has approximately 5,700 km of lines, of which 57% are electrified lines. The company transports approximately 188 million passengers per year.

[47] Ferrovie dello Stato Italiane (FS, Italian State Railways) they are an Italian public company that operates both in the rail transport and local public transport sectors, as well as in the freight sector.

[48] Société Nationale des Chemins de fer Français (SNCF, National Society of French Railways) it is an exclusive concessionaire both for public rail transport services - passengers and goods, and for the infrastructures of the French national railway network. The exploited network has approximately 32,000 km of lines, of which 1,500 km of high-speed lines and 14,500 km of electrified lines.

2. (Breil-sur-Roya -) Vievola SNCF - Limone FS (- Cuneo): FS works through between (Ventimiglia -) Breil-sur-Roya and Cuneo. Although FS diesel railcars ALn663.1195-1204 are fitted with SNCF VACMA signalling equipment for operation to Nice, FS services no longer run there. Although the line is in France, there are few SNCF workings between Breil-sur-Roya and Tende, and none north thereof.
3. Breil-sur-Roya SNCF - Olivetta S Michele FS (- Ventimiglia): FS works to Breil-sur-Roya.
4. (Nice -) Menton-Garavan SNCF - Ventimiglia FS: SNCF works to Ventimiglia. The line from Marseille is electrified at 25kV 50Hz, but Ventimiglia station itself is 1500V dc. This system can be used by both the SNCF dual-system locomotives that operate in the area and FS 3kV dc stock.

Border crossing with Slovenia:

1. Gorizia Centrale FS - Vrtojba SŽ[49] (- Nova Gorica): FS works to Nova Gorica. Freight only.
2. (Trieste -) Villa Opicina FS - Kreplje SŽ (- Nova Gorica): Freight only but clearly no traffic at as June 2019. This line is probably used only rarely, if the line via Sežana is blocked. SŽ works to Villa Opicina.
3. (Trieste -) Villa Opicina FS - Sezana SŽ (- Ljubljana): SŽ works to Villa Opicina. Five pairs of local SŽ trains between Sežana and Villa Opicina were reinstated on 5 January 2015 replacing substitute bus services, following approval for the 312 'Desiro' units by the Italian authorities. All were apparently withdrawn from 4 September 2023 leaving just the two daily FS Ljubljana - Trieste - Udine EMU pairs that commenced from 9 September 2018 and a Wien - Trieste EC that commenced in 2021. The one passenger train night pair which previously ran direct from Venezia via Villa Opicina had ceased on 11 December 2011.

Border crossing with Switzerland:

1. (Domodossola -) Iselle di Trasquera FS - Brig SBB[50]: SBB and BLS[51] work to Domodossola, where electric locomotives are shunted back to their own end of the station. Through freight trains change locomotive in sidings adjacent to Domodossola station. Those requiring remarshalling are worked to and from Domodossola Smistamento by SBB and BLS via an independent line electrified at 15kV 16.7Hz. FS owns the railway to Iselle di Trasquera but operates no trains. Electrification equipment is to Italian design, with typical tubular masts, but energised at 15 kV 16.7 Hz.

[49] Slovenske železnice (SŽ, Slovenian Railways) is the state railway company of Slovenia. The Slovenian railway system has 1229 kilometers of lines, 331 km of double track, and reaches all regions of the country. The electrification of the network is carried out with a 3 kV DC system, (like the Italian one), and covers approximately 503 km of line. The continuation of the electrified railway line in Croatia is at 25 kV AC, this makes it necessary to replace the traction vehicles in the Slovenian city of Dobova, on the border with Croatia.

[50] Schweizerische BundesBahnen (SBB, Swiss Federal Railways) they are the main operator of the Swiss railway network. The acronyms of the name are expressed in French and Italian also. In Italian acronym is: Ferrovie Federali Svizzere SA (FFS); while in French: Chemins de Fer Fédéraux suisses (CFF).

[51] BLS is a Swiss railway company created in 2006, infrastructure manager of a 440 km standard gauge network and is therefore the largest privately-owned railway in Switzerland.

2. (Domodossola -) Ribellasca SSIF[52] - Camedo FART[53] (- Locarno): This metre-gauge railway is operated as a single entity by Società Subalpina di Imprese Ferroviarie (SSIF, Italian company) and Ferrovie autolinee regionali ticinesi (FART, Swiss company), with through electric multiple units from end to end.
3. (Luino -) Pino-Tronzano FS - Ranzo-S Abbondio FFS [54](- Cadenazzo): FFS/SBB works a two hourly Bellinzona - Malpensa service jointly with Trenord.
4. (Arcisate -) Cantello-Gaggiolo FS - Stabio FFS (- Mendrisio): This new international line opened to passengers on 7 January 2018. Passenger services on the Mendrisio - Stabio section within Switzerland started in November 2014.
5. (Malnate -) Santa Margherita Confine IT/CH (- Stabio - Mendrisio): Club del San Gottardo started operating a summer tourist service over the Ponte Lanza - Santa Margherita section of the former Ferrovia Mendrisio-Stabio in 1993. It was extended in stages until from 2007 it covered the Mendrisio - Stabio CH - Malnate IT section. Operations on the cross-border section were suspended in 2015 as a result of the start of work on the Stabio - Arcisate line (see previous entry), the tourist service operating exclusively in Swiss territory. After a considerable period of inactivity, the Mendrisio site was closed from 31 December 2020 with the Club concentrating on their "Swiss Railpark" site at Biasca, to where all rolling stock and offices have been transferred. Therefore, there are no longer any tourist trains on any part of this line. Reopening of the entire line through to Castellanza has been proposed by various local authorities on the route.
6. (Milano -) Cucciago FS/Como S Giovanni FS - Border FS 50.5 = FFS 206.5 - Chiasso FFS (- Lugano): The Como avoiding line (via Monte Olimpino tunnel II) joins the FS main line (via Como and Monte Olimpino tunnel I) in Italian territory but north of the tunnel mouths. The Chiasso Smistamento freight line diverges from the passenger line here, still in Italian territory and giving rise to two parallel border crossings, as follows:
    a. (Milano -) Cucciago FS/Como S Giovanni FS - Chiasso FFS (passenger station) (- Lugano): Passenger line. Italian single-voltage locomotives work to Chiasso, where they are shunted off their trains; there is no voltage switching.
    b. (Milano -) Cucciago FS/Como S Giovanni FS - Chiasso Smistamento FFS (- Lugano): Freight line. Italian single-voltage locomotives work to Chiasso Smistamento marshalling yard.
7. Tirano RhB - Campocologno RhB (- St.Moritz): This is the Rhätische Bahn metre gauge line, worked exclusively by that company.

1.9.5 ERTMS implementation

The ERTMS (European Railway Traffic Management System) system works as a unique signalling system standard that guarantee a better interoperable network across Europe. The ERTMS is also foreseen by the

[52] Società Subalpina Imprese Ferroviarie (SSIF, Subalpina Railway Companies) is the joint-stock company that manages the Italian section of the Italian-Swiss railway Domodossola-Locarno, both as a railway company and as an infrastructure manager.

[53] Ferrovie Autolinee Regionali Ticinesi (FART, Ticino Regional Bus Railways) they are a local and tourist transport company in Ticino, Switzerland. It is based in Locarno. The company manages the Verdasio - Rasa and Intragna - Pila - Costa cable cars in the Centovalli, local traffic in the Locarno region and the Centovallina, which connects the Gotthard railway with the Sempione railway line in Domodossola (Italy).

[54] See note number 50.

Regulation (EU) 1315/2013 on Union guidelines for the development of the TEN-T network and to be completed by 2030.

In Italy, RFI is responsible for implementing the ERTMS on the TEN-T network and in all the national network by 2035, starting at first with the High-Speed network. In particular, the High Speed/High Capacity (AV/AC) network was developed using ERTMS L2 and so far, more than 700km of line is equipped with this standard.

The following figure shows the state of the art of the ERTMS implementation and the plan for the next years.

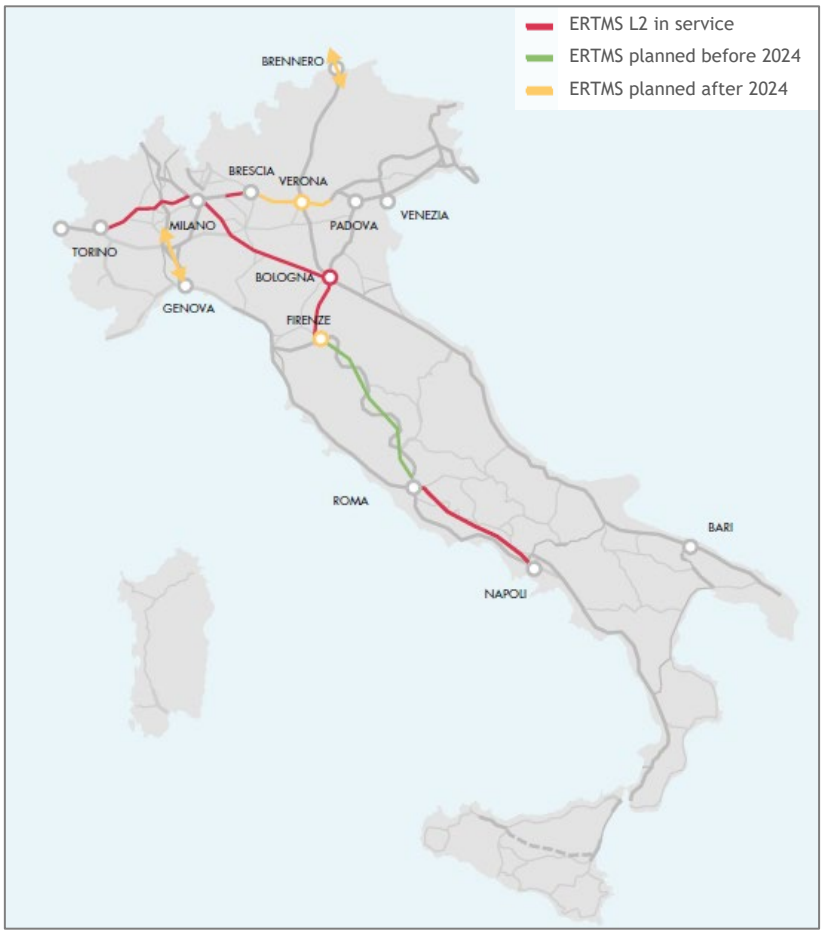

Figure 41 ERTMS implementation on the Italian railway network [Source: Il Piano Commerciale RFI, Business merci, 2021]

1.9.6 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out related to the Italian railway system, by type of impact.

Table 41 Italy: Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILITY	SAFETY/SECURITY	SERVICE	SUSTAINABILITY	CAPACITY
ITALY	8,000 km of lines are still not electrified	■			■	
	750 metres long freight train are not allowed in all the network (or cannot be managed at terminals)	■				■
	Still more than 50% of the of the Corridor lines in Italy do not guarantee the p/c 80 loading gauge.	■				■
	Still 17% of the TEN-T core network do not allow D4 (22.5 t) standard	■				■
	ERTMS not implemented on the entire network	■	■			■

1.10 Summary of the key issues identified on the rail transport network in the EUSAIR region

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out on the EUSAIR rail network by type of impact. It has to be considered that some intervention may cause more than one a single impact on, for instance, accessibility of safety and security, therefore the table blow shows the most relevant impact the identified key issues may produce.

Table 42 Identified Key Issues by type of impact.

COUNTRY	KEY ISSUE	INTEROPERABILI	SAFETY/SECURIT	SERVICE	SUSTAINABILITY	CAPACITY
ALBANIA	All lines are single track					■
	All lines are not electrified (only diesel traction)	■			■	
	Maximum speed between 50km/h to 70 km/h					■
	Axle load < 20tons on the entire network	■				■
	Gradients are quite relevant in some sections	■				■
	ERTMS not implemented on the entire network	■	■			■
	Very limited number of lines and network length (420km)			■		■
BOSNIA AND HERZEGOVINA	Many lines are still single-track including Corridor 'sections					■
	Maximum train length is limited to 300m	■				■
	Maximum speed between 50km/h to 70 km/h					■
	ERTMS not implemented on the entire network	■	■			■
	Very limited number of lines and network length (1000km)			■		■

COUNTRY	KEY ISSUE	INTEROPERABILI	SAFETY/SECURIT	SERVICE	SUSTAINABILITY	CAPACITY
MONTENEGRO	All lines are single-track including Corridor 'sections					
	Maximum train length is limited to 500m (many section <300m)					
	Maximum speed between 50km/h to 100 km/h					
	ERTMS not implemented on the entire network					
	Very limited number of lines (only three lines converging in the Capital Podgorica) and network length (250km)					
	Some sections are not electrified including the Corridor 'section Podgorica-Tuzi					
SERBIA	Just 7.9% of the network is double track					
	Maximum train length is limited to 500m					
	Maximum speed is limited to 50km/h in almost all sections					
	ERTMS not implemented on the entire network					
	Just 33.6% of the network is electrified					
	Some sections are not electrified including the Corridor 'section Podgorica-Tuzi					
CROATIA	Just 10% of the network is double track					
	Just 36% of the network is electrified					
	Maximum speed is below 100% for the 70% of the network					
	section Pula – Buzet has no direct connection with the rest of Croatian network					
	No direct connection between Croatia and port of Ploče					
	Maximum train length below 500m for most of the network					
	ERTMS level 1 only implemented in the section Vrpolje-Vikonvci-Tovarnik					
SLOVENIA	Just 50% of the network is electrified					
	Just 27% of the network has double track					
	Maximum train length is always below 600m					
	Entering in Austria, Hungary and Croatia requires to change locomotive due to the different electrification and voltage					
	ERTMS Level 1 only partially implemented					
	Just single-track line to access the Port of Koper					
GREECE	Just 30% of the network has double track					
	35% of the network (Peloponnesus) equipped with metric gauge					
	Morphology (steep gradients) and acute curvatures allows low speed travel for most of the secondary lines					
	The new port in Patras has no connection with the main network					
	Electrification only partially implemented					
	ERTMS Level 1 not yet implemented					
	No connection with Albania					

COUNTRY	KEY ISSUE	INTEROPERABILI	SAFETY/SECURIT	SERVICE	SUSTAINABILITY	CAPACITY
NORTH MACEDONIA	Just 34% of the network is electrified	■			■	
	All the network has single track					■
	There are no national terminals, the Country is supplied by the foreign port of Durres (Albania) and Thessaloniki (Greece)			■		
	No railway connection with the foreign Port of Durres (Albania)			■		
	Change of locomotives and driver are required at borders (most of)	■				
	ERTMS not implemented on the entire network	■	■			
	Intermodal container transport in the country is undeveloped.			■		
ITALY	8,000 km of lines are still not electrified	■			■	
	750 metres long freight train are not allowed in all the network (or cannot be managed at terminals)	■				■
	Still more than 50% of the of the Corridor lines in Italy do not guarantee the p/c 80 loading gauge.	■				■
	Still 17% of the TEN-T core network do not allow D4 (22.5 t) standard	■				■
	ERTMS not implemented on the entire network	■	■			■

2 Planned projects in the Adriatic Ionian Macro Region

2.1 Introduction

The following chapters provide the extensive list of rail infrastructural projects identify in the Adriatic-Ionian Macro Region. The projects have been identified through the review of existing and available transport plans and investment programs, including both national and international documents.

To provide the details of planned projects, investment plans and drafting the road transport sector programmatic framework, the following national transport plans, EU investment plans and strategies and other international financial institution investment plans have been investigated based on availability and included, whether available, for each member state of the EUSAIR region:

- Connecting Europe Facility (CEF) Transport projects funding by EU
- The National Recovery and Resilience Plan (NRRP)
- Trans-European Transport Network (TEN-T)
- Development of indicative TEN-T extensions of the Comprehensive and Core Network in Western Balkans
- The National Transport Plan
- The National Rail Transport Strategy
- The international financial investment plans (World Bank, EU Investment Bank, etc.)

The following volume therefore analyses the main planning document on a national scale, making a summary of the projects for EU countries, while for non-EU countries a specific focus is made on the strategic plan drafted by the Transport Community. This insight concerns Western Balkans Countries (Albania, Bosnia and Herzegovina, Montenegro, Serbia and North Macedonia), for which in addition to the national strategic plans, will also be verified the main measures and objectives included in the strategic work plan "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans".[55]

Following paragraphs present tables including rail infrastructural projects identified in each Country and characterized by type of project, main goal of the intervention and the belonging scenario. Type of project includes new construction or rather upgrade of existing infrastructures. Belonging scenario is divided into two categories: baseline or project scenario. Baseline scenario includes those interventions planned and financed, under construction or completed by 2030 and the Project scenario, describes interventions which are included in a plan/program/strategy but not entirely financed (for some of the projects, partial investment is already in place but not the whole required amount to complete the investment, therefore these have been considered as part of Project Scenario).

[55] "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022

2.2 Albania

2.2.1 National Transport Strategy and Action Plan

The Government of Albania adopted the "Sectorial Strategy of Transport (SST) and Action Plan 2016- 2020" [56] through the Decision of the Council of Ministers, No. 811, dated 16th of November 2016, "For the approval of the Transport Strategy and Action Plan 2016-2020".

National Strategy is focused on reaching an efficient transport system, integrated in the region and in the EU network, with the purpose to promote economic development and upgrade life quality. The overall objective of the Sectorial Strategy of Transport and Action Plan 2016-2020 is to develop national transport system by improving its sustainability, interconnectivity, interoperability, and integration with the international and European transport system.

The main challenges in the rail sector for the 2016-2020 planning period are:

1. Reform the rail system to set up an open market for public and private investors whether in terms of market regulation, infrastructure management or rail operations.

2. Strengthen human capacities and resources at all levels, to effectively build up the legal and institutional structure that are necessary to ensure a smooth operation of an open market.

3. Create favourable legal and institutional conditions for attracting foreign investment.

4. Create a level playing field with other modes of transport.

2.2.2 Proposed objectives and measures

The strategy identified 43 Policies (Priority Actions) for the 5-year period which are deeply interlinked and strike a balance between soft measures and investments. Each priority action is detailed in specific tasks required for its attainment. Priority Action are divided into six reference sectors. The first of these considers the transport sector as a whole and identify two Transversal Priority Actions, other sectors covered are road, rail, maritime, air and intermodal and combined transport.
Focusing on the rail transport, the major project on the railway network consists of the Rehabilitation of the Durres - Tirana railway public transport terminal PTT and construction of the new Tirana - Rinas branch line. The project foresees more than 34 km of the existing track between Tirana and the Port of Durres to be rehabilitated and new 7.4 km-long track connecting the city of Tirana to the International Airport of the city.

Following table decline Priority Actions for rail transport set in the Strategy.

[56] https://www.infrastruktura.gov.al/wp-content/uploads/2020/07/3rd-Monitoring-Report-of-Sectorial-Transport-Strategy-and-Action-Plan-2016-2020_June-2020.pdf

Table 43 Albania Priority Actions for Rail Transport [Source: Sectorial Strategy of Transport and Action Plan 2016-2020]

ID	Description
1	*Adoption and effective implementation of the new railway code in line with the respective EU Directives, especially EU Directive 2012/34/EU RECAST*
2	*Separation of HSH into infrastructure manager, freight and passenger operator, operator of rail services*
3	*Setting up the railway safety bodies (safety, and accident investigation) and market regulatory bodies (incorporation of the Railway Regulatory Body within the Competition Authority) and training of staff*
4	*Clarify situation at the ports concerning port and railway law (clarify tasks and requirements of concessionaires, rail infrastructure manager and port authority)*
5	*Integrate SEETO Flagship Axes into the Rail Network Europe (RNE) corridor system and implement respective RNE procedures and RFCs*
6	*Build up attractive and competitive hinterland rail corridors for the Port of Durres in line with the SSPP for transport and actively involve the ports for promotion and marketing*
7	*Ensure a high level of maintenance with a preventive maintenance system on core and comprehensive rail networks*

Task planned in the Strategy are constantly monitored thanks to information gathered from different institutions which are involved in the implementation of the Action Plan, with the aim to measure progress achieved.

3rd Monitoring Report of the Strategy covers the progress achieved during 2019, the following tables provide information regarding the Status of ten Priority Actions regarding the road transport sector:

Table 44 Albania Status of Priority Actions for Rail Transport. [Source: Sectorial Strategy of Transport and Action Plan 2016-2020]

Strategic Priority 1	Reform the rail sector to set up an open market for public and private investors	
Goal 1.1	Expected Result	
Establish an open legislation for a fair, non-discriminatory and transparent railway market and strengthen the capacities of all levels.	Open up the railway sector in line with the European Directives and the European framework. Establish an attractive framework for the entrance of new railway undertakings. Better control over the use of public funds in respect to HSH. Opening up the market also in the field of technical acceptance of EU standards (acceptance of EU notified bodies, cross border acceptance, etc., and ensure open and non-discriminatory access to the rail network and serviced- facility providers). Establish a fair, non-discriminatory and transparent rail market	
Priority Action RAIL 1	Specific tasks	
Adoption and effective implementation of the new railway code in line with the respective EU Directives, especially EU Directive 2012/34/EU RECAST.	Operational, regulatory & licensing – **2016**: Effective implementation of the new Railway Code.	Completed
	– **2017 - 2018**: Preparation and implementation of other relevant sub-legal acts (implementation acts/directives) in the realm of licensing, safety, accident and incidence investigation, interoperability and market regulation required by the new Railway Code.	In progress
Strategic Priority 1	Reform the rail sector to set up an open market for public and private investors.	
Goal 1.1	Expected Result	
Establish an open legislation for a fair, non-discriminatory and transparent railway market and strengthen the capacities of all levels	Open up the railway sector in line with the European Directives and the European framework. Establish an attractive framework for the entrance of new railway undertakings. Better control over the use of public funds in respect to HSH. Opening up the market also in the field of technical acceptance of EU standards (acceptance of EU notified bodies, cross border acceptance, etc., and ensure open and non-discriminatory access to the rail network and serviced- facility providers) Establish a fair, non-discriminatory and transparent rail market	
Priority Action RAIL 2	Specific tasks	
Separation of HSH into: infrastructure manager, freight and passenger operator operator of rail services	Institutional & organizational – **2016 - 2018**: Total separation of the different entities: o Set-up of new organization structure (i.e. Infrastructure manager is independent from operations – freight/passenger services -) be it complete separation or vertically integrated organization. o Separation of accounts of infrastructure manager and railway undertaking(s) in case of a horizontally integrated organization structure (no legal separation of infrastructure and operations). o Definition of tasks o Contract between rail infrastructure manager and Government (budget, investment…) Note this agreement will include all proposed priority actions, their financing, performance and monitoring, in particular the implementation of a preventive maintenance plan for	In progress

	improving the present state of maintenance of the rail infrastructure (permanent way, fixed installations – stations etc.) to support Priority Action RAIL 7. o Contracts between government entities (central government, provinces, municipalities) and service providers of public service obligations (PSO). o Publication of the first network statement by the infrastructure manager. o Training of staff on the new challenges of restructuring the HSH to accomplish the above-mentioned specific tasks.	
Strategic Priority 1	Reform the rail sector to set up an open market for public and private investors	
Goal 1.1	**Expected Result**	
Establish an open legislation for a fair, non-discriminatory and transparent railway market and strengthen the capacities of all levels	Open up the railway sector in line with the European Directives and the European framework Establish an attractive framework for the entrance of new railway undertakings Better control over the use of public funds in respect to HSH Opening up the market also in the field of technical acceptance of EU standards (acceptance of EU notified bodies, cross border acceptance, etc., and ensure open and non-discriminatory access to the rail network and serviced- facility providers) Establish a fair, non-discriminatory and transparent rail market	
Priority Action RAIL 3	**Specific tasks**	
Setting up the railway safety bodies (safety, licensing and accident investigation) and market regulatory bodies (incorporation of the Railway Regulatory Body within the Competition Authority), and Training of staff	Institutional & organizational **2017 – 2018**: Setting up railway bodies (in order of priority: Infrastructure managers; Charging body; Railway safety body; Rail accident and incident investigation body; Rail market regulatory body; Licensing body; Interoperability body): o Organization structure o Job profiles/functional description o Budget o Training of staff at respective educational institutions in EU member states and European Railway Agency (ERA) for periods of one to three months (approximately, Ministry responsible for Infrastructure and Energy (MoIE): 4 persons, Rail market regulatory body :2 persons, Safety / Interoperability /Licensing / Accident bodies: 20 persons, Infrastructure / Charging: 20 persons)	In progress
Strategic Priority 1	Reform the rail sector to set up an open market for public and private investors	
Goal 1.2	**Expected Result**	
Create favorable legal and institutional conditions for attracting foreign investment to the Albanian ports	Attract new investments and new volumes Increase the attractiveness of Albanian ports	
Priority Action RAIL 4	**Specific tasks**	
Clarify situation at the ports concerning port and railway law (clarify tasks and requirements of concessionaires, rail infrastructure manager and port authority)	Institutional & organizational – **2016 - 2018**: Clarify/solve the legal and institutional issues with respect to ownership, management, operation and maintenance of rail infrastructure in the port: o Clarify/solve the legal and institutional issues with respect to rail operations, in light of the forthcoming updating of the Albanian Railway Law. o Assess the market opportunities for commercial port operators or port authorities to establish their own rail operations inside and outside the ports. (Action No. 25, SEETO Strategic Working Program: *"Find out the legal, operational and technical demands of the market*	completed

	participants that shall act on the Corridor VIII to ensure an increasing competitiveness and attractiveness of Corridor VIII to and from the port of Durres"). o Study for the improvement the efficiency of loading and unloading of goods/ transfer of containers between ship and rail/road in the ports (organisational and technical barriers and possible solutions incl. action plan)	
	- Planning & investment – **2016 – 2018**: Feasibility study for a Port Community System for improvement of the electronic communication and interchange between port operators, port authorities, rail operators and other stakeholders involved in the transfer of goods.	completed
Strategic Priority 2	Positioning of Albania within the European railway market as a player in South-East Europe transport corridors and Rail Freight Corridors RFCs	
Goal 2.1	Expected Result	
Increase the competitiveness and visibility of extensions of TEN-T Corridors and SEETO Corridors	Attract investments Reduce rail transit times and transport costs (less delays, competitive transport times) Establish joint border crossings Reduce logistics costs	
Priority Action RAIL 5	Specific tasks	
Integrate SEETO Flagship Axes into the Rail Network Europe (RNE) corridor system and implement respective RNE procedures and RFCs	Institutional & organizational - **2016-2017**: Join RNE and join RNE international Working Groups.	Not started
	- **2016 – 2017**: Find out the legal, operational and technical demands of the market participants that shall act on the Corridor VIII to ensure an increasing competitiveness and attractiveness of Corridor VIII to and from the Port of Durres. (interviews and talks with shippers, market study).	Completed
	- **2016 – 2020**: Integrate SEETO Flagship Axes into the RNE corridor.	In progress
	- **2016 – 2020**: Extension of RFCs in Albania (Action No. 2 of SEETO Strategic Working Program: "Establish corridor management on selected flagship corridor that have a Sub-group on a pilot basis by using the model of the corridor management for the European Corridors"). Reference/Best practice: Rail Freight Corridor management in the EU according to EU Regulation 913/2010 as in force, Reference Corridor: Corridor 1 North – SeaPorts – Italy.	In progress
Strategic Priority 2	Positioning of Albania within the European railway market as a player in South-East Europe transport corridorsand Rail Freight Corridors RFCs	
Goal 2.1	Expected Result	
Increase the competitiveness and visibility of extensions of TEN-T Corridors and SEETO Corridors	Attract investments Reduce rail transit times and transport costs (35 % time saving through electronic transmission system) Establish joint border crossings Reduce logistics costs	
Priority Action RAIL 6	Specific tasks	
Build up attractive and competitive hinterland rail corridors for the Port of Durres in line with the SSPP for transport and actively involve the ports for promotion and marketing	Institutional & organizational – **2016**: Establish joint railway border crossings according to the existing BCA signed with the Republic of Montenegro by signing the subsequent protocols for border police, customs, phyto-sanitary and sanitary checking.	Completed
	Planning & investment (approved by SEETO and the EU) – **2016-2020**	
	1. **2016**: Establish the respective border crossing facilities for the Albanian border authorities (office, parking and other facilities) at the joint border station Tuzi.	Completed

	2. **2017**: Establish the electronic transmission system of the road sector (SEED or NCTS) or rail specific systems (RAILDATA, RNE systems. (Action No. 4 of SEETO Strategic Working Programme) *Note: With respect to the sustainability and international integration in the TEN-T corridors and considering in particular the future position of the Port of Durres – see also the Strategic Priorities of intermodality -, the above priorities 1 to 2 are established based on the SEETO Strategic Working Program. They have the approval of the EU.*	Completed
	Planning & investment (pipeline projects from SSPP for Transport) 3.**2016 - 2018**: Feasibility study and detailed design for the rehabilitation of railway line Durres – Rrogozhina –Elbasan – Pogradec – Linand construction of new railway link to Macedonian border	Completed
	4.**2017**: Feasibility study for the Construction for the new railway Pogradec – Korça – border to Greece.	In progress
	5. **2017-2018**: Detailed design for the rehabilitation of the railway Vora – Hani Hotit frontier to Montenegro and signaling and communication system of the Albanian railway connection.	In progress
	6. **2017-2020**: Construction and modernization of the railway lines Durres – Tirana Public Transport Terminal and the new railway missing connection to Tirana Rinas International Airport TIA.	In progress
Strategic Priority 2	Positioning of Albania within the European railway market as a player in South-East Europe transport corridorsand Rail Freight Corridors RFCs	
Goal 2.1	Expected Result	
Increase the competitiveness and visibility of extensions of TEN-T Corridors and SEETO Corridors	Attract investments Reduce rail transit times and transport costs (35 % time saving through electronic transmission system) Establish joint border crossings Reduce logistics costs	
Priority Action RAIL 7	Specific tasks	
Ensure a high level of maintenance with a preventive maintenance system on core and comprehensive rail networks	Planning & investment – **2016 – 2020**: Improvement of the present state of the Core and Comprehensive rail lines taking part of the TEN-T Indicative Extension to Neighbouring Countries Comprehensive/Core network to Western Balkans Region: Core network: ▪ Tirana – Durres: 37 km ▪ Vora – Hani Hotit: 119 km Comprehensive network: ▪ Durres – Lin – Pogradec: 152 km ▪ Rrogozhina – Fier: 84 km In all cases the distance will be extended by 10% of extra track in stations and yards. The improvement actions will include: ▪ Introduction of a preventive maintenance system (2017) in the organization of the Infrastructure Manager (IM) – see Priority Action RAIL 2 –; ▪ Inclusion of the preventive maintenance plan in the (medium-term) Contract between rail infrastructure manager and Government (budget, investment…) required by the new rail code – see Priority Action RAIL 2 –; and ▪ Implementation of the rail maintenance, for permanent way (including bridges and tunnels), fixed installations (including stations, yards and signaling and communication system).	In progress

	– **2016 – 2020**: Prepare an annual report monitoring the increase in AADT (annual average daily traffic) in the road sections with a high potential for tolling identified by the Albanian Road Tolling Strategy (ARTS).	In progress

2.2.3 Overview of transport project in Albania based on "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans"[57]

This work plan is a Strategic document which represents an important basis for a "common, more focused approach to regional connectivity" for the implementation of the Transport Community Treaty.

The main purpose is to ensure coordinated development of the TEN-T in the region and achieve transition to a cohesive network, while all regional partners are pursuing their own connectivity goals.

The document provides an overview of the state of play in development of the indicative extension of the TEN-T network, in term of compliance with TEN-T Standards, to the Western Balkans. The status shown is based on data from the Annual Report on the Development of the TEN-T network of the Regional Steering Committee.

Another document's section includes an overview of TEN-T development plans in the region by analysing regional plan, the top priorities for the region in terms of TEN-T network development, a list of concrete actions for Regional Partners to focus on over the next few years.

Finally, The Transport Community Permanent Secretariat has developed a Sustainable and Smart Mobility Strategy for the Western Balkans together with a corresponding GAP analysis. The purpose is also providing a roadmap for digitalisation and decarbonisation of the region's transport sector.

The main objectives identified for the region are summarized below.

Key objectives:

- Enhancing connectivity within the Western Balkans and with the European Union.
- Improving accessibility and mobility on the TEN-T Network.
- Building the transport of the future towards a smart, sustainable, green, safe and resilient TEN-T network.
- EU acquis implementation and associated policy reforms.

2.2.4 Priority projects maturity in Albania

Regulation (EU) No 1315/2013 defines transport infrastructure requirements as well as the specific requirements expanded from the priorities for railway infrastructure development:

- Electrification - railways network to be electrified by 2030 (including sidings where necessary);
- Axle load: Freight lines 22.5 t axle load by 2030;
- Line speed: Freight lines must allow 100 km/h by 2030 (no speed requirement for passenger lines);
- Train length: Freight lines to allow for 740 m trains by 2030;
- Track gauge: Nominal track gauge for new railway lines 1.435 mm;
- European Railway Train Management System (ERTMS) / signalling system: Core network to be equipped with ERTMS by 2030.

[57] "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022

Railway electrification compliance of the operational network is already 73% on the Core and 54% on the Comprehensive Network. Certain parts of the networks, mainly in Albania and North Macedonia (Corridor VIII), are still in the construction phase.

The TEN-T railways network consists of two layers: the Core and Comprehensive Networks. The total length of the Comprehensive is 3,895 and 2,602 km of the Core. It consists of three corridors (Vc, VIII and X) and seven routes.

Current projects in the region were examined and detailed in the TEN-T annual report. Based on the expected completion date of these projects, the annual report included a forecast of TEN-T compliance rate for the year 2027. Summary tables of mature and non-mature TEN-T projects in the region are presented here, with details on location, cost and expected completion times.

Table 45 Railway Transport Project in Albania Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority projects.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)	Expected Completion
ECONOMIC AND INVESTMENT PLAN FOR WESTERN BALKANS					
FLAGSHIP 3 – CONNECTING THE COASTAL REGION					
Railway projects					
Route 2b	Core	ALB	Rehabilitation of Vore – Han i Hotit Railway Line	260	2028
OTHER PRIORITY PROJECTS					
Railway projects					
Corridor VIII	Comprehensive	ALB	Corridor VIII Railway Albania: Phase 1, Reconstruction of Durres to Rrogozhine stretch	78	2025[23]

Table 46 Railway Transport Project in Albania Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority under preparation.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)
Railway projects				
Corridor VIII	Comprehensive	ALB	Construction of the new railway Po-gradec – Korca – Greek border	240
Corridor VIII	Comprehensive	ALB	Rehabilitation of Rrogozhone – Pogradec – Lin Railway Line and Construction of New Line Lin – Border with North Macedonia	220

2.2.5 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 47 Rail projects in Albania

ID	Scenario	Type	Name	Main goal
AL1	Baseline 2030	New construction	Rehabilitation of Tirana - Durrës railway line (34.5km) and construction for a new railway line Tirana - Rinas Airport (7.4km)	Increasing of East-West connections along Mediterranean TEN Corridor in Tirana-Durres section
AL2	Project	New construction	Rehabilitation of Vora/Vorë - Han i Hotit railway line	Albania's international rail link, connecting the country with Montenegro and beyond
AL3	Project	New construction	Construction of a new railway line Pogradec - Korçë border to Greece (Krystallopigi)	Construction for a new railway increasing connection of cross-border between Greece and Albania
AL4	Project	New construction	Rehabilitation of Durrës - Pogradec - Lin railway line and construction for a new railway line Lin - border to North Macedonia (part of rail Corridor VIII)	Rehabilitation of the Durres - Pogradec - Lin section and construction of railway link between Lin and the border with North Macedonia

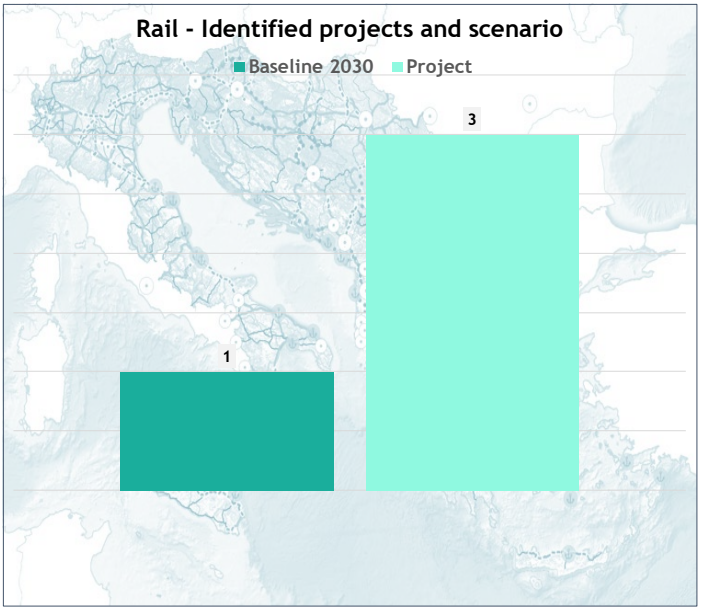

Figure 42 Rail projects by scenario, in Albania

4 rail interventions selected in Albania are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

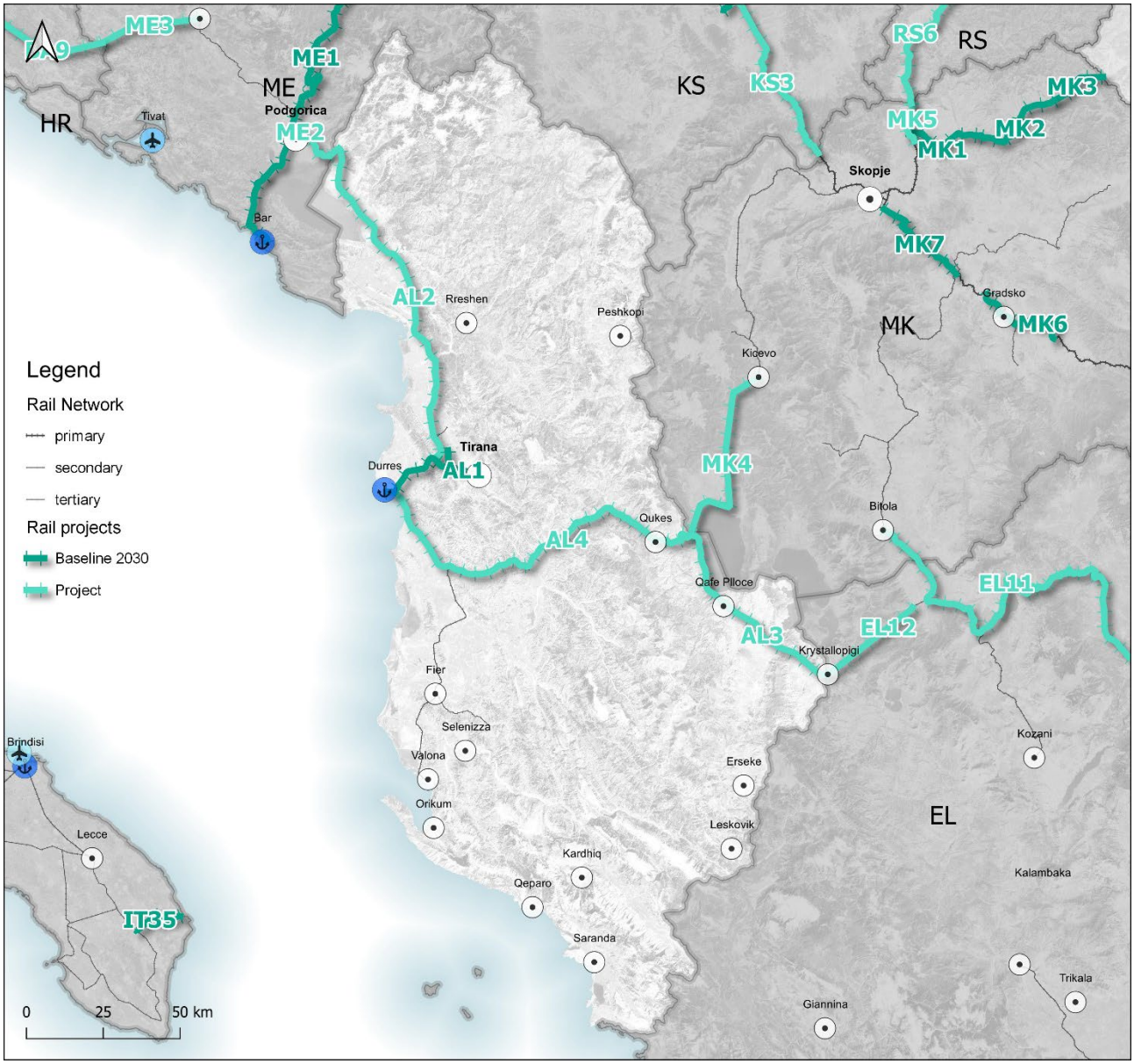

Figure 43 Map of rail project by scenario in Albania

2.3 Bosnia and Herzegovina

2.3.1 National Transport Strategy and Action Plan

Following the adoption of the Framework Transport Policy for BiH, Council of Ministers of BiH adopted in July "2016 Framework Transport Strategy (FTS) and Action Plan" (Official Gazette No.1/16).

The Transport Strategy is therefore defined in the Framework Transport Strategy (2016-2030) of Bosnia and Herzegovina (FTS), which considered two different "entities" (Bosnia and Herzegovina Federation and Srpska Republic). Each of these entities distinguishes "main goals" and "specific targets".

The strategic planning of the transport sector can be defined as a tool at the service of major economic and social policy objectives. For each transport mode, the Framework Transport Strategy aims at defining the actions to be implemented to achieve the general and specific objectives in the short (2016-2020), medium (2021-2025) and long term (2026- 2030).

National transport strategy is oriented to the improvement and efficiency of the railroad system, trying to align its internal goals to European standards and regulations. The following are the most important elements of the Framework Transport Strategy:

1. Meet social and economic demands.

2. Satisfy the needs in terms of maintenance, improvement, and development of transport infrastructure.

3. Be financially sustainable.

4. Comply with EU standards and regulations.

5. Satisfy safety and information requirements.

6. Have a minimal permissible environmental impact.

Actions stemming from the Framework have been allocated to different time periods based on their maturity, budget restriction, etc. The following development categories can be defined:

- actions to be implemented primarily (in the short term).
- action to be implemented after proper preparation (in the medium term).
- actions with low level of maturity and/or constrains (in the long term).

For each action, the Framework Transport Strategy defines: the stakeholders responsible to implement the action and the instruments to be used to implement the action.

Most important project on the railway network interest the Corridor Vc with the overhaul and modernisation of the railway section Samac – Doboj – Rjecica in order to complete 325 km of Corridor Vc running through Bosnia and Herzegovina to connect the port of Ploce on the Croatian Adriatic with Budapest.

2.3.2 Overview of transport project in Bosnia and Herzegovina based on "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans"[58]

This work plan is a Strategic document which represents an important basis for a "common, more focused approach to regional connectivity" for the implementation of the Transport Community Treaty.

The main purpose is to ensure coordinated development of the TEN-T in the region and achieve transition to a cohesive network, while all regional partners are pursuing their own connectivity goals.

[58] "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022

The document provides an overview of the state of play in development of the indicative extension of the TEN-T network, in term of compliance with TEN-T Standards, to the Western Balkans. The status shown is based on data from the Annual Report on the Development of the TEN-T network of the Regional Steering Committee.

Another document's section includes an overview of TEN-T development plans in the region by analysing regional plan, the top priorities for the region in terms of TEN-T network development, a list of concrete actions for Regional Partners to focus on over the next few years.

Finally, The Transport Community Permanent Secretariat has developed a Sustainable and Smart Mobility Strategy for the Western Balkans together with a corresponding GAP analysis. The purpose is also providing a roadmap for digitalisation and decarbonisation of the region's transport sector.

The main objectives identified for the region are summarized below.

Key objectives:

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- Improving accessibility and mobility on the TEN-T Network.
- Building the transport of the future towards a smart, sustainable, green, safe and resilient TEN-T network.
- EU acquis implementation and associated policy reforms.

2.3.3 Priority projects maturity in Bosnia and Herzegovina

Regulation (EU) No 1315/2013 defines transport infrastructure requirements as well as the specific requirements expanded from the priorities for railway infrastructure development:

- Electrification - railways network to be electrified by 2030 (including sidings where necessary);
- Axle load: Freight lines 22.5 t axle load by 2030;
- Line speed: Freight lines must allow 100 km/h by 2030 (no speed requirement for passenger lines);
- Train length: Freight lines to allow for 740 m trains by 2030;
- Track gauge: Nominal track gauge for new railway lines 1.435 mm;
- European Railway Train Management System (ERTMS) / signalling system: Core network to be equipped with ERTMS by 2030.

Railway electrification compliance of the operational network is already 73% on the Core and 54% on the Comprehensive Network. Certain parts of the networks, mainly in Albania and North Macedonia (Corridor VIII), are still in the construction phase.

The TEN-T railways network consists of two layers: the Core and Comprehensive Networks. The total length of the Comprehensive is 3,895 and 2,602 km of the Core. It consists of three corridors (Vc, VIII and X) and seven routes.

Current projects in the region were examined and detailed in the TEN-T annual report. Based on the expected completion date of these projects, the annual report included a forecast of TEN-T compliance rate for the year 2027. Summary tables of mature and non-mature TEN-T projects in the region are presented here, with details on location, cost and expected completion times.

Table 48 Railway Transport Project in Bosnia Herzegovina Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority projects.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)	Expected Completion
ECONOMIC AND INVESTMENT PLAN FOR WESTERN BALKANS					
ECONOMIC AND INVESTMENT PLAN FOR WESTERN BALKANS FLAGSHIP 2 - CONNECTING NORTH TO SOUTH					
Railway projects					
Corridor Vc	Core	BIH	Upgrade and reconstruction of the Corridor Vc, rail line Doboj – Rasputnica Miljacka	500	2030

Table 49 Railway Transport Project in Bosnia Herzegovina Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority under preparation.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)
Railway projects				
Route 9a	Comprehensive	BIH	Rehabilitation and Modernization of the railway section Banja Luka – Doboj –Tuzla- Zvornik – border with Serbia	323

2.3.4 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 50 Rail projects in Bosnia and Herzegovina

ID	Scenario	Type	Name	Main goal
BA1	Project	New construction	Construction of a new railway line BanjaLukaPrijedor - Novi and Grad - Dobrljin (Route 9a - parallel to Corridor X)	Increasing of East-West connections across the Region in section between Croatia border and BanjaLuka.
BA2	Project	Upgrade	Rehabilitation of Doboj - PetrovoNovo - Tuzla (Route 9a - parallel to Corridor X)	Increasing of East-West connections across the Region in section between Doboj and Tuzla.
BA3	Project	Upgrade	Rehabilitation of Živinice - Caparde - Zvornik incl. tunnel Križevići (Route 9a - parallel to Corridor X)	Increasing of East-West connections across the Region in section between Živinice and Serbia border.
BA4	Project	Upgrade	Rehabilitation of Brčko - Banovići (Route 9a - parallel to Corridor X)	Increasing of North-South connections across the Region in section between Živinice and Croatia border.

ID	Scenario	Type	Name	Main goal
BA5	Baseline 2030	Upgrade	Modernization of the signaling equipment of Sarajevo - Bradina and Doboj - Banja Luka railway lines: Miljacka railway station and Stup freight station	Increasing of North-South connections on Western Balkans corridor
BA6	Baseline 2030	Upgrade	Modernization of the signaling equipment of Sarajevo - Bradina and Doboj - Banja Luka railway lines: Banja Luka - Doboj line	Increasing of East-West connections across the Region on Banja Luka-Doboj line
BA7	Baseline 2030	Upgrade	Rehabilitation of Sarajevo - Bradina railway line	Increasing of North-South connections on Western Balkans corridor in Sarajevo –Bradina section
BA8	Project	Upgrade	Overhaul of Sarajevo - Podlugovi railway section (Mediterranean Corridor - Rail CVc)	North-South connection along Mediterranean Corridor: Overhaul of Sarajevo - Podlugovi Railway Section
BA9	Project	New construction	Construction of a new railway line ČapljinaTrebinje - Nikšić as a part of Adriatic Ionian Corridor	Construction of new rail lines (Čapljina-Trebinje-Nikšić) as a part of Adriatic Ionian corridor, East-West connection with Montenegro border
BA10	Project	Upgrade	Rehabilitation of Šamac - Doboj section (Corridor Vc)	North-South connection along Mediterranean Corridor: Šamac (Croatia border)-Doboj section
BA11	Project	Upgrade	Rehabilitation (2 tracks) of Doboj - Maglaj section (Corridor Vc)	North-South connection along Mediterranean Corridor: Doboj-Maglaj section
BA12	Project	Upgrade	Rehabilitation (2 tracks) of Maglaj - Jelina section (Corridor Vc)	North-South connection along Mediterranean Corridor: Maglaj-Jelina section
BA13	Project	Upgrade	Rehabilitation of Jelina - Zenica section (Corridor Vc)	North-South connection along Mediterranean Corridor: Jelina-Zenica section
BA14	Project	Upgrade	Rehabilitation of Zenica - Podlugovi section (Corridor Vc)	North-South connection along Mediterranean Corridor: Zenica-Podlugovi section

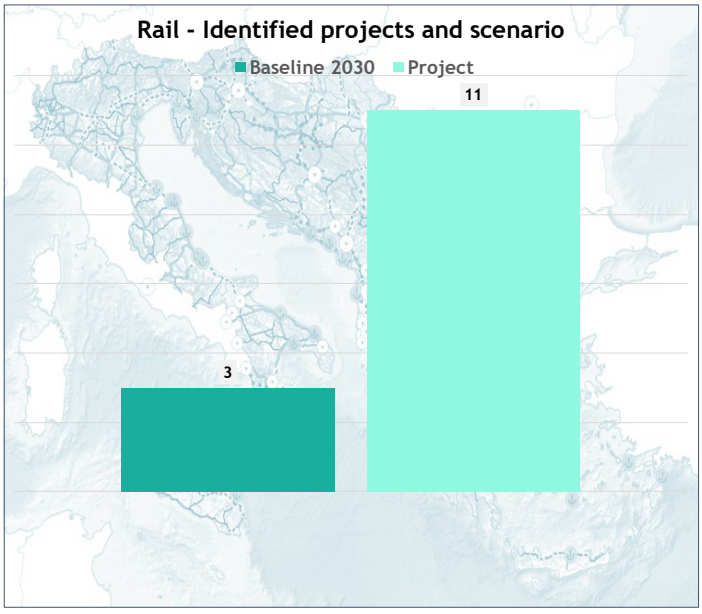

Figure 44 Rail projects by scenario, in Bosnia and Herzegovina

14 rail interventions selected in Bosnia and Herzegovina are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

Figure 45 Map of rail project by scenario in Bosnia and Herzegovina

2.4 Montenegro

2.4.1 National Transport Strategy and Action Plan

The "Transport Development Strategy (TDS) of Montenegro" [59] aims to support the improvement of economic efficiency, safety, accessibility, and the environment sustainability of the country's transportation system, while ensuring national and Community policies. The development of transport Strategy (TDS) will assist the Ministry of Transport and Maritime Affairs (MTMA) of Montenegro to provide a solid framework for its operations and at the same time to pose lay the foundation for the future development of the transport

[59] https://dokumen.tips/documents/transport-development-strategy-report.html?page=1

sector in a sense respond to the socio-economic needs of the country, in line with the TEN-T guidelines and EU policies. The TDS will determine the condition of the various transportation areas, will define the concept of transportation system development, establish long-term objectives for the development of transport infrastructure and establish an action plan for their implementation.

The role of the TDS is to create the path for improving and upgrading Montenegro's transportation system and to support full harmonization with EU policies and requirements TDS sets five high-level/strategic objectives, which reflect the vision for the country's future transportation system:

1. Economic Welfare: Achieve economic efficiency and financial sustainability and support for economic development.
2. Accessibility, Performance of Operations and Quality of Services: Provide maximum possible accessibility, offer quality transportation services and maintain an adequate performance in operations, as a whole and with respect to its individual elements within the system.
3. Safety and Security: Improve safety, security of people and goods in the transportation sectors.
4. EU Integration: Core transportation network and policies which are fully compatible and integrated to EU requirements.
5. Environmental Sustainability: Minimize carbon footprint, noise pollution and impact to the natural, historical and socio-economic environment. For this objective, a special Separate has been prepared: Strategic environmental impact assessment of Transport Development Strategy – Montenegro, period 2018-2035.

On the other hand, seven priority areas represent generic aspects of the transport sector (services as well as infrastructure) on which measures are to be applied. These areas are:

- Priority Area 1: Organization of the transport sector
- Priority Area 2: Transport investments
- Priority Area 3: Level of service on networks
- Priority Area 4: Financial sustainability
- Priority Area 5: Management of rail and port services
- Priority Area 6: Implementation of intelligent transportation systems (ITS)
- Priority Area 7: Intermodality and road freight transport

2.4.2 Proposed objectives and measures

Based on the established strategic objectives, TDS defines specific objectives related to transport infrastructure and proposed measure.

The major project on the railway network consists of Rail Interconnection, Bar – Vrbnica which concerns reconstruction works along the Vrbnica (Serbian border) - Podgorica - Bar railway line, forming part of the Orient/East Mediterranean TEN-T Core Network Corridor, as indicative extension TEN-T network to the Western Balkans.

The following table highlights relevant specific objectives, targeting into rail transport infrastructures and summarizes measures and objectives addressed.

Table 51 Summary of infrastructure measures

	Specific Objective	Measures
1.1	Complete infrastructure projects in SPP	• Program and monitor single pipeline projects for target years 2025 and 2035. • Continue and intensify actions towards project completion. • Align project activities and programming with those of neighbouring countries.
1.2	Align rail with interoperability requirements	• Introduce European Rail Traffic Management System (ERTMS) in rail network. • Expand overtaking sections length of selected rail stations up to 740 m
1.3	Reduce border clearance times	• Add control booths in road border crossings
1.4	Improve connectivity in the Port of Bar	• Improve rail connection segments to Port of Bar • Expand piers and passenger terminal
2.1	Maintain adequate LOS of state road network	• Reconstruct state road sections • Upgrade roads to recreational areas (ski and coastal resorts).
2.2	Complete rail network overhaul and improve rail infrastructures	• Upgrade the railway lines through implementation of planned rehabilitation works of the railway network
2.3	Revitalize and / or upgrade transport infrastructure in maritime transport	• Increase of transhipment of general cargo and containers by securing

Specific Objective		Measures
		the status of a transhipment port; • Expansion of the capacity for transhipment and storage of dry bulk cargo on the northern slope of Volujica hill; • Increase of transhipment of liquid and bulk cargo.
2.4	Reinforce the creation of an efficient and integrated transport system through intermodality	• Develop intermodal stations in Podgorica and Bijelo Polje
2.5	Determine possibilities and needs for revitalization and/or reconstruction of transport infrastructure of air transport	• Valorisation of other airports in Montenegro (besides Podgorica and Tivat)
2.6	Deployment of ITS technologies in the road, rail and maritime sectors	• Installation of ITS equipment in the core network and selected parts of the main road network (variable message signs, dynamic signage etc.). • Installation of axle load measuring systems. • Completion of Vessel Traffic Management Information System (VTMIS).
3.1	Improve road safety on state road network	• Complete planned road reconstruction projects (2019-20121). • Improve signage and road furniture of main roads

Table 52 Summary of organizational and operational measures

Specific objectives		Organizational and operational measures
1	Secure a good governance and management structure across the whole life cycle of highways.	• Introduction of Total Quality Management in transportation systems and services. • Personnel training in transport infrastructure management
2	Create conditions for coordination between transport stakeholders	• Expansion of e-governance • Development of a monitoring and data collection system in transport sector
3	Update governance structure and bodies in transport sector	• Adoption and implementation of remaining EU legislation and completion of bylaws • Establishment of a body for regulatory activities on the railway
4	Re-organize governance responsibilities in transport sector	• Redistribution of responsibilities in transport sector management
5	Secure alternative funding sources for transport investments	• Introduction of new funding sources and market players, mainly in the form of concessions
6	Improve programming and allocation of funds and achieve efficiency in road transport operations	• Development of asset management system
7	Better valorisation of transport subjects in air transport sector	• Better valorisation of certain port services • Valorisation of the Port of Bar as the new cruising destination
8	Achieve efficiency in operations, maintenance expenditures and budget allocation in order to promote environment friendly projects in transport sector	• Promotion of alternative fuels and electro-mobility • Promotion of road transport fleet replacement / renewal • Establishment of the Virpazar inland navigation line

9	Reduce border clearance times	• Establish border processes in cooperation with neighbouring countries
10	Alleviate barriers in rail transport	• Adoption and implementation of the remaining EU legislation • Facilitation of the introduction of new market players in rail services
11	Reinforce the creation of an efficient and integrated transport system through intermodality	• Promote and support intermodal agreements • Develop a study on intermodality in Montenegro
12	Enhance support for road freight transport	• Introduce ITS services targeting to road freight transport
13	Improve connectivity of the Port of Bar	• Better valorisation of certain port services • Valorisation of the Port of Bar as the new cruising destination
14	Maintain adequate LOS of state road network	• Plan and operate efficient and passenger friendly interurban public transport services
15	Deployment of ITS technologies in the road, rail and maritime sectors	• Preparation of studies for ITS development and implementation • Seek financing instruments for ITS deployment
16	Improve traffic safety on state road network	• Plan Road Safety Inspection and Road Safety Audit Activities • Improve road safety surveillance and systematic traffic enforcement of the Law on Roads

Table 53 Summary of rail project

Sector	Year 2027	Year 2035	Align with neighbouring countries
Rail	Reconstruction and modernization of the railway line Vrbnica-Bar, state border with Serbia	Reconstruction and modernization of the railway line Podgorica - Tuzi – across the border with Albania Construction of the railway Nikšić- border with BiH – Trebinje-Čapljina	Yes

2.4.3 Overview of transport project in Montenegro based on "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans"[60]

This work plan is a Strategic document which represents an important basis for a "common, more focused approach to regional connectivity" for the implementation of the Transport Community Treaty.

[60] "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022

The main purpose is to ensure coordinated development of the TEN-T in the region and achieve transition to a cohesive network, while all regional partners are pursuing their own connectivity goals.

The document provides an overview of the state of play in development of the indicative extension of the TEN-T network, in term of compliance with TEN-T Standards, to the Western Balkans. The status shown is based on data from the Annual Report on the Development of the TEN-T network of the Regional Steering Committee.

Another document's section includes an overview of TEN-T development plans in the region by analysing regional plan, the top priorities for the region in terms of TEN-T network development, a list of concrete actions for Regional Partners to focus on over the next few years.

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2.4.4 Priority projects maturity in Montenegro

Regulation (EU) No 1315/2013 defines transport infrastructure requirements as well as the specific requirements expanded from the priorities for railway infrastructure development:

- Electrification - railways network to be electrified by 2030 (including sidings where necessary);
- Axle load: Freight lines 22.5 t axle load by 2030;
- Line speed: Freight lines must allow 100 km/h by 2030 (no speed requirement for passenger lines);
- Train length: Freight lines to allow for 740 m trains by 2030;
- Track gauge: Nominal track gauge for new railway lines 1.435 mm;
- European Railway Train Management System (ERTMS) / signalling system: Core network to be equipped with ERTMS by 2030.

Railway electrification compliance of the operational network is already 73% on the Core and 54% on the Comprehensive Network. Certain parts of the networks, mainly in Albania and North Macedonia (Corridor VIII), are still in the construction phase.

The TEN-T railways network consists of two layers: the Core and Comprehensive Networks. The total length of the Comprehensive is 3,895 and 2,602 km of the Core. It consists of three corridors (Vc, VIII and X) and seven routes.

Current projects in the region were examined and detailed in the TEN-T annual report. Based on the expected completion date of these projects, the annual report included a forecast of TEN-T compliance rate for the

year 2027. Summary tables of mature and non-mature TEN-T projects in the region are presented here, with details on location, cost and expected completion times.

Table 54 Railway Transport Project in Montenegro Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority projects.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)	Expected Completion
ECONOMIC AND INVESTMENT PLAN FOR WESTERN BALKANS					
FLAGSHIP 3 – CONNECTING THE COASTAL REGION					
Railway projects					
Route 2b	Core	MNE	Reconstruction and Moderni-zation Railway Line Podgorica – Tuzi – Cross Border Albania	84	no data provided

2.4.5 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 55 Rail projects in Montenegro

ID	Scenario	Type	Name	Main goal
ME1	Baseline 2030	Upgrade	Reconstruction and modernization of railway line Vrbnica - Bar (Orient/East-Med Corridor R4)	Increasing of North-South connections along Orient/East-Med Corridor: upgrade of railway Vrbnica - Bar line
ME2	Project	Upgrade	Reconstruction and electrification of Podgorica - Tuzi - border with Albania and Route 4	The railway network of Montenegro would be fully integrated in corridors of TEN-T network
ME3	Project	New construction	Construction of a new Capljina - Trebinje - Niksic railway line	New relevant section of the railway network, connecting BH and Montenegro

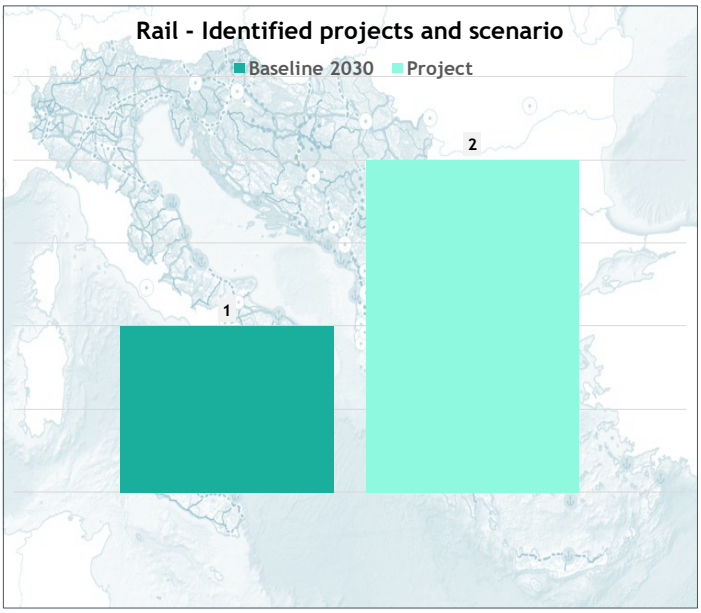

Figure 46 Rail projects by scenario, in Montenegro

3 rail interventions selected in Montenegro are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

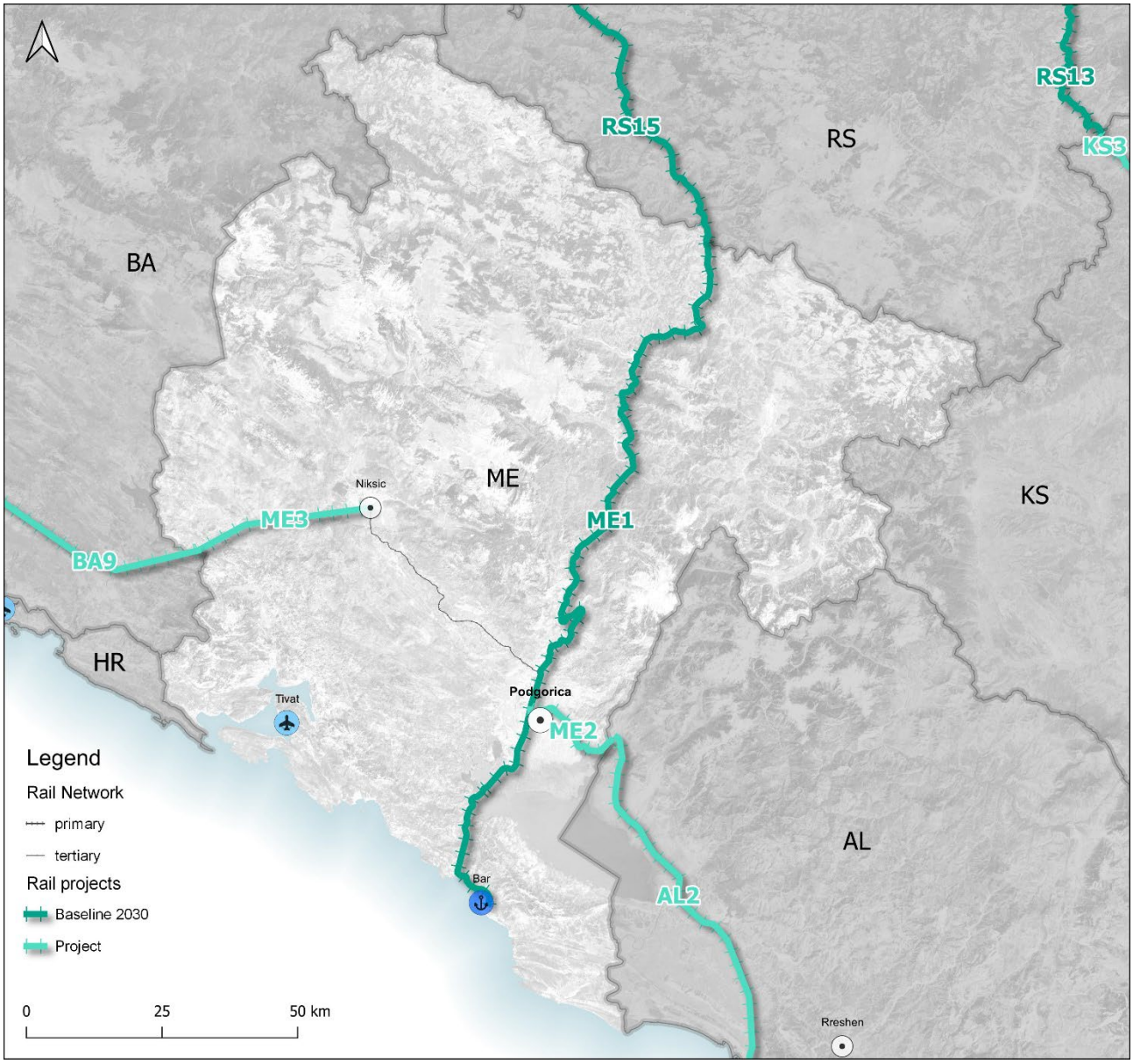

Figure 47 Map of rail project by scenario in Montenegro

2.5 Serbia

2.5.1 National Transport Strategy and Action Plan

£Strategy of railway, road, inland waterway, air and intermodal transport development in the republic of Serbia, 2008 – 2015" [61]defines goals and objectives for transport system development and Action Plan for them implementation in the Republic of Serbia. Guidelines for such development are based on safety and

[61] https://www.putevi-srbije.rs/images/pdf/strategija/Strategijatransport_eng.pdf

intermodality principles, the application of new technologies, and, above all, on the rational exploitation of available capacities and resources in the country.

Attracting international transit flows of freight and passengers represents a framework for shaping the transport system development and setting priorities in strategic planning.

Taking into account the above mentioned, the transport infrastructure promotion must primarily focus on the improvement of the existing networks, the level of safety and services, construction of additional lanes/tracks and by-passes in the context of environmental improvement, relocation of transit flows out of the urban city zones, modernization of equipment, reconstruction of crossroads and elimination/rehabilitation of highly risky road sections.

Considering the experiences of developed European countries in the transport sector, the transport development policy in the Republic of Serbia should be in the function of subsidiary goals and it should be based on the analysis of the effectiveness and efficiency of individual sectors. This should provide the choice and offer of optimized transport options, reached through the use of intermodal solutions.

The main points of reference of complementary transport policy can be generalized through:

- redirecting the demand towards ecologically more acceptable modes of transport
- application of relevant and the state-of-the-art technologies;
- fair infrastructure charges;
- intermodal cooperation in transport;
- modification of regulations;
- flexible determination of transit transport charges;
- prevention of unnecessary transport;
- socially and ecologically more acceptable organization of urban and suburban passenger public transport;
- facilitating the integration of transport networks (solving border crossing issues regarding infrastructure, organization, and border crossing procedures).

The major projects on the railway network consist of

- the reconstruction and modernization of double-track line Belgrade - Stara Pazova - Sid -Croatian Border,
- the reconstruction and modernization of the railway line Nis - Brestovac - Presevo - North Macedonian Border
- the reconstruction and modernization of railway line Belgrade - Novi Sad - Subotica - Hungarian border

2.5.2 Proposed objectives and measures

In accordance with the assumptions of the EU transport policy, which is set in the White Paper “European Transport Policy for 2010: Time to decide” and the Strategy of sustainable transport development (The ECMT Council, Prague 2000), the main goals of complementary transport policy are:

- purposeful planning and transport flows management;
- reduction of harmful effects of transport on the environment;
- increase of traffic safety;

- increase of transport system efficiency;
- compensation of the consequences of market deregulation and liberalization in the transport sector.

Although it may seem that some goals are not sensitive to the criteria of satisfying real transport demand, in the long-term they provide optimal integration of the transport sector into the national and international framework of progressive economic development.

Investment policy and programs of transport infrastructure investments are based on the identification of relevant critical elements of infrastructure management, and the following:

- definition of distribution of investments into certain modes of transport;
- definition of the ratio between investment in construction and investment in maintenance of transport infrastructure for each transport mode, especially taking into account reconstructions and routine maintenance backlog;
- adequate infrastructure charges (institutional and social limitations which obstruct the charging of real expenses);
- solving the productivity problem (excess of personnel, lack of competitiveness);
- market and regulatory reform;
- partnership of the public and private sector;
- adoption of European norms;
- methodology of making investment decisions.

Focus on rail transport:

- **Modern rail network**: The Republic of Serbia gives priority to the system of interoperable railway corridors, on which certain standards are met along the whole length, in terms of infrastructure quality, train speed, information exchange and different services, as well as harmonized system of infrastructure charges. This system of services contributes to the increase of traffic frequency and safety, along with additional effects of economic development acceleration and the increase of services demand. The aim is to facilitate and develop international railway transport by coordinated plan for reconstruction, construction and equipment of railway lines in line with the future international transport needs according to AGC. The Republic of Serbia will direct capacities according railway service demand. Significant increase of capacities of single-track lines is possible by the construction of shorter double-track sections only in the places where it is necessary for passing over and/or overtaking, according to the national priorities. In all other cases, feasibility studies must be prepared to check whether the alternative and cheaper solution, single-track railway with double-track islands and larger investments in the automatic systems can sufficiently increase the railway track capacity. In order to increase the average speed and competitiveness of the railways, agreements should be concluded with the neighbouring countries. These agreements will provide transport characteristics "with one stop" (One Stop Shop) in the first phase, and later the system "without borders".
- **Organization and management**: The process of restructuring of PE “Serbian Railways” should be carried out according to guidelines of competent bodies. Besides the process of commercialization and the approach to railway infrastructure to other operators is needed
- **Passenger transport**: High-quality railway passenger transport is the alternative to road transport and particularly at distances between 200 and 500 km railway passenger transport may be very

competitive to road transport, if particular standards are met. Between capital cities and major cities of the West Balkans in cooperation with railway companies of the neighbouring countries, a system of fast passenger trains with market-oriented timetable should be established. Furthermore, a national system of comfortable trains connecting major cities on the Core Network should be established, with the timetable based on regular intervals, so that it can be competitive with individual transport.

- **Internationally competitive freight transport system:** Railway freight transport system in the Republic of Serbia must be organized to be highly competitive to road and other transport modes. Operators of combined transport and operators on terminals, together with their foreign partners, must offer appropriate logistic packages to the economy of the Republic of Serbia. As such, they must be competent partners to other transport companies and provide a complete service to clients, with modern transport technology. Nowadays all clients insist on a full service, not wanting to burden their business activities and to spend time on transport organization and contracting with operators and later to face the responsibility generated. A popular term freight transport "door to door" can be provided via combined transport operator, and for railways this would represent generating new freight flows in combined transport. Delays at railway border crossings create great losses and result in low average commercial speed. Solutions for border crossings must start from the adoption of bilateral agreements based on mutual goals and interoperability requirements from one side, and better coordination of customs public authorities in their work, from the other. Significant contribution will be provided by establishing electronic information exchange between PE “Serbian Railways” and customs authorities of the Republic of Serbia. Changes in bilateral railway agreements, both for infrastructure and for operations, will be based on adopted state agreements. This may lead to transit time decrease by about 40% and operational costs reduction of about 25%. Successful implementation of the Strategy of Integrated Border Management in the Republic of Serbia and the Action Plan for its execution, which represents a great step in the sphere of border safety, at the same time creates a prerequisite for development of economic activities and unhindered cross-border trade and openness of border for efficient flow of passengers and goods in the region.
- **Serbian railway companies and railway industry**: The liberalization of the European railway market gives a chance to innovative railway companies and operators to survive as domestic or trans-national companies.
- **Financial aspects**: Public Enterprise “Serbian Railways” needs subsidies from the budget of the Republic of Serbia, so that competitive railway system could be maintained, as well as fair competition among different transport modes, especially considering external expenses. Funds may be obtained from domestic and foreign sources, considering the difference between domestic and foreign demand.
- **Concept of railway network development:** The REBIS study defined a relatively modest volume of investment projects, in relation to the Spatial plan of the Republic of Serbia, but in the World Bank document "Southeast Europe Framework Paper-Final", from December 2004, it is thought to be too ambitious. The opinion expressed in this document is that single-track diesel railway is the most suitable option for the current traffic volume on most of the railway network in the Republic of Serbia. However, although this opinion emerged from the WB practice, there are certain reservations towards this attitude, especially in the part referring to diesel traction. Due to the sustainable development principle, the saving of (imported and more and more expensive) fossil fuels,

environment protection, the use of local sources of energy and unification of the railway rolling stock, electrification and modernization of main (single track) railways and the mentioned rolling stock, the reserve of the Republic of Serbia towards the attitude of the WB, has strategic and economic justification. This is supported by the fact that PE "Serbian Railways", spend today more on energy than on maintenance. With the anticipated further rise of price of petrol and possible shortage, the use of electric power on the market of transport services will be a comparative advantage of railway transport in the Republic of Serbia. With limited resources of the state and restricted international support, accepting a more realistic approach and defined priorities, the development plans of the railways must be reduced to a rational measure. The development guidelines should place emphasis on Corridor X, its branches and the railway line Belgrade-Bar, in order to achieve the goal of railway transport recovery. Raising the level of service on the originally projected level must be the basic mid-term strategic goal of the railways in the Republic of Serbia, both in the field of infrastructure and in their operation. The Republic of Serbia does not need "High-speed railways", as an alternative to air transport, not even in the long-term. Priority in the first mid-term period and probably in the second as well, will be given to the rehabilitation of critical sections on Corridor X, on the line Belgrade-Bar and later on other national and international lines of the Core Network.

2.5.3 Overview of transport project in Serbia based on "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans"[62]

This work plan is a Strategic document which represents an important basis for a "common, more focused approach to regional connectivity" for the implementation of the Transport Community Treaty.

The main purpose is to ensure coordinated development of the TEN-T in the region and achieve transition to a cohesive network, while all regional partners are pursuing their own connectivity goals.

The document provides an overview of the state of play in development of the indicative extension of the TEN-T network, in term of compliance with TEN-T Standards, to the Western Balkans. The status shown is based on data from the Annual Report on the Development of the TEN-T network of the Regional Steering Committee.

Another document's section includes an overview of TEN-T development plans in the region by analysing regional plan, the top priorities for the region in terms of TEN-T network development, a list of concrete actions for Regional Partners to focus on over the next few years.

Finally, The Transport Community Permanent Secretariat has developed a Sustainable and Smart Mobility Strategy for the Western Balkans together with a corresponding GAP analysis. The purpose is also providing a roadmap for digitalisation and decarbonisation of the region's transport sector.

The main objectives identified for the region are summarized below.

Key objectives:

- Enhancing connectivity within the Western Balkans and with the European Union.
- Improving accessibility and mobility on the TEN-T Network.

[62] "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022

- Building the transport of the future towards a smart, sustainable, green, safe and resilient TEN-T network.
- EU acquis implementation and associated policy reforms.

2.5.4 Priority projects maturity in Serbia

Regulation (EU) No 1315/2013 defines transport infrastructure requirements as well as the specific requirements expanded from the priorities for railway infrastructure development:

- Electrification - railways network to be electrified by 2030 (including sidings where necessary);
- Axle load: Freight lines 22.5 t axle load by 2030;
- Line speed: Freight lines must allow 100 km/h by 2030 (no speed requirement for passenger lines);
- Train length: Freight lines to allow for 740 m trains by 2030;
- Track gauge: Nominal track gauge for new railway lines 1.435 mm;
- European Railway Train Management System (ERTMS) / signalling system: Core network to be equipped with ERTMS by 2030.

Railway electrification compliance of the operational network is already 73% on the Core and 54% on the Comprehensive Network. Certain parts of the networks, mainly in Albania and North Macedonia (Corridor VIII), are still in the construction phase.

The TEN-T railways network consists of two layers: the Core and Comprehensive Networks. The total length of the Comprehensive is 3,895 and 2,602 km of the Core. It consists of three corridors (Vc, VIII and X) and seven routes.

Current projects in the region were examined and detailed in the TEN-T annual report. Based on the expected completion date of these projects, the annual report included a forecast of TEN-T compliance rate for the year 2027. Summary tables of mature and non-mature TEN-T projects in the region are presented here, with details on location, cost and expected completion times.

Table 56 Railway Transport Project in Serbia Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority projects.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)	Expected Completion
OTHER PRIORITY PROJECTS					
Railway projects					
Route 13	Comprehensive	SRB	Modernization and reconstruction of the existing railway line Subotica – Horgos – Hungarian border (Segedin)	100	2023

Table 57 Railway Transport Project in Serbia Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority under preparation.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)
Railway projects				
Corridor X	Core	SRB	Reconstruction and modernization of the railway line Brestovac – Preše-vo – border with North Macedonia	400
Corridor X	Core	SRB	Construction of a single operational centre for railway traffic management on the railway network of the Republic of Serbia	120
Corridor X	Core	SRB	Construction works on the Main Railway station - phase 2	25
Corridor X	Core	SRB	reconstruction and modernization of the two-track railway line Stara Pazova – Šid – border with Croatia and section Golubinci – Indija	400
Corridor X	Core	SRB	Construction of the by-pass railway line Beli Potok – Vinca – Pancevo with road-railway bridge over the Danube River near Vinca	300
Corridor X	Core	SRB	Reconstruction of the railway bypass around Belgrade, Batajnica – Os-truznica – Beograd Ranzirna	52
Corridor Xc	Core	SRB	Reconstruction and modernization of single-track railway Belgrade – Nis	1800
Route 10	Core	KOS	Construction and modernisation of a Railway Line Pristina – Fushe Kosove – Pristina Airport "Adem Jashari"	40.2
Route 10	Core	SRB	Reconstruction and modernization of the railway line Kraljevo – Rudnica	299
Route 11	Core	SRB	Reconstruction and modernization of the railway line Stalać – Kraljevo	180
Route 4	Core	SRB	Reconstruction and modernization of the Belgrade Podgorica railway line (section Valjevo – Vrbnica)	980
Route 4	Core	SRB	Reconstruction and modernization of the railway line Pančevo – Vršac	270
Route 7	Comprehensive	KOS	General Rehabilitation of the East-ern Railway line (CCP with Ser-bia – Podujevo – Fushe Kosove)	67.3
Route 9a	Comprehensive	SRB	Modernization of the railway line Ruma – Sabac – Donja Borina – State Border with Bosnia and Herzegovina	120

2.5.5 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 58 Rail projects in Serbia

ID	Scenario	Type	Name	Main goal
RS1	Baseline 2030	New construction	High speed rail connection Novi Sad - Subotica	Increasing of North-South connections along Corridor X: Novi Sad-Subotica high-speed railway
RS2	Baseline 2030	New construction	High speed rail connection Belgrade - Stara Pazova	Increasing of North-South connections along Corridor X: Belgrade-Stara Pazova high-speed railway
RS6	Project	Upgrade	Upgrade of railway section Nis - Presevo - Border between two States of the Serbia - North Macedonia CX Rail Interconnection (Orient/East-Med Corridor)	Serbia - North Macedonia CX Rail Interconnection, Nis - Presevo - Border Between the Two States Section
RS7	Baseline 2030	Upgrade	Upgrade of railway section Niš - Dimitrovgrad - Border with Bulgaria of the Serbia - Bulgaria CXc Rail Interconnection (Orient/East-Med Corridor)	Increasing of East-West connections along Orient/East-Med Corridor: Serbia – Bulgaria Rail Interconnection
RS8	Baseline 2030	New construction	Construction works on the Main Railway station - phase 2	When the Belgrade Centre Railway Station is constructed, the country and its capital will have a modern railway station, which will be able to accept a larger number of trains on national and international transport lines in a much more efficient manner, and local, regional and international passenger trains will be able to go through the “Prokop” railway station.
RS9	Baseline 2030	Upgrade	Reconstruction and modernization of the two-track railway line Stara Pazova – Šid – border with Croatia and section Golubinci – Inđija	This railway line is also very important for passenger traffic because this railway line connects two cities, Zagreb, the capital of Croatia, and Belgrade, the capital of Serbia. Upgrading this railway line for speed up to 160 km/h will improve and induce passenger mobility.
RS10	Baseline 2030	New construction	Construction of the by-pass railway line Beli Potok – Vinca – Pancevo with road-railway bridge over the Danube River near Vinca	Electrify the existing single-track railway Pancevo Hipodrom - Pancevo-Varos, which should enable safe operation of road, rail and river traffic. The bridge over Danube consists of a main bridge, an access road and highway construction, where the railroad is in the middle of the width of the bridge, and on the outside of the railroad there are road traffic lanes.
RS11	Baseline 2030	New construction	Reconstruction of the railway bypass around Belgrade, Batajnica – Ostruznica – Beograd Ranzirna	Increasing of connections in Belgrado area

ID	Scenario	Type	Name	Main goal
RS12	Baseline 2030	New construction	Reconstruction and modernization of single-track railway Belgrade – Nis	The aim of the modernisation works is to enable a speed increase to up to 200 kilometres per hour. At such a speed, the journey would be covered in 1 hour and 15 minutes, whereas the current travel time between Belgrade and Niš is 5,5 hours.
RS13	Baseline 2030	New construction	Reconstruction and modernization of the railway line Kraljevo – Rudnica	The railway line, Stalac – Kraljevo – Rudnica (SKR) is single track, non-electrified line, and has a total length of 149 km length, divided in two sections: Stalac – Kraljevo (72 Km, on Route 11) and Kraljevo – Rudnica (77 Km, on Route 10).
RS14	Baseline 2030	New construction	Reconstruction and modernization of the railway line Stalać – Kraljevo	The railway line, Stalac – Kraljevo – Rudnica (SKR) is single track, non-electrified line, and has a total length of 149 km length, divided in two sections: Stalac – Kraljevo (72 Km, on Route 11) and Kraljevo – Rudnica (77 Km, on Route 10).
RS15	Baseline 2030	New construction	Reconstruction and modernization of the Belgrade Podgorica railway line (section Valjevo – Vrbnica)	strategic significance for Serbia, in terms of the development of business networks with Montenegro, Albania and Italy, as well as connecting Serbia with Central and Eastern European countries by directly linking the Adriatic-Ionian Basin and the Pan-European Transport Corridors X and VII (Danube).
RS16	Baseline 2030	New construction	Reconstruction and modernization of the railway line Pančevo – Vršac	This project aim is reconstruction of the existing track, construction of additional track plus track in ''Krnjača'' passing station together with relevant connections; reconstruction of track and connections in ''Pančevački Most'' railway post; construction of new stopping place near Krnjača Settlement; electrification, extension and reconstruction of overhead catenary system, and installation of signaling/interlocking and telecommunication systems.

ID	Scenario	Type	Name	Main goal
RS17	Baseline 2030	New construction	Modernization of the railway line Ruma – Sabac – Donja Borina – State Border with Bosnia and Herzegovina	Reconstruction and upgrade of the safety equipment for the level crossing "Banja Koviljača", at km. 56+521 of main railway line "Ruma - Šabac - Raspiunica Donja Borina" - state border - (Zvornik Novi), User: Infrastructure Serbian Railways, Serbia. Investor: Company for the roads Serbia, Serbia. Production, delivery, installation, testing and commissioning and putting into the operation of the ELC - Electronic Level Crossing system (Signalling & Control Ltd.). Work completed at July of year 2020. In operation at 8th of April 2021.y.
RS18	Baseline 2030	New construction	Modernization and reconstruction of the existing railway line Subotica – Horgos – state border with Hungary (Segedin)	Increasing of North-South connections along Corridor X: Subotica-border with Hungary high-speed railway

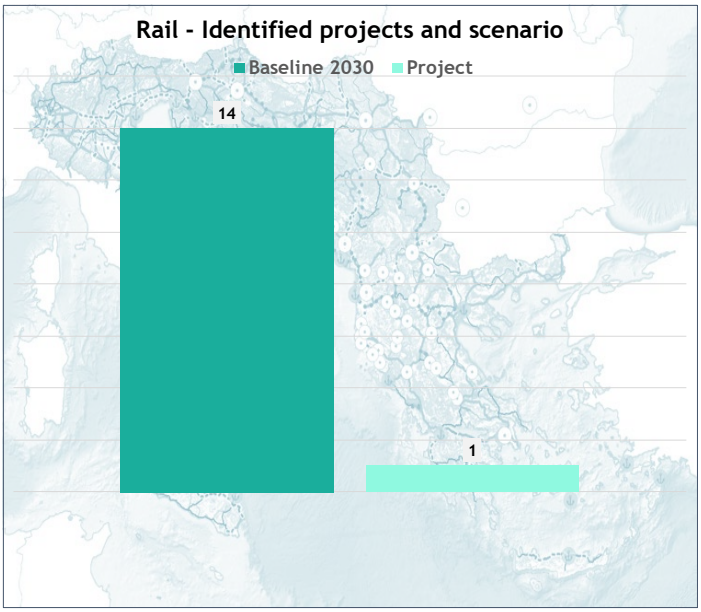

Figure 48 Rail projects by scenario, in Serbia

15 rail interventions selected in Serbia are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

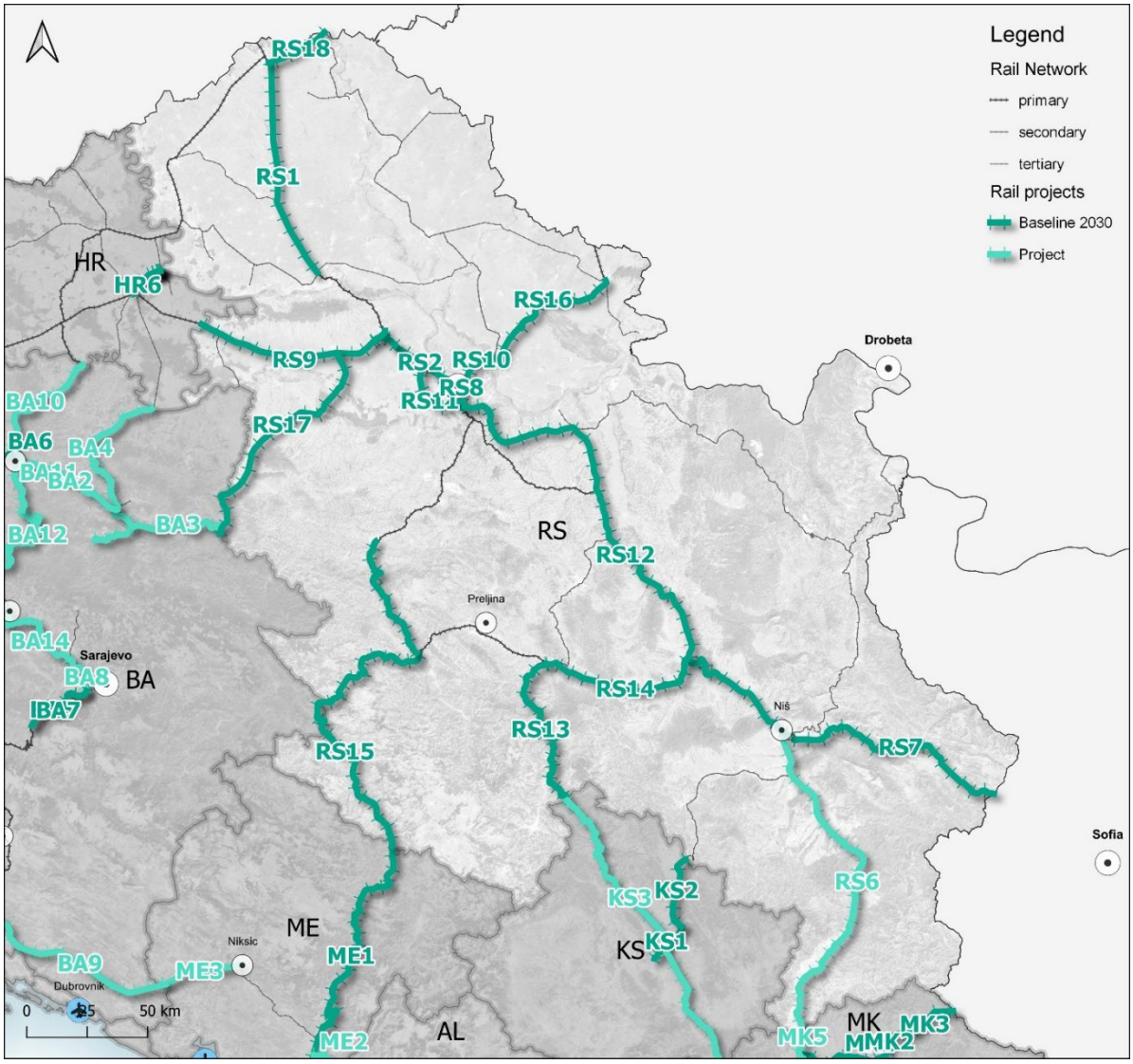

Figure 49 Map of rail project by scenario in Serbia

2.6 Croatia

2.6.1 National Transport Strategy and Action Plan

"Transport Development Strategy of the Republic of Croatia for the period 2017 to 2030" [63](TDS 2017), shall assess and define the future measures (infrastructure, operation, and organization) in the transport sector related to international and national transport in all transport segments independent from the funding source. The TDS (2017) shall provide the framework for the development of interventions and define the interfaces to other strategies or assessments (Functional Regional Concepts-FRC, Master Plans, sectorial strategies, etc.) The TDS (2017) shall consider the European strategies and requirements (TEN-T, ERTMS, TSI, environmental protection, climate protection etc. – general objectives) and be based on a thorough analysis of the Croatian situation (specific objectives for Croatia).

[63] https://mmpi.gov.hr/UserDocsImages/dokumenti/INFRASTRUKTURA/Infrastruktura%2010_19/Transport%20Development%20Strategy%20of%20the%20Republic%20of%20Croatia%202017-2030%2029-10_19.pdf

The TDS (2017) shall be based on a thorough analysis of the transport sector as well as the key drivers for transport development in Croatia (key findings). From the previous assessments done on a strategic level or project level, several hypotheses have been identified, which in case they have been confirmed by data or analysis shall be turned into key findings in case they have not been confirmed by data or the analysis they shall either be dismissed or stay on the level of hypothesis for further investigation. The key findings shall be translated into objectives, which consequently lead to measures around investment, operation, and organization.

2.6.2 Proposed objectives and measures

Transport Development Strategy is based on the analysis of the current situation of the Country having identified opportunities and problems and having analyzed best solutions to accomplish and respond to existing needs. The Strategy is a document which determines a medium and long-term development in the Republic of Croatia and constitutes a positive development in relation to the existing situation and the achievement of a new stage, which consists in increasing the quality of transport system and the transport infrastructure. For that purpose, the definition of accurate objectives is considered a basic and crucial stage of the Transport Development Strategy process.

As a result of EU/CRO policies and EU/CRO strategies the list of **general objectives** was set. Second list is composed of **specific objectives** which are resulting from the analysis of the Croatian transport system. Specific objectives are further divided by the sector to which it refers.

General Objectives (GO)

- Developing the passenger Modal Split in favor of Public transport (PT) and 0 emission modes. This includes agglomeration PT (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long-distance buses as well as pedestrians and bikers.
- Developing the freight Modal Split in favor of rail transport, maritime freight transport and inland water transport.
- Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
- Reducing the Climate change impact of the Croatian transport system.
- Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
- Improve the traffic safety in the Croatian Transport system.
- Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
- Improve the integration of transport modes in Croatia (operation, ITS, P&R, etc.)
- To further develop the Croatian TEN-T (core and comprehensive) network.

Specific Objectives (SO)

Specific objectives which apply cross sectorial

- To better harmonize the transport operations with neighboring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
- To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant, by adequate transport development especially in favor of PT and green mobility

- To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
- To develop on the potentials of the main logistic centers (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Zagreb hub)
- Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb.
- To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
- To address the specific situation in Croatia related to the seasonality of traffic.

Rail transport Specific Objectives:

- To improve the rail freight corridors from Port of tiRijeka towards the markets with the biggest potential for the port (Hungary, BiH, Slovakia, Italy, Southern Poland and Serbia)
- To better utilize the Croatian railway system in the main Croatian agglomerations (Zagreb, Rijeka, Split, Varaždin, Osijek)
- To improve the LOS and environmental impact of rolling stock
- To improve the integration of the railway system into the local transport systems (safety and security of stations, interfaces with other transport modes, etc.)
- To improve the safety at level crossing with roads
- To improve the efficiency of the Croatian rail system (traffic management, operations etc.)
- To safeguard the maintenance of the infrastructure taking into account economic considerations

Measures

Based on the analysis of the current situation and in order to address the defined general and specific objectives, a set of measures has been identified in each sector. The measures propose interventions not only related to improve the infrastructure of the different transport systems but also related to operational and organisational aspects, since isolated interventions on the infrastructure will not have a big impact on the efficiency and sustainability of the system if they are not accompanied by adequate changes in the setup of the system, and the operations are not adapted to the real demand needs.

The following tables show the list of general measures and measures per transport sector including a detailed description of the measure to facilitate the understanding of their content.

In order to distinguish between group of measures, taking into account their alignment with the Transport Development Strategy objectives, the following colour code, which is included as well in the tables below, has been defined:

- Green label: Duly aligned with the strategy; the measure is needed and well defined, even if some further studies might be necessary.
- Yellow label: Missing data to determine the duly apparently alignment with the Strategy; some further studies are required to assess or verify the eligibility of the measure.
- Red label: Non-aligned with the Strategy; the eligibility is remote in terms of current and mid-term traffic forecasts. If the new studies confirm the eligibility of this investment, the measure will be reviewed.
- Blu label: Measure covered by general measure.

Table 59 General measures

Code	General measure	General measure description
G.1	National logistic concept for freight	Croatia should define a national concept for freight logistics involving all modes of transport. It is very important to define a role for, among others, ports Rijeka and Ploče and Zagreb node. A specific study needs to be developed involving all relevant stakeholders. As generally speaking the Croatian Transport system has large unused capacities available, it should be assessed whether shifting of traffic from other countries - where bottlenecks have been identified for example Italy - is feasible.
G.2	Improvement of the public transport accessibility for the international airports	Accessibility of the airports by public transport is not adequate. Individual solution should be found for each airport taking into account specifics. Solution should be assessed in the context of the functional region master plan and taking into account potential functionality of connections such as connectivity of Velika Gorica with Zagreb, Trogir with Split,..
G.3	Improvement of safety in transport system	As safety is one of the main objectives of the TDS it is necessary to improve it in all modes of transport system. • To increase the level of safety of the railway system specific measures such as removal of level crossings (if justified by the traffic flows). If there is justification to denivelate or eliminate a rail-road crossing, it is necessary to assure it with adequate safety devices. In order to increase safety at level crossings it is necessary to develop and implement educational marketing campaigns in order to raise awareness of drivers of road vehicles. • In terms of road safety, the Commission has set as its overall objective that the number of fatalities needs to be moved to zero by 2050. To improve road safety in Croatia, the following measures should be developed: o Integrate road safety in all the stages of project implementation via road safety impact assessments which will demonstrate, on a strategic level, the implications on road safety of the different alternatives of an infrastructure project and they will play a relevant role in the selection of the routes and final alternative. At a more advanced stage of the project phase, during construction and operation, road safety audits should identify, in a detailed way, unsafe features of a road infrastructure project and propose corrective measures. o To reduce the negative impacts of accidents, the procedures to be followed in case of accidents will be reviewed and improved to reduce the response time. The information channels will be as well improved and simplified and the situation on the black spots will be monitored. • In order to develop the maritime sector in a safe and sustainable manner it is necessary to increase the share of energy-efficient vessels by modernization of the fleet and to improve public service of search and rescue at sea. The goal is to constantly raise the efficiency of the system of control over vessels and floating facilities. It is also necessary to establish an effective monitoring system of recreational craft and smaller passenger and cargo ships. Security of ports and waterways need to be enhanced by investments in the objects of navigational safety, security devices and equipment, ensuring the necessary depth in the port area and defining the conditions of navigability of waterways. It is necessary to develop a system of targeted inspections and technical inspections on maritime facilities and vessels in order to establish the highest international, European and national safety standards. • To raise up the safety level on waterways to a higher level, besides the implementation of the River Information Services and the availability of timely and accurate information regarding the movement of vessels, it is necessary to establish clear procedures regarding the actions

Code	General measure	General measure description
		which should be taken in cases of incidents, as well as upgrading the existing systems of marking and monitoring the navigability of the inland waterways. For safety reasons, it is also necessary to modernize and upgrade the ports with safety systems. For a more effective safety control and inspection, and installation and maintenance of signalization system on waterways, it is necessary to increase the fleet of safety and environmental protection vessels. • Safety and security in urban areas should be improved at least on two different levels: o Identifying and eliminating black spots such as rail-road crossings, signalling pedestrian crossings, providing additional protection to pedestrians and cyclists by constructing new pedestrian footpaths and bike paths where needed, constructing pedestrian islands to minimize crossing distances, extending curbs where necessary and even construction of new pedestrian sidewalks / footpaths to improve the accessibility to the main public transport stations and terminals. o The rolling stock and vehicles for public transport will be modernized. Procurement of new public transport vehicles that comply with the highest safety and quality standards is a priority. These vehicles are to incorporate the latest advances in safety and control and surveillance devices (e.g. video cameras). The infrastructure and stations will also be modernized with the necessary adaptations to increase safety and accessibility to the public transport and with the installation of surveillance and control devices to improve the security.
G.4	Improvement of passenger intermodality and development of intermodal passenger hubs	To ensure the sustainability of the transport sector as a whole, it is important to increase the interoperability to be able to use the potential of each transport mode. A network of intermodal terminals should be established to allow the passengers to easily interchange between transport modes. A well-conceived, balanced, intermodal network is key to maximizing the efficiency of the overall system, minimising nuisances to users. Location and modes of each terminal will be determined according to a specific area study (e.g. Masterplan). In the road sector it is important to ensure the proper accessibility to demand generation/attraction nodes (such as ports, airports, railway stations, working areas, commercial zones, etc.). An increase in the number of parking spaces linked to public transport systems, port and airports will help to increase the modal shift in favour of public transport and consequently reduce the congestion on the roads.
G.5	Maintenance concept for different transport sectors	Owner of the national infrastructure should have maintenance concept which would ensure long term sustainability of different modes. Adequate structures and organisation for maintenance must be put in place in order to provide an efficient and effective/sustainable rail service. The concept must derive from an appropriate and specific analysis of the Croatian and HZ Infrastructure Ltd. context, taking into account technical, financial and users' requirements, the indications from Directive 2008/57/EC on the interoperability of the rail system and the main international standards related to RAMS. Road maintenance is essential in order to preserve the road in its originally constructed condition, protect adjacent resources and user safety and provide efficient, convenient travel along the route. For efficient and effective/sustainable maintenance, adequate structures and organisation for maintenance must be put in place. The concept must derive from an appropriate and specific analysis of the Croatian and relevant stakeholders context, taking into account technical, financial and users requirements. The concept of maintenance in maritime sector can be divided into: maintenance of ports and port infrastructure, and maintenance of shipping

Code	General measure	General measure description
		fleet. Adequate structures and organisation for maintenance must be put in place in order to provide an efficient and effective/sustainable maritime transport service. The concept must derive from an appropriate and specific analysis of the Croatian and maritime operators context, taking into account technical, financial and users requirements.
G.6	Improve energy efficiency in transport system	Promoting the efficient and sustainable use of the infrastructure is one of the priorities for infrastructure development according to the guidelines for development of the Trans-European transport network. In this sense, it is necessary to improve energy efficiency and prioritise low carbon energy sources and propulsion systems. Further studies will analyse specific requirements.
G.7	Reorganization of the transport system to increase financial sustainability	Public Service Contract(s) in compliance with EU Reg. 1370/2007 are a fundamental tool to assure transparency and efficiency in the provision of public transport services. A widespread implementation of PSCs is therefore required not only for compliance purposes, but also as a first step towards an improvement in sustainability of Croatian's transport system. Typology and duration of the PSC will have to be determined on a case-by-case analysis, together with the applicability of the in-house model (either based of pure compliance issues or after a thorough assessment of technical and financial requirements). Increasing financial sustainability is one of the objectives of the Trans-European transport network. To achieve this objective it is necessary to optimise the organisational setup of the transport systems and to increase the efficiency of the operation and maintenance. Financial sustainability of the transport system intends to reduce the dependence of the system on public subsidies.
G.8	Harmonization of legislatives and planning guidelines taking into account relevant EU requirements and policies	Legislation and planning guidelines must support the development of the sector and should be in line with international best practice and European regulations, especially regarding safety, security, interoperability, sustainability and environment. The overall legal framework should be harmonized to facilitate the implementation of major infrastructure projects. In all laws and regulations certain procedures need to be simplifies and the definitions harmonized.
G.9	Preparation and adaptation to Schengen requirements	Future scenarios of Croatia and surrounding countries entering the Schengen area will increase the relevance of international traffic. The adaptation of the transport systems requires the elimination of infrastructure and administrative bottlenecks. Elimination of bottlenecks with non-Schengen surrounding countries will help in increasing the relevance of international traffic on certain corridors with international connections. Specific studies will assess on the technical requirements to be met in each specific case.
G.10	Increase administrative capacity/training	The lack of administrative capacity and the properly trained staff is one of the key issues identified in the transport sector and is one of the priorities in the EU cohesion policies. The implementation of new technologies and increasing requests for the control of traffic and means of transportation implies the necessity to train the existing and new staff in accordance with their specific needs.
G.11	Improvement of the public perception of the transport system in Croatia	Promoting and creating a positive image of the public transport system as a reliable, safe and environmentally friendly mean of transport is important for encouraging the demand, and consequently the investments. For better promotion, it is necessary to have complete and up to date information and knowledge of the infrastructure, possibilities and development plans. In the road sector is very important to inform users of the current situation of the traffic and weather conditions to reduce the amount of traffic jams and accidents by offering information's on alternative routes. It is also important to inform drivers of amendments to the existing or adoption of new laws in the sector relevant for the users and to provide instant information on the motorways of the incidental situations that might require changes in the allowable speed or restrictions to the use of lanes. For that reasons, the need to constantly revise and update the information

Code	General measure	General measure description
		technologies and channels is very relevant for the improvement of the sector. It is important as well to increase the involvement of the media as a crucial partner for the transmission of the information. In the maritime transport sector, it is necessary to continuously modernize and integrate IT platform in order to ensure reliable and comprehensive data and information for all users. It is also necessary to establish network services of e-business for all users of public services, to establish a unique port information system in ports in order to improve business processes and raising the competitiveness of ports, to establish hydrographic information system, to improve services maritime meteorology, to develop ICT solutions for operation with emergencies at sea and to improve and to develop the nautical information service as public and free services of safe navigation of boats and yachts.
G.12	Reduce environmental impact of transport	Based on the environmental monitoring, negative environmental and socio-economic impacts of the transport system should be reduced by effective planning/implementation of the infrastructure and the establishment of the necessary measures of environmental protection. Mitigation of the negative impact of transport on the environment must be achieved through greater energy efficiency, in particular, the use of energy sources with low or zero emissions of hydrocarbons and reducing noise emissions and the amount of continuous pollution and waste. To prevent pollution of the Adriatic Sea with maritime facilities and vessels it is necessary to renew and modernize the fleet cleaner, to ensure the availability of services, equipment and devices for operational activities, particularly for interventions in case of large scale marine pollution. It should also provide the conditions for sustainable and accessible service of reception and disposal of ship generated waste and cargo residues in accordance with international and EU regulations and strengthen supervision of the Ballast Water Management on the basis of a risk assessment and in accordance with internationally agreed guidelines. Timely response to combat sea pollution is of particular importance, given that sea pollution could have far-reaching consequences.
G.13	Adaptation and mitigation of climate change	The development of the transport sector in Croatia should be done taking into account the need to reduce the CO2 emissions and thus mitigating the impact of transport on climate change. At the same time, transport infrastructure and operations should be developed taking into account the potential effects of climate change and weather extremes on them.
G.14	Improvement of data collection	For further development of the transport sector, it is necessary to have "up to date" data. It is necessary to improve and simplify the data collection, in order to increase the accessibility of data.
G.15	Improvement of interoperability with neighbouring countries	Improvement of the interoperability of the Croatian transport system, in all the sectors, with the neighbouring countries is very important to ensure the proper connectivity and consolidate the role of Croatia as a transport hub for the Western Balkans and thus, increasing the transport demand in Croatian territory. Harmonisation of the technical standards in the different sectors and simplification of the procedures at the border crossings with Schengen and non-Schengen countries, are examples of the tasks to be undertaken. Specific studies are necessaries in each sector to identify the bottlenecks and propose solutions.

Table 60 Railway transport measures

Code	Measure	Alignment	Measure description
RAILWAY TRANSPORT			
Rail network elements			
R.1	Zagreb - SLO border towards Ljubljana (core/X/Mediterranean)		Line M101 belongs to the TEN-T core network and to RH1 and is one of the main international connections to Zagreb, the only urban node of the rail TEN-T core network in Croatia. As a result, RH1 historically has been the most relevant corridor in terms of long distance passenger traffic. Although some specific activities for the improvement of this line are being developed, the fact is that at present, some sections of M101 line have a speed limit of 60 Km/h. The local/regional functionality of line M101 should be assessed in the Functional Regional Concept, which shall take into account eastern parts of Slovenia. Further studies will assess the technical requirements to be achieved in terms of capacity, permissible speed, taking into account also economic and environmental aspects. As the line is as well relevant for freight traffic, it will have to meet the following minimum technical criteria: 22.5 axle load, 750 m siding length, ERTMS.
R.2	Zagreb - Karlovac (core/Vb/Mediterranean)		The corridor connecting Zagreb and Rijeka is mainly relevant for freight and partially for commuter traffic. The analysis shows that this commuter activity is mainly related to the section from Zagreb to Karlovac. At present, this part of the line M202 runs mainly on single track, which is limiting the potential to increase in capacity. It is expected that the importance of this line for freight will increase in the medium to long term due to the fact that Rijeka has been defined as the TEN-T core port of Croatia. Further studies will analyse the design speed and capacity requirements taking into account economic and environmental aspects. Besides increase in capacity, freight traffic requires that the line meets the following technical criteria: 22.5 axle load, ERTMS. siding length depends on logistical concept.
R.3	Karlovac+ to Rijeka (core/Vb/Mediterranean)		The analysis shows that this part of the corridor connecting Zagreb and Rijeka in mainly used for freight. At present, this part of the line M202 runs on single track which is electrified and some sections have speed limits of 50 km/h. Rijeka has been defined as the TEN-T core port of Croatia and consequently, the importance of this line for freight will increase in the medium to long term perspective. Therefore, this section needs to meet the following technical criteria: 22.5 axle load, ERTMS. Siding length depends on logistical concept. Further studies will analyse the design speed and capacity requirements taking into account economic and environmental aspects.
R.4	RRailway network around Rijeka		Current preliminary analyses show that there might be a potential for a reorganisation of the Rijeka railway node with introduction of commuter services, thus favouring modal shift from private cars. Further analysis should investigate railway capacities taking into account logistical concept and capacities of the terminals in the port Rijeka. Remaining capacities could be used for regional passenger transport. Improvement of the link to Slovenia needs to be seen in line with measures R.2 and R.3.

Code	Measure	Alignment	Measure description
R.5	Zagreb - Križevci (core/Vb/Mediterranean)		The corridor connecting Rijeka and Zagreb to East Europe via Hungary is mainly used for freight and partially for commuter traffic. The analysis shows that in this part of the corridor, commuter activity is mainly related to Dugo Selo (15,568 passenger trains in 2012) and Križevci (11,516 passenger trains in 2012). At present, this part of the line M201 runs on double track to Dugo Selo and single track to Križevci. This fact is limiting the potential of increase in capacity, specially taking into consideration that the importance of this line for freight will increase in the medium to long term due to the fact that Rijeka has been defined as the TEN-T core port of Croatia. Besides the increase in capacity, as the line is as well relevant for freight traffic, it will have to meet the following minimum technical criteria: 22.5 axle load, 750 m siding length, ERTMS.
R.6	Križevci -HU border towards Budapest (core/Vb/Mediterranean)		The analysis shows that this part of the corridor connecting Zagreb and Rijeka to East Europe via Hungary is mainly relevant for freight and partially for commuter traffic. Complementary developments are currently under implementation on the Hungarian side (Gysev network development and Szekesfehervar - Boba line development). At present, this part of the line M201 runs on single track which is electrified and some sections have speed limits of 80 km/h. Rijeka has been defined as the TEN-T core port of Croatia and consequently, the importance of this line for freight will increase in the medium to long term perspective. Therefore, and taking into account that this section belongs to the TEN-T core network, it needs to meet the following technical criteria: 22.5 axle load, 750 m siding length, ERTMS.
R.7	Zagreb - Novska (core/X)		Lines M102 and M103 belong to the TEN-T core network and to RH1, one of the main international connections of Zagreb, the only urban node of the rail TEN-T core network in Croatia. As a result, RH1 historically has been the most important corridor in terms of long distance passenger traffic (between Zagreb and Dugo Selo over 59,000 passenger trains in 2012). Although some specific activities for the improvement of the line from Dugo Selo to Novska are being developed, the fact is that at present, some sections of both lines have a speed limit of 50 Km/h. Further studies will analyse the design speed and capacity requirements taking into account economic and environmental aspects. As the line is as well relevant for freight traffic, it will have to meet the following minimum technical criteria: 22.5 axle load, 750 m siding length, ERTMS.
R.8	Novska - SRB border towards Belgrade (core/X)		Line M105 belongs to the TEN-T core network and to RH1, one of the main international connections of Zagreb. RH1 historically has been the most important corridor in terms of long distance passenger traffic. Future scenarios like Croatia entering the Schengen area and other surrounding countries like Serbia entering EU will increase the volume of traffic in this line. At present, M105 runs on double track between Novska and Tovarnik, which has been designed as the core rail network crossing point between Croatia and Serbia. Further studies will assess the technical requirements to be achieved, taking into account also economic and environmental aspects. As the line is as well relevant for freight traffic, it will have to meet the following minimum technical criteria: 22.5 axle load, 750 m siding length, ERTMS.

Code	Measure	Alignment	Measure description
R.9	HU border - Osijek - BIH border (comprehensive/core/Vc)		Line M303 belongs to the TEN-T core network in Croatia, and Slavonski Šamac is the railway core network border crossing point to Bosnia and Herzegovina. Lines M301 and M302 belong to the comprehensive network but serve as a Bosnia Herzegovina-Croatia-Hungary link, following the Pan European corridor Vc. From the NTM it can be seen that at the moment there is no need to invest. The potential of this international connection will increase in future scenarios in which Schengen borders will vary from its present configuration.
R.10	Regional connection Vinkovci - Vukovar (core/access to Pan-European corridor X)		Railway line M601 Vinkovci – Vukovar will serve as the railway line connection of RH1 and the only inland core port on the Danube within Croatia, Vukovar. Future scenarios related to the development of the port of Vukovar will increase the importance of freight traffic on this line for the medium to long term perspective. As the line is as well relevant for freight traffic, it will have to meet the following minimum technical criteria: 22.5 axle load, 750 m siding length, ETRMS.
R.11	Zagreb node		The present configuration of the Croatian rail network and the fact that Zagreb is the only urban node of the core transport network, outline the importance of the capital city of Croatia within the entire transport system. In order to enhance the role of railways in the regional connectivity and in urban transport system of Zagreb, further studies will analyse specific requirements to be fulfilled.
R.12	Zagreb freight		Covered by the general measure G.2
R.13	Zagreb airport connection		Zagreb Main Station must play a key role not only in long distance traffic but also in local and regional traffic. Adaptation of the existing accesses and platforms, organization of passenger flows inside and outside the station, favouring modal interchange, are likely to be required. Specific technical requirements will be a result of functional regional concept, which will take into consideration economic, social and environmental aspects.
R.14	Zagreb main station		Line M101 belongs to the TEN-T core network and to RH1 and is one of the main international connections to Zagreb, the only urban node of the rail TEN-T core network in Croatia. As a result, RH1 historically has been the most relevant corridor in terms of long distance passenger traffic. Although some specific activities for the improvement of this line are being developed, the fact is that at present, some sections of M101 line have a speed limit of 60 Km/h. The local/regional functionality of line M101 should be assessed in the Functional Regional Concept, which shall take into account eastern parts of Slovenia. Further studies will assess the technical requirements to be achieved in terms of capacity, permissible speed, taking into account also economic and environmental aspects. As the line is as well relevant for freight traffic, it will have to meet the following minimum technical criteria: 22.5 axle load, 750 m siding length, ERTMS.
Rail network			
R.15	ETCS L1, L2 on other lines, GSM-R		Installation of ETCS on lines other than the ones described in the previous measures would allow increasing the interoperability of the entire network. Dependent on the operational concept it might be feasible to install ETCS and GSM-R also on other lines of the Croatian

Code	Measure	Alignment	Measure description
			network (comprehensive and non-TEN-T). Functional Region Concept will define specific needs and technical parameters in each case.
R.16	Electrification of other lines		Dependent on the operational concept, electrification of railway lines would allow increasing efficiency on existing infrastructure. Further studies will define specific needs and technical parameters in each case.
R.17	Rehabilitation, upgrading of other lines		Case by case studies will identify the need to rehabilitate and upgrade lines other than the ones described in the previous measures, taking into account the operational concept and also economic and environmental aspects.
R.18	Regional traffic other than Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)		Rail transport can play as well an important role in regional transport in regional centres outside the railway TEN-T core network, due to the existing configuration of the network in these areas. Functional Region Concept will analyse this potential in cities such as Split, Varaždin and Osijek. These studies will also assess case by case the necessary technical parameters.
R.19	Improvements and new marshalling yards		Functional Region Concept will analyse, based on demand forecasts, the necessity to develop new marshalling yards or improve the existing ones to increase the potential of railways for freight.
R.20	Improvement of safety at crossing, axle load detectors, hot axle detectors, etc.		Covered by the general measures G.1 and G.3
R.21	Added value services and improvement of the railway image		Covered by the general measure G.11
R.22	Intermodal passenger hubs		Covered by the general measure G.4
R.23	Intermodal freight hubs		Covered by the general measure G.1
R.24	Development of concept of maintenance of the existing infrastructure		Covered by the general measure G.5
R.25	Energy efficiency		Covered by the general measure G.6
Rail operation/organization			
R.26	Reorganization of Track access charge		Track Access Charge can be used as a tool for improving the sustainability of the rail transport system. Track Access Charge has to be proportional to the emissions and therefore addressing the polluter pays principle. Coordinating Track Access Charge with rail administrations of neighbouring countries will facilitate international traffic.

Code	Measure	Alignment	Measure description
R.27	Multi annual PSC		Covered by the general measure G.7
R.28	Increase financial sustainability		Covered by the general measure G.7
R.29	Reorganization of the railway transport system		Covered by the general measure G.7
R.30	Improvement of passenger rolling stock		The current railway fleet is aged and based on outdated and inefficient technologies. In order to increase the competitiveness of rail transport in comparison with other transport modes it is necessary to modernise the rolling stock, in coordination to the foreseen improvements on the infrastructure. The first step to develop this measure is to perform a comprehensive analysis of the current organisational, operational and maintenance setup of the railway operator analysing the future requirements and operational and maintenance plan. Once the real needs are identified further studies will define the specific technical requirements for the rolling stock.
R.31	Improvement of freight rolling stock		The freight fleet consists mostly of conventional covered or open wagons, some suitable for combined traffic operations. A large number of locomotives are in need of replacement, with an estimated 70% reaching the end of their working lives within the next decade. The first step to develop this measure is to perform a comprehensive analysis of the current organisational, operational and maintenance setup of the railway operator analysing the future requirements and operational and maintenance plan. As the freight market has been liberalized, it is important to involve the interested and relevant freight operators. Once the real needs are identified further studies will define the specific technical requirements for the rolling stock.
R.32	Update legislation and planning guidelines		Covered by the general measure G.8
R.33	Prepare for changes in Schengen borders		Covered by the general measure G.9
R.34	Preparation/adaptation of non-Schengen borders		Covered by the general measure G.9
R.35	Liberalization of operations for passengers		Gradual opening of the transport market ensuring equal opportunities to all potential operators is one of the main criteria of compliance fulfilled by Croatia in the process of harmonization with the EU Acquis Communitaire, in line with the objectives of the White Paper. Croatian administrative institutions like the Regulatory Body and the Safety Agency must be prepared for the future situation.

Code	Measure	Alignment	Measure description
R.36	Liberalization of operations for freight		Liberalization of the railway freight sector in Croatia has already started. and the following freight operators are active in the Croatian market: HŽ Cargo d.o.o., PPD Transport d.o.o., Rail Cargo Carrier Croatia d.o.o., RAIL & SEA d.o.o., RTS Rail Transport Service GmbH, Train Hungary Kft, SŽ — Tovorni promet d.o.o. i Pružne građevine d.o.o.
R.37	Increase administrative capacity/training		Covered by the general measure G.10
R.38	Reorganization of the operations/time schedules		In order to increase the share of rail mode, reorganization of time schedules (e.g. TAKT) is necessary to improve connectivity and efficiency of the services provided. Functional Region Concept will analyse this possibility taking into account origin-destination patterns and the operational and infrastructural requirements.
R.39	Information platforms		Covered by the general measure G.11
R.40	Reduce environmental impact		Covered by the general measures G.12 and G.13
R.41	Improvement of data collection		Covered by the general measure G.14

2.6.3 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 61 Rail projects in Croatia

ID	Scenario	Type	Name	Main goal
HR1	Baseline 2030	New construction	Upgrade and construction for a 2nd track on the Križevci - Koprivnica - state border railway section	Once completed, the Action will have a positive impact on traffic management, modal split, congestion, inter-operability, service quality, safety and security, and on environment by shifting traffic from road to rail
HR2	Baseline 2030	New construction	Preparation for construction of 2nd track, upgrade and modernisation of Škrljevo - Rijeka - Jurdani railway section	The main objective of the project is to upgrade, electrify and renovate the existing single-track railway Vinkovci - Vukovar, reconstruct the railway stations Vukovar / Borovo Naselje and Vukovar, Nuštar and Bršadin - Lipovača stops and perform all necessary works on railway infrastructure subsystems
HR3	Baseline 2030	New construction	Upgrade of Dugo Selo - Križevci railway line and construction for a 2nd track	The modernisation will help reduce the journey times from Dugo Selo to Križevci from the existing 30 minutes to 18 minutes
HR4	Baseline 2030	Upgrade	Upgrade of existing railway line Hrvatski Leskovac - Karlovac	Increasing of East-West connections on Western Balkans corridor
HR5	Baseline 2030	New construction	Reconstruction of railway line on the section Zagreb Zapadni Kolodvor - Savski Marof	Increasing of East-West connections on Western Balkans corridor on the section Zagreb Zapadni kolodvor - Savski Marof
HR6	Baseline 2030	Upgrade	Upgrade of railway line Vinkovci - Vukovar	Increasing of North-South connections across the Region on railway line Vinkovci - Vukovar
HR7	Baseline 2030	New construction	Modernization of railway section Zaprešić - Zabok	The objective of this project is to modernize and electrify the Zaprešić - Zabok line
HR8	Baseline 2030	New construction	R3 - Karlovac - Port of Rijeka	The 170-kilometre railway line between Karlovac and Rijeka will improve and speed up train traffic to the port of Rijeka; the new railway allows for shortening the travel time between Zagreb and Rijeka from 3.5 to 1.5 hours
HR9	Project	New construction	Construction of a new railway line Dugo Selo - Novska	Increasing of East-West connections across the Region in section between Dugo Selo - Novska

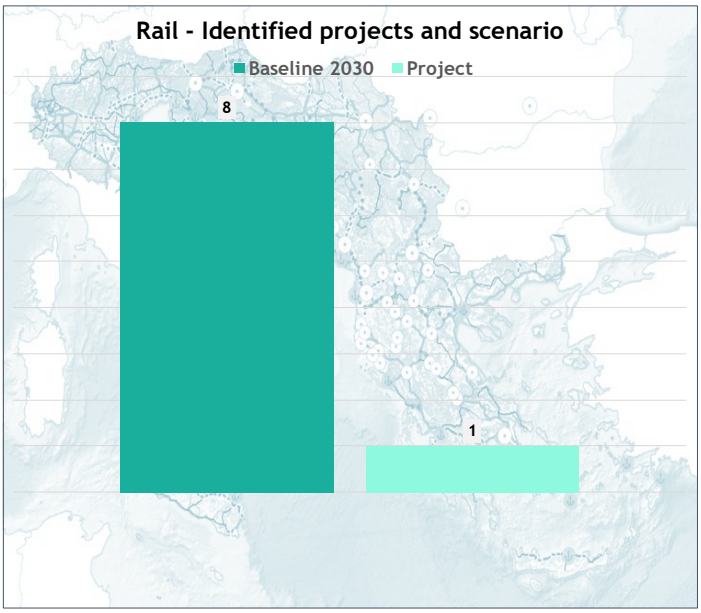

Figure 50 Rail projects by scenario, in Croatia

9 rail interventions selected in Croatia are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

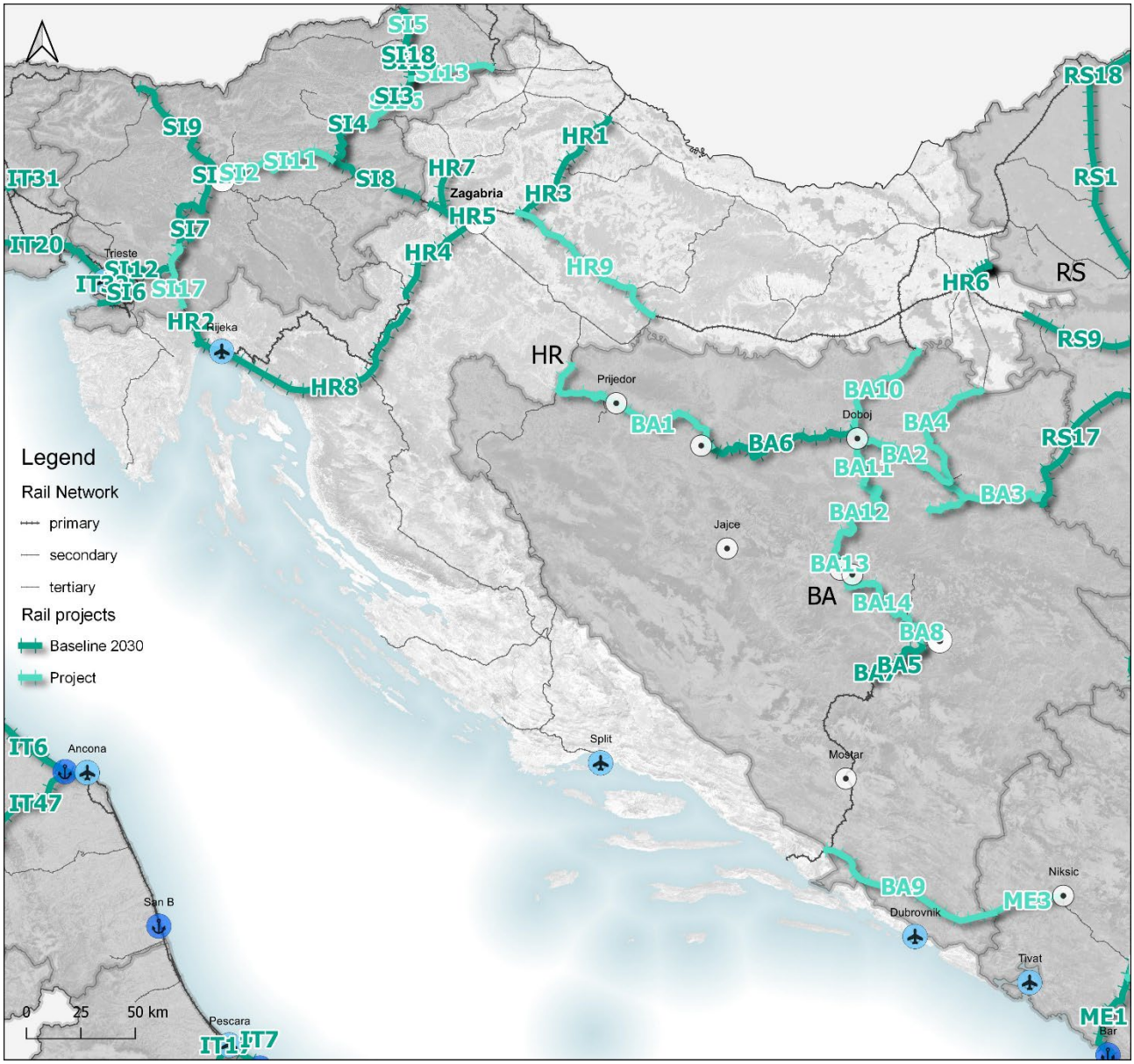

Figure 51 Map of rail project by scenario in Croatia

2.7 Slovenia

2.7.1 National Transport Strategy and Action Plan

In Slovenia Transport Strategy is represented by the document: "Transport Development Strategy of the Republic of Slovenia Until 2030"[64]. The best possible transport system of a country is one of the fundamental conditions for its efficient operation, since it provides for the implementation of the other country's policies, it is regarded as a precondition for economic development. The transport policy vision is thus a part of a

64 https://www.gov.si/assets/ministrstva/MzI/Dokumenti/Transport-Development-Strategy-of-the-Republic-of-Slovenia-Until-2030.pdf

common vision of a country and a necessary condition for its operation. It is defined as the provision of sustainable mobility for the population and supply to the economy. The definition derives from basic traffic and transport activity, which is moving or transferring people, goods and information in space and time. The word "provision" means that a country will ensure the sustainable mobility of the population and sustainable supply to the economy by transport policy measures. The word "sustainable" relates to the efficient operation of a transport system which functions at the intersection of environmental, social, and economic aspects.

Measures at the intersection of environmental and economic aspects are implementable, but not necessarily socially acceptable; measures at the intersection of social and economic aspect are just, but not necessarily environmentally acceptable; measures at the intersection of the environmental and social aspect are tolerable, but not necessarily economically acceptable. The vision of transport policy strives to implement such measures which will provide the sustainable mobility of the population and sustainable supply to the economy.

The wider developmental goals of the program pursue the combined objective of sustainable development in Slovenia and are as follows:

- Preservation of the achieved level of competitiveness of the economy by shortening travel times and reducing transport costs.
- Harmonizing and/or guaranteeing the interoperability of public railway network with EU network.
- Better accessibility to individual regions and better interregional connection, linking parts of Slovenia that have not been connected appropriately yet to the main European railway corridors, thus enabling a more equal distribution of economic benefits of Slovenia's development.
- Improvements of traffic safety.

The wider goals of the development program are determined by the basic development concepts.
Objectives are:

- Public railway infrastructures in RS.
- Public railway infrastructure for the needs of transit and domestic goods transport.
- Public railway infrastructure for the needs of suburban passenger transport.
- Intercity and international passenger transport.
- Fast long-distance transport.
- Common (network) strategic starting points for developing public railway infrastructure.

2.7.2 Proposed objectives and measures

The general objectives of transport policy which ensure that the vision is realised are determined on the basis of the vision. Objectives are:

- improve mobility and accessibility;
- improve the supply to the economy;
- improve traffic safety and protection;
- reduce energy consumption;
- reduce costs to user and operators;
- reduce environmental burdens.

The last objective (the reduction of environmental burdens) is also crucially related to the objective of reducing the burden of diseases caused by inadequate transport pursued by the Ministry of Health. Therefore, the measures defined on the basis of this objective will also include the area of health.

Objectives are harmonized with the objectives of the TEN-T ordinances on the technical specifications for interoperability in terms of the "infrastructural" subsystem of the Pan-European railway system for conventional speeds (2011/275/EU): the Commission's Decision of 26 April 2011 on a technical specification for interoperability relating to the "infrastructure" subsystem of the Pan-European railway system for conventional speeds (notified under document C (2011) 2741)).

Special objectives – railways

The developmental program objectives of railway infrastructure pursue the joint objective of sustainable development of Slovenia, and are as follows:

- increase economic competitiveness by reducing travel times, eliminating the low traffic flow, and reducing transport costs.
- harmonize and/or guarantee the integration of the public railway network with the EU network.
- improve accessibility to individual regions and interregional connections.
- improve traffic safety.
- reduce the environmental burden.
- improve traffic management efficiency.
- reduce operating costs.
- introduce interoperability.
- observe the TEN-T standards (22,5 tons of axle pressure, speed of 100 km/h, electrification; ERTMS, length of trains up to 740m) in the core TEN-T network, where this does not cause disproportionately high costs.
- observe standards pursuant to the TSI for the entire TEN-T network.
- provide arranged and safe PPT stations and stop facilities.

Measures

On the basis of the specific objectives, the measures are defined, which are divided into general measures and measures relating specifically to rail, road, public passenger transport, air and sea transport and urban centers. Measures are not represented at the level of concrete projects, but at the level of identified needs (at the level of strategic level).

Below is displayed the description of the measures for achievement of specific projects objectives according to the rail transport area.

Table 62 Description of measures on rail transport

Harmonisation with the Transport Development strategy/ Code	Measure	Description of measure
Railways		
Description of measure		
R.1	Koper–Ljubljana	The corridor connecting Koper and Ljubljana to Eastern Europe, is used mainly to transport goods. However, it also provides the possibility for international passenger transport at the section from Divača to Ljubljana. It is part of the Mediterranean (MED) and Baltic-Adriatic TEN-T corridor. To deal with the expected growth in needs for goods transport at the Port of Koper and similar economic growth, the capacity has to be increased. Koper is also the main Slovenian TEN-T port and one of the most important ports in the Adriatic Sea. In addition to the increase in capacities related to the importance of the rail connection for goods transport, the railway network will have to fulfil the following minimum technical criteria: axle load of 22.5 tonnes, train length of 740 metres, ERTMS and electrification. The basis for project speed is up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances will also be taken into consideration pursuant to TSI with regard to line functionality. R.39 measure must be taken into account when siting and designing.
R.2	Zidani Most–Dobova (HR)	The section is part of the TEN-T core network; it is intended for mixed transport. The TEN-T standards have to be provided on the corridor with a sufficient axle load, speed, electrification and capacity. An upgrade is required relating to the length of trains (740 m) and introduction of the ERTMS. The line should allow speeds up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality. Measure R.39 must be taken into account when siting and designing.
R.3	Ljubljana–Jesenice (AT)	The section is part of the comprehensive TEN-T network. It is important for goods and at least on 2/3 of the Ljubljana–Kranj section for passenger transport (daily commuters). It is important to increase the capacity of the line and upgrade the (quality) of service. The line should allow speeds up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality. The length of trains of 740 metres should be taken into account. The ERTMS system must be introduced. The Karavanke railway tunnel must be arranged according to the requirements of transport safety and throughput capacity. Measure R.39 must be taken into account when siting and designing.
R.4	Ljubljansko železniško vozlišče (LŽV)	It is a crossroads of international transport corridors and the most important transport hub in Slovenia The enhancement of capacities is necessary for the provision of throughput of trade flows and to improve public passenger transport services. In addition to the re-arrangement (reorganisation) of the existing hub, extensions and the construction of missing tracks (e.g. the Tivoli Arc), and a bypass for goods transport will be necessary, so that it no longer runs through the main railway station. The Ljubljana passenger station is arranged. The ERTMS system must be introduced. Measure R.39 must be taken into account when siting and designing.

Harmonisation with the Transport Development strategy/ Code	Measure	Description of measure
Railways		
Description of measure		
R.5	Ljubljana–Zidani Most	The section is in the Baltic-Adriatic (BA) and MED corridor and is part of the TEN-T network. It is intended for mixed transport. The TEN-T standards for the core network have to be provided on the section, with sufficient axle load and capacity. The line is also electrified; the upgrade is necessary to achieve higher speeds, namely up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality. A train length of 740 metres must be taken into account and ERTMS must be introduced. R.39 must be taken into account when siting and designing.
R.6	Divača–Sežana (IT)	The section is in the Baltic-Adriatic (BA) and MED corridor and is part of the TEN-T network. It is intended for mixed transport. The TEN-T standards for the core network have to be provided on the section, with sufficient axle load and capacity. The line is also electrified; the upgrade is necessary to achieve higher speeds, namely up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality. A train length of 740 metres must be taken into account and ERTMS must be introduced. Measure R.39 must be taken into account when siting and designing.
R.7	Pragersko–Hodoš (HU)	The section is part of the MED corridor and the TEN-T core network; the Murska-Sobota-Hodoš section is in particular intended for goods transport and partly also for mixed transport; the line complies with the TEN-T standards (or it will comply after the completion of the current investment). Its capacity is currently sufficient (although it is a single-track line). The possible construction of an additional second track depends on Hungary's plans or the enhancement of transport flows. The ERTMS system must be introduced. R.39 must be taken into account when siting and designing.
R.8	Maribor–Šentilj (AT)	The section is part of the BA corridor and the TEN-T core network; it is intended for mixed transport. This is a single-track line on which capacities must be increased (also by constructing a second track) and which requires an upgrade in order to achieve TEN-T standards (mainly: axle load 22.5 t, speed up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality). Trains 740 metres long must be provided for and ERTMS must be introduced. Measure R.39 must be taken into account when siting and designing.
R.9	Pragersko–Maribor	The section is part of the BA corridor and the TEN-T core network; it is intended for mixed transport. The line capacity suffices; its upgrade is necessary to meet the TEN-T standards (mainly: axle load 22.5 t, speed up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality; Trains 740 metres long must be provided for and ERTMS must be introduced.). Measure R.39 must be taken into account when siting and designing.
R.10	Zidani Most–Pragersko	The section is part of the BA and MED corridor and the TEN-T core network; it is intended for mixed transport. The line capacity suffices; however, its upgrade is necessary to meet the TEN-T standards (mainly: axle load 22.5 t, speed up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality; trains 740 metres long must be provided for and ERTMS must be introduced). Measure R.39 must be taken into account when siting and designing.
R.11	Postojna–Ilirska Bistrica–Šapjane (HR)	The section is a part of the comprehensive TEN-T network and has important capacities, in particular for goods transport. The line capacity has to be improved and upgraded to a higher level of service, i.e. increased speed and frequency or passenger transport rides and adequate throughput and goods transport capacity. The line should allow speeds up to 160 km/h for passenger transport and up to 100 km/h for goods transport, whereby possible tolerances must also be taken into consideration pursuant to TSI with regard to line functionality. Trains 740 metres long must be provided for and ERTMS must be introduced. Measure R.39 must be taken into account when siting and designing.

Harmonisation with the Transport Development strategy/ Code	Measure	Description of measure
Railways		
Description of measure		
Railway network		
R.21	ETCS	The installation of the ETCS system on tracks which are not described in the previous measures would enable an increase of the interoperability of the entire network. The ETCS installation on other lines of the Slovenian network (fully and not only on parts of the TEN-T network) is also reasonable. Further studies will determine specific needs and technical parameters for each case (e.g. ETCS second level on main and regional lines – ETCS Regional). Measure R.39 must be taken into account when siting and designing.
R.22	Electrification	The electrification of regional railway lines would increase the efficiency of the existing infrastructure. Further studies will determine specific needs and technical parameters for each case. Measure R.39 must be taken into account when siting and designing.
R.23	Renovation or new construction of other lines	The studies of individual sections will determine the need for renovation and upgrading of lines which were not included in the specific measures, whereby the concept of operations and economic and environmental aspects will also be observed (regional lines and lines to neighbouring countries which are not included in the TEN-T network). Measure R.39 must be taken into account when siting and designing.
R.24	Safety	The elimination of dangerous level crossings: the relevant legislation must be changed for this purpose, and we would have to redetermine which types of level crossings may be defined as suitably or unsuitably secured and thus dangerous. Then, on the basis of this, a schedule has to be prepared for the elimination of improperly protected railway crossings. Measure R.39 must be taken into account when siting and designing.
Functioning/organisation of the railway		
R.31	The reorganisation of the user charges for railway lines	Railway user charges have to be proportional to emissions, and therefore in accordance with the 'polluter pays' principle. They must be the same as marginal costs incurred directly by the provision of railway transport service; the system for calculating user charges must be changed by introducing an adequate incentive to equip trains with ETCS. The harmonisation of railway user charges with the railway administrations of neighbouring countries will facilitate international transport.
R.32	Multi-annual contract on the implementation of public services	The contract/contracts for the implementation of public service pursuant to Regulation (EC) No 1370/2007 of the European Parliament and of the Council of 23 October 2007 on public services of railway and road passenger transport and repealing Council regulations (EEC) Nos 1191/69 and 1107/70 are basic tools for providing transparency and efficiency in performing public transport services. Therefore, the expanded realisation of contracts on the implementation of public service is not only necessary for the purposes of harmonisation, but also as the first step to improving the sustainability of the Slovenian transport system. The typology and duration of contracts on the implementation of public service have to be determined by the analysis of individual cases together with the applicability of its own model (which could be based on the issues of full conformity or on applicability after a thorough evaluation of technical and financial requirements).
R.33	Increase in financial sustainability	An increase in financial sustainability is one of the objectives of the Pan-European transport system. In order to achieve this objective, the organisational structure of the railway system has to be optimised and the efficiency of functioning and maintenance has to be increased. The financial sustainability of the railway transport system should reduce the dependence of the system on public subsidies. Further studies will assess the individual measures needed to optimise the ratio between costs and income.
R.34	Improvement of the railway passenger vehicle fleet	To increase the competitiveness of rail transport over other transport modes, it is necessary to modernise the railway fleet in accordance with the foreseen improvements in the infrastructure. The first step in the development of this measure is a comprehensive analysis of the current organisation, operation and maintenance structures of the railway operator and thus the future requirements and operation and maintenance plan. After establishing the actual needs, the specific technical requirements regarding the rolling stock will be defined on the basis of further studies.

Functioning/organisation of the railway		
R.35	Modernisation of goods rolling stock	Goods rolling stock consists mainly of standard close and open carriages, with some of them suitable for combined transport. The first step in the development of this measure is a comprehensive analysis of the current organisation, operation and maintenance structures of the railway operator and thus the future requirements and operation and maintenance plan. After establishing the actual needs, the specific technical requirements regarding the rolling stock will be defined on the basis of further studies.
R.36	Modernisation of legislation and planning guidelines	The legislation and planning guidelines related to the railway have to stimulate the development of the sector and should be pursuant to the best international practice and European regulations, especially those related to safety, interoperability, transport sustainability and environment.
R.37	Development of the concept for maintaining the railway network	The Republic of Slovenia has a widespread road as well as railway infrastructure and other infrastructures. The infrastructure enables the mobility of the population and implementation of commercial activities. In recent years, the operators introduced various measurements of the situation which are used to establish the actual state of infrastructure quality. A computer-based system was introduced on some segments, providing continuous monitoring of the state and preparation of renovation plans on the basis of mathematical models. Such systems enable efficient infrastructure management and the long-term financial sustainability of the system. Systems based on real data on the state of the infrastructure enable more suitable planning of necessary financial resources in the long term. After these bases are established, multi-annual contracts for maintaining railway infrastructure will also be signed.
R.38	Reorganisation of operations/timetables	To increase the share of rail transport, it is necessary to reorganise the timetable (clock-face timetable) to improve the interrelation and efficiency of services. This possibility will be analysed in further studies while observing passenger potential and operational and infrastructural demands.

Harmonisation with the Transport Development strategy/ Code	Measure	Description of measure
R.39	Measures to prevent, mitigate and maximise the elimination of the consequences of significant impacts of the plan on the environment, nature, health and cultural heritage (mitigation measures)	Measures to protect the environment against noise caused by rail transport in particular include measures to reduce the noise at source (upgrade of rolling stock and railway infrastructure), measures to prevent the spread of noise into the environment (standard and low-noise barriers) and measures on buildings (anti-noise renovation of façade elements). More detailed measures must be defined in the operational programme for protection against noise, which must include all important railway lines and the railway network on both sides of settlement areas (Municipality of Ljubljana and Municipality of Maribor). The reduction of noise must also be taken into account in implementing measures R.34 and R.35 (modernisation and technical measures on rolling stock). In terms of reducing degradation of the natural environment, the reconstruction of existing infrastructure connections has priority over the construction of new traffic routes, and also the positioning of transport infrastructure in the existing infrastructural corridor has priority over positioning in naturally preserved areas. Therefore, sustainable land management and soil protection must be ensured when planning the integration of transport infrastructure in the environment. Activities in agricultural land and woodland must be reduced to the lowest level possible, and the planning of activities on land with poorer productive potential, and land outside dense forest areas and forest areas with important wood production functions at the first level must be given top priority. Railway infrastructure should not be integrated into coastal land. Such interventions may cause significant impacts on the ecological status of watercourses, a reduction in retention surfaces, including cumulative impacts on the biodiversity and ecosystem services of the area. When planning railway infrastructure in areas with extremely high, very high and highly vulnerable aquifers, it is necessary to study and plan appropriate technical solutions that prevent negative impacts of construction and operation, as well as extraordinary events. In the spatial integration of transport infrastructure, it is necessary to avoid water protection areas and areas at risk of flood and related erosion. Infrastructure corridors should not be integrated into cultural heritage areas, exceptional landscapes or landscapes with distinctive features at the national level. The proper technical measures must be applied to provide a high-quality landscape image by taking into account the natural and cultural features and topography of the area. When siting railway infrastructure in the area, it is necessary to avoid placing facilities in areas with nature conservation status (Natura 2000 areas, protected areas, ecologically important areas, areas proposed for protection). The time when interventions occur has to be adjusted to the life cycles of animals and plants. If the electrification of a railway line is planned in the area of flight and migration routes of birds, appropriate technical solutions for preventing the collisions of birds with power lines must be anticipated. Variants with less impact on the migration paths of wild animals should be given priority (those with long sections in tunnels, covered burrows; those which cross fewer migration paths). When fragmenting migration paths, adequate passages must be provided pursuant to good practices in the European Union. Chapter 9 of this document also states specific mitigation measures according to individual areas which must be taken into account in the preparation of spatial plans and designing of railway infrastructure.
R.40	Development of network into intermodal hubs, agglomerations in accordance with demand	The new TEN-T Regulation lists the following transport hubs in Slovenia: Ljubljana and Koper as hubs in the core section of the TEN-T network, and Maribor as the hub in the comprehensive section of the TEN-T network. These points have the best possibilities for the development of logistics activities relating to cargo, and Ljubljana and Maribor have the potential for establishing multimodal passenger platforms However, a wider (greater scope) approach to goods transport and the transition of passengers from one transport mode to the other could be provided in Slovenia. This would enable more efficient combinations of different means of transport in a transport chain and thus increase transport efficiency, in particular in areas where environmental issues are dealt with.. For this purpose, it is necessary to define possible points of passenger and goods transition between various transport modes in the future. Where necessary and efficient, intermodal passenger platforms should be established to increase the use of public passenger transport and the proper connection of logistics freight terminals with various modes of transport should be provided where a commercial interest exists.
R.41	Recycling and use of waste in construction	Stimulating recycling and the use of own waste in the construction and reconstruction of transport infrastructure and also the use of certified construction materials from recycled by-products or waste material from other sectors (Decree on Green Public Procurement is used). When using building materials for transport infrastructure which are not of primary natural origin, it should be taken into account that it is the use of larger amounts, especially for construction fillings, and that some hazardous substances from waste materials are permanently mobilised. New building materials may have better functional qualities than materials of natural origin.

Harmonisation with the Transport Development strategy/ Code	Measure	Description of measure
R.42	Preparedness for extreme weather conditions	Pursuant to Article 41 of Regulation (EU) No. 1315/2013 with regard to adaptation to climate change: with detailed documents, the preparation of an analysis of the sensitivity of transport infrastructure to climate change should be provided, and on the basis of the findings of the analysis, the measures and adaptations that adequately improve the resistance of infrastructure to these changes must be implemented. Guidelines, methodologies and procedures for collecting information on extreme weather conditions and for planning and implementing the measures to reduce the sensitivity of transport infrastructure to these phenomena have to be developed.
R.43	Provision of migration corridors for wild animals and protection of drivers against collisions with wild animals	Provision of migration corridors for wild animals and protection of drivers against collisions with wild animals: when constructing the projected railway lines, the existing migration corridors for wild animals have to be preserved by constructing proper structures of other arrangements to cross the facilities (especially for large mammals and bats). For the needs of planning, the purpose study was prepared already in the first phase (or the results of already conducted studies, if available, are summarised) which includes data on species the migration of which will be affected by the intervention, and guidelines for the project designer on planning the facility or arrangement (location, shape, size, greening of the facility and surroundings, etc.).
R.44	More accessible infrastructure for less mobile persons	The proper accessibility of infrastructure must be provided for all users. It must be adapted to be more accessible for less mobile persons, e.g. arrangement of proper access from platforms.

2.7.3 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 63 Rail projects in Slovenia

ID	Scenario	Type	Name	Main goal
SI2	Project	New construction	Preparation of design documentation for upgrading of railway sections and railway stations in Ljubljana Hub	Upgrading of railway sections and railway stations in Ljubljana
SI3	Baseline 2030	Upgrade	Upgrade of railway line Poljčane - Slovenska Bistrica, including railway stations Poljčane and Slovenska Bistrica	Baltic-Adriatic Sea Corridors, North-South connection, Poljčane - Slovenska Bistrica upgrade

ID	Scenario	Type	Name	Main goal
SI4	Baseline 2030	Upgrade	Upgrade of railway line Zidani Most - Celje	Baltic-Adriatic Sea Corridors, North-South connection, Zidani Most-Ceije upgrade
SI5	Project	Upgrade	Upgrade of existing rail track on the Maribor - Šentilj - national border section	Western Balkans corridors: North-South connections, upgrading of the existing rail track on the Maribor-Šentilj-national border section
SI6	Baseline 2030	New construction	Construction of new tunnels T1-T7 of second track Divača - Koper	Western Balkans corridors: North-South connections, second track "Divača-Koper"
SI7	Baseline 2030	Upgrade	Upgrade of R1 - Koper - Ljubljana (HSL)	Western Balkans corridors: North-South connections, upgrade of Koper–Ljubljana section
SI8	Baseline 2030	Upgrade	Upgrade of R2 - Zidani Most - Dobova (HR)	Western Balkans corridors: East-West connections, Zidani Most – Dobova upgrade
SI9	Baseline 2030	Upgrade	Upgrade of R3 - Ljubljana - Jesenice (AT)	Western Balkans corridors: North-South connections, upgrade of Ljubljana–Jesenice
SI10	Baseline 2030	Upgrade	Upgrade of R4 - Ljubljana Railway Hub (LRH)	Western Balkans corridors: increasing in capacities of Ljubljana railway Hub
SI11	Project	New construction	Upgrade of R5 - Ljubljana–Zidani Most	Western Balkans corridors: East-West connections, Ljubljana-Zidani Most section
SI12	Baseline 2030	Upgrade	Upgrade of R6 - Divača - Sežana (IT)	Western Balkans corridors: East-West connections along Baltic-Adriatic (BA) and MED corridor, TEN-T standards upgrading on Divača–Sežana section
SI13	Project	Upgrade	Upgrade of R7 - Pragersko - Pukonci and Pukonci - Hormoz (HU)	Baltic-Adriatic Sea Corridors, East-West connection, Pragersko – Hormoz upgrade
SI15	Baseline 2030	Upgrade	Upgrade of R9 - Pragersko - Maribor	Western Balkans corridors: North-South connections along Baltic-Adriatic (BA) and MED corridor, TEN-T standards upgrading on Pragersko–Maribor section
SI16	Project	Upgrade	Upgrade of R10 - Zidani Most - Pragersko	Baltic-Adriatic Sea Corridors, North-South connection, Zidani Most-Pragersko upgrade
SI17	Project	Upgrade	Upgrade of R11 - Postojna - Ilirska Bistrica - Šapjane (HR)	Postojna - Croatia border connection
SI18	Baseline 2030	Upgrade	Deployment of ERTMS/ETCS on the Dobova - Zidani Most and Pragersko - Maribor - Sentilj railway lines	Western Balkans corridors: North-South connections along Baltic-Adriatic (BA) and MED corridor, TEN-T standards upgrading on Dobova-Zidani Most and Pragersko-Maribor-Sentilj railway lines

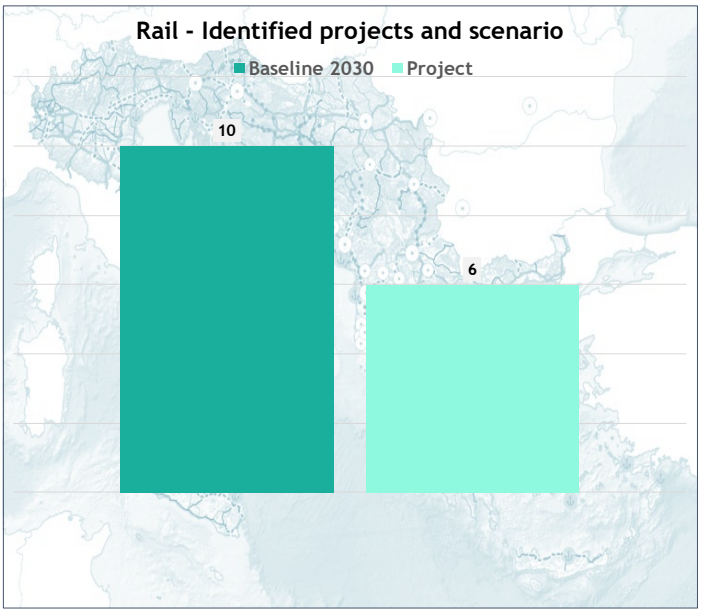

Figure 52 Rail projects by scenario, in Slovenia

16 rail interventions selected in Slovenia are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

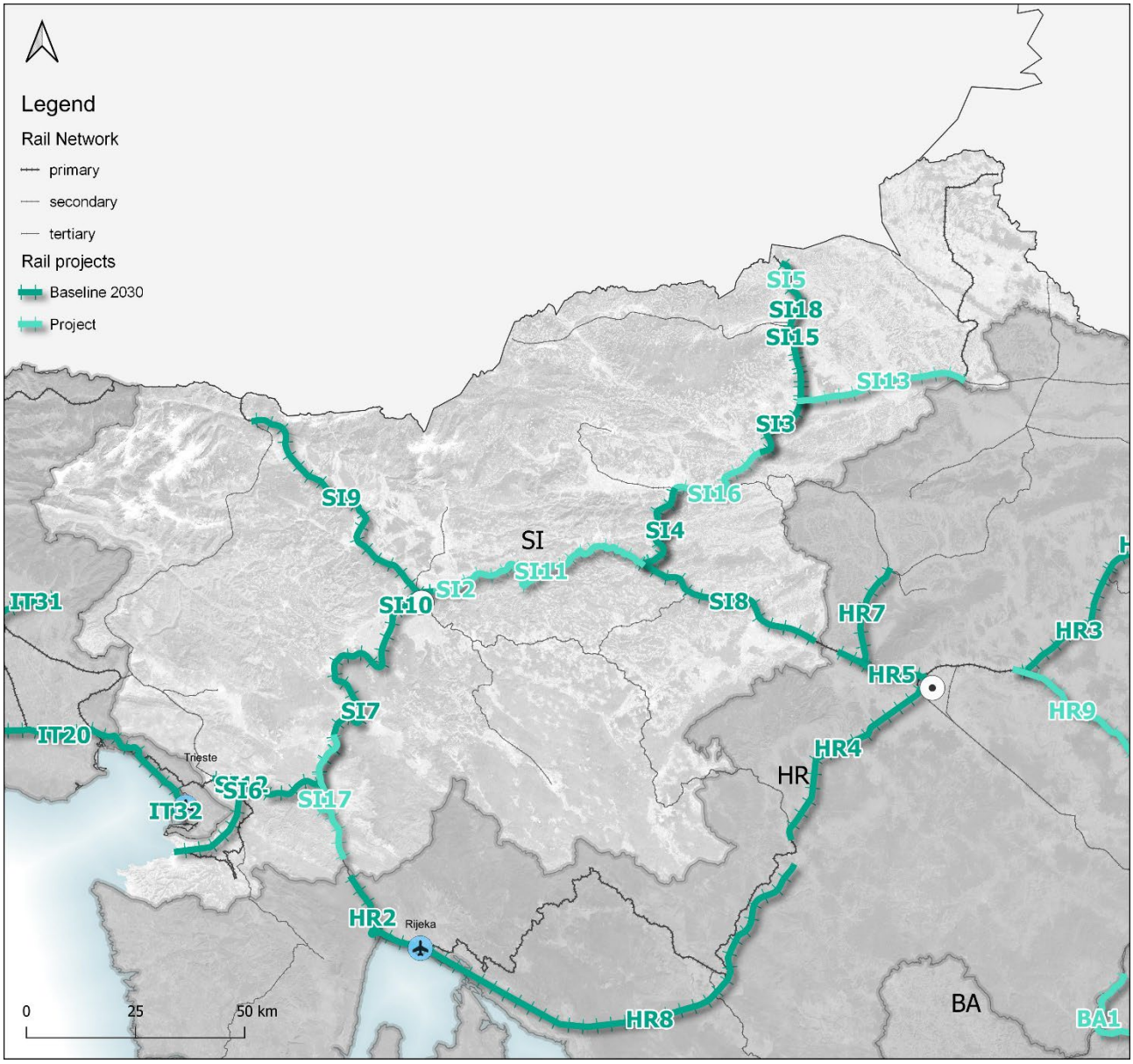

Figure 53 Map of rail project by scenario in Slovenia

2.8 Greece

2.8.1 National Transport Strategy and Action Plan

The "National Transport Plan for Greece – NTPG" [65]is a consultancy project with the primary objective to provide the basis for sustainable transport infrastructure and service development in Greece over the medium to long term. The National Transport Plan for Greece is a key policy document which will define the transport sector development strategy on a long-term time horizon of 20 years (2017-2037) and will support

[65] http://nationaltransportplan.gr/

Greece's economic development. It will also determine the main actions that may receive financial support from International Financing Institutions and donors.

The High-Level Objectives (HLO) defined for the transport sector in Greece are:

- Delivering Economic Growth and Efficiency in the development and operation of the transport system, at Regional and National level, measured through travel times, reliability, and cost effectiveness,
- Improving Transport Connectivity, comprising connectivity with the islands, connectivity between complementary transport modes, interoperability of systems, territorial cohesion and cross-border connectivity with EU/non-EU countries,
- Ensuring an Environmentally Sustainable transport sector,
- Providing Accessibility and Social Inclusion with respect to jobs, education and social services for the population,
- Maintaining a Safe and Secure transport system.

2.8.2 Proposed objectives and measures

Investment Pillars

In parallel with the fulfilment of the five High Level Objectives of this Plan eight Investment Pillars were defined aiming to guide the identification of measures. The pillars represent the country's vision to transport development and they define those specific areas where most attention should be focused on in order to deliver an economically efficient, safe, environmentally sustainable, accessible and connected transport sector. An additional ninth pillar was necessary to include measures linked also with the subsequent 20-year strategy forming thus the interface between the current plan and its updates and ensuring the continuity of actions. Therefore, these nine strategic pillars are the identified priority areas for transport investment and development for Greece, aiming at further improving and integrating the national transport system.

They are defined as follows:

1. Enhancing Safety, Sustainability, Efficiency and Competitiveness of Transport
2. Making PATHE an Efficient Multimodal Corridor
3. Building Stronger International Land Connectivity
4. Supporting the Tourism Sector
5. Enhancing Connectivity to the Greek Islands
6. Improving the Efficiency of Logistics Sector
7. Developing an efficient Urban and Suburban Public Transport System to support National Transport System
8. Fostering Regional Mobility and Growth
9. Exploring Further Opportunities

Measures

The ongoing upgrading of the railway network continues with a focus on the Core Corridors of the Trans-European Network (TEN-T). Projects are funded through European Funds (both Regional Development Funds and those allocated through the Connecting Europe Facility).

- Athens – Patras Railway Reconstruction: Construction of new double rail line between Kiato and Patra (sections: Diakopto - Rododafni, Rododafni - Psathopirgos, Psathopirgos - Rio, and Rio - New Port of Patra). In addition, new investments include the standardisation and electrification of the railway link Isthmos – Loutraki.
- Athens – Thessaloniki: Completion of new double, higher speed, electrified railway line between Tithorea and Domokos.
- Thessaloniki – Idomeni – North Macedonia: Upgrade of railway line Thessaloniki – Idomeni and completion of upgrading and electrification works in section Polikastro – Idomeni.
- Thessaloniki – Florina – North Macedonia: Rail network reconfiguration on existing Thessaloniki-Platy-Edessa-Florina-Neos Kafkasos line.

2.8.3 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 64 Rail projects in Greece

ID	Scenario	Type	Name	Main goal
EL1	Baseline 2030	New construction	New double high speed (160-200 km/h) railway line Tithorea - Lianokladi - Domokos (106 km) along the Athens - Thessaloniki axis, replacing the existing single line (122 km)	Increasing of North-South connections on Western Balkans corridor along the Athens-Thessaloniki axis
EL2	Baseline 2030	New construction	Construction of a railway infrastructure in section Rododafni (Km 91,5) - Psathopirgos (Km 113) of the new railway line Athens - Patras (part of Orient/East-Med Corridor)	New North-South connection on Western Balkans corridor: new railway line Athens - Patras, part of Orient/East-Med corridor
EL3	Baseline 2030	Upgrade	Electrification of existing Kiato - Rododafni railway line (71 km) (project expected to start by December 2020)	New East-West connection on Western Balkans corridor: Electrification of the existing Kiato - Rododafni railway line, part of Orient/East-Med corridor

ID	Scenario	Type	Name	Main goal
EL4	Baseline 2030	New construction	Construction of new double track Kiato - Diakopto of Athens - Patras railway line	Increasing of East-West connections on Western Balkans corridor: new double track on Kiato - Diakopto railway line, part of Orient/East-Med corridor
EL5	Baseline 2030	New construction	Construction of new double track Diakopto - Rododafni of Athens - Patras railway line	Increasing of East-West connections on Western Balkans corridor: new double track on Diakopto - Rododafni railway line, part of Orient/East-Med corridor
EL6	Project	New construction	Construction of new double railway line between Kiato and Patra (sections Rododafni - New Port of Patra) of Athens - Patras railway line	Increasing of East-West connections on Western Balkans corridor: new double track on Rododafni - New Port of Patra railway line, part of Orient/East-Med corridor
EL7	Project	New construction	Construction of new double railway line between Kiato and Patra (sections Rododafni - New Port of Patra) of Athens - Patras railway line	Increasing of East-West connections on Western Balkans corridor: new double track on Rododafni - New Port of Patra railway line, part of Orient/East-Med corridor
EL8	Baseline 2030	Upgrade	Standardisation and electrification of railway link Isthmos - Loutrak	Increasing of East-West connections on Western Balkans corridor: standardisation and electrification of the railway link Isthmos - Loutrak, part of Orient/East-Med corridor
EL9	Baseline 2030	New construction	Installation of signaling & ETCS level1 on the existing single railway line Thessaloniki-Edomeni	Increasing on Thessaloniki - Idomeni - North Macedonia new railway line
EL10	Baseline 2030	New construction	Upgrade of railway Thessaloniki - Edomeni. Polikastro - Idomeni variant section	Increasing of North-South connections on Western Balkans corridor on Polikastro - Idomeni railway section
EL11	Project	New construction	Reconfiguration of railway line Thessaloniki - Florina - North Macedonia on the existing Thessaloniki - Platy - Edessa - Florina - Neos Kafkasos railway line	Part of the upgrade (safety and capacity upgrade) of the Thessaloniki - North Makedonia line

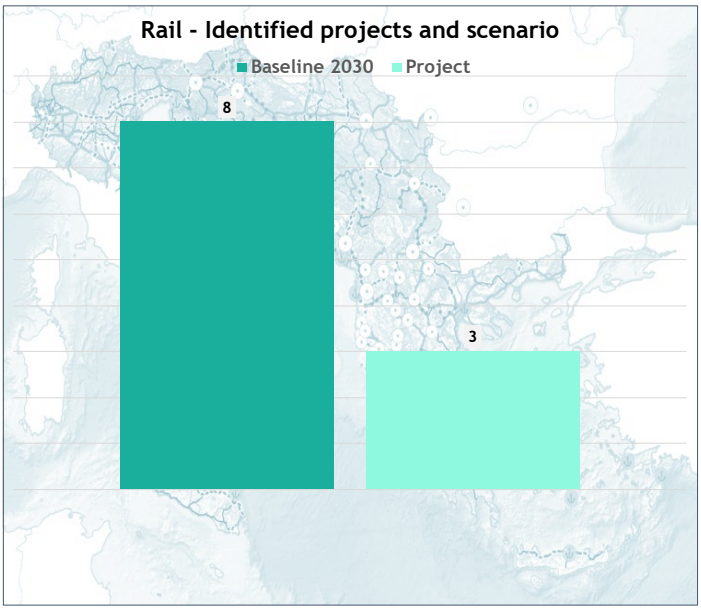

Figure 54 Rail projects by scenario, in Greece

11 rail interventions selected in Greece are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

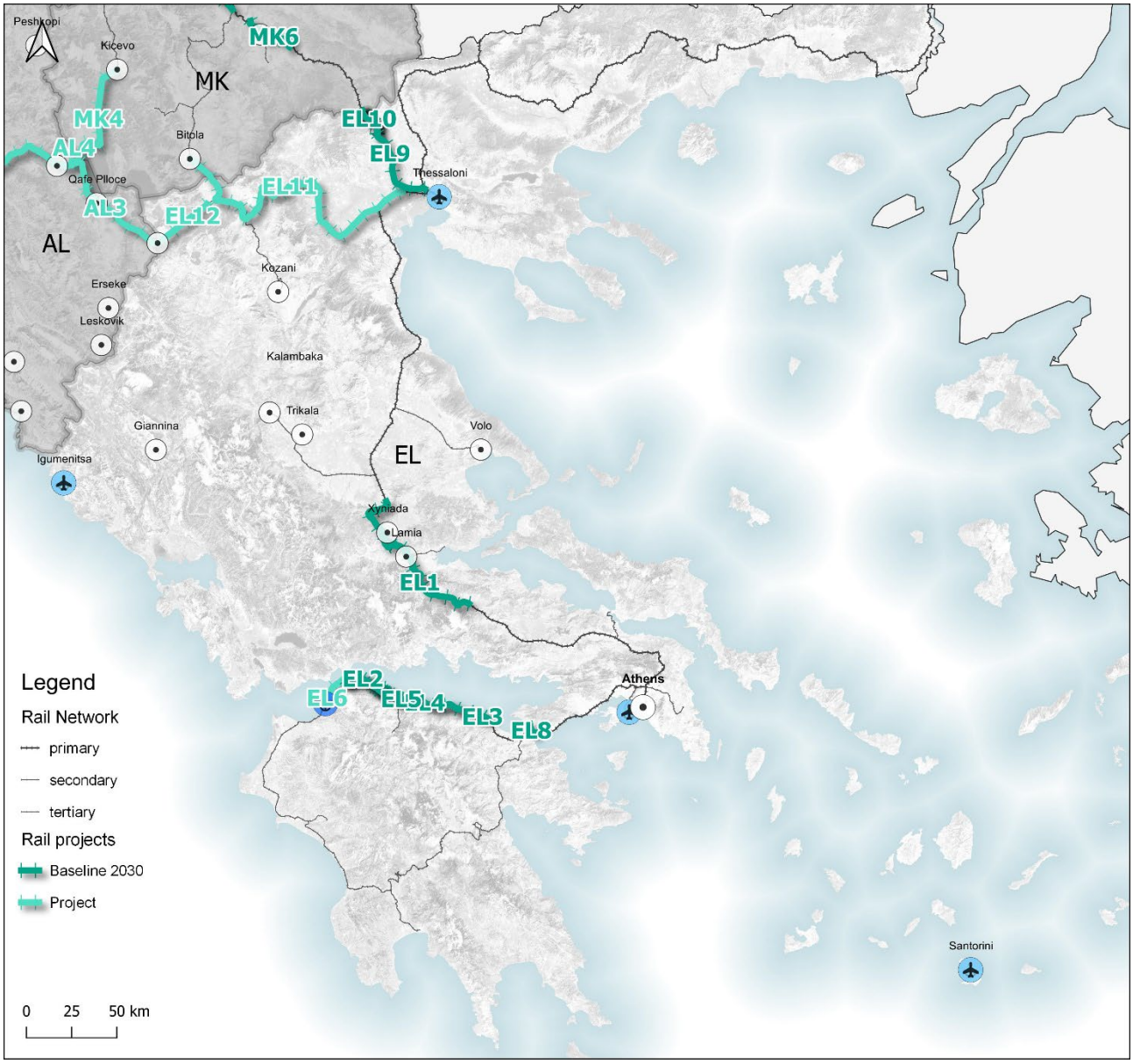

Figure 55 Map of rail project by scenario in Greece

2.9 North Macedonia

2.9.1 National Transport Strategy and Action Plan

"Draft National Transport Strategy of the Republic of Macedonia" [66] dates to December 2018. The Government incorporates into the plan the EU Guidelines, Directives/regulations with the aim of integration of the Country within the European Union.

[66] http://www.mtc.gov.mk/media/files/2019/NTS-final%20EN.pdf

The National Transport Strategy (NTS) demonstrates this ambition through the development of a sustainable transport sector which is harmonized with other strategic developments of the country, that has an intermodal infrastructure fully integrated into the European TEN-T network.

Guided by the fundamental principle that transport is a service rather than an economic good, the NTS considers the general objectives for the economic and social development of the country, bearing in mind the needs of future generations and the preservation of the environment. The strategy therefore proposes medium and long-term policy measures and activities period to address the fundamental challenge of improving the quality of transport infrastructure and operations efficiently and effectively.

Looking at relevant projects on rail freight terminals, the study for strategic multimodal nodes is carried out in 2014 according to the best international practices. Next a Feasibility Study for multimodal freight node in region of Skopje is planned along with a tender procedure for preparation of project documentation for multimodal node in Trubarevo, which will be in the frames of the EU funds-IPA2 program (see Figure 56).

Rail traffic volumes (passengers and freight) and characteristics. The Feasibility Study and Cost Benefit Analysis for Development of strategic multimodal transport nodes in the country, supported by the EU Operational Programme for Regional Development are completed in 2013/14 and recommended the existing marshalling station in Trubarevo near Skopje as optimal location for the development of Intermodal terminal. The selected Contractor will explore a technically, economically, financially, and environmentally feasible solution for developing an Inter Modal Terminal in the area of the existing railway marshalling yard at Trubarevo. The project should be developed so that provides possibility to be implemented as either a Public Private Partnership or a Concession Contract, and thereby should be developed based on sound market understanding and strict value engineering; and to prepare the necessary documentation for a grant application, including a Feasibility Study, supported by Environmental Assessments, necessary permits/approvals, and a completed application package and to develop the necessary design studies for the final design solution, incorporating relevant phases and with the delivery of the initial phase clearly outlined. The selection is ongoing.

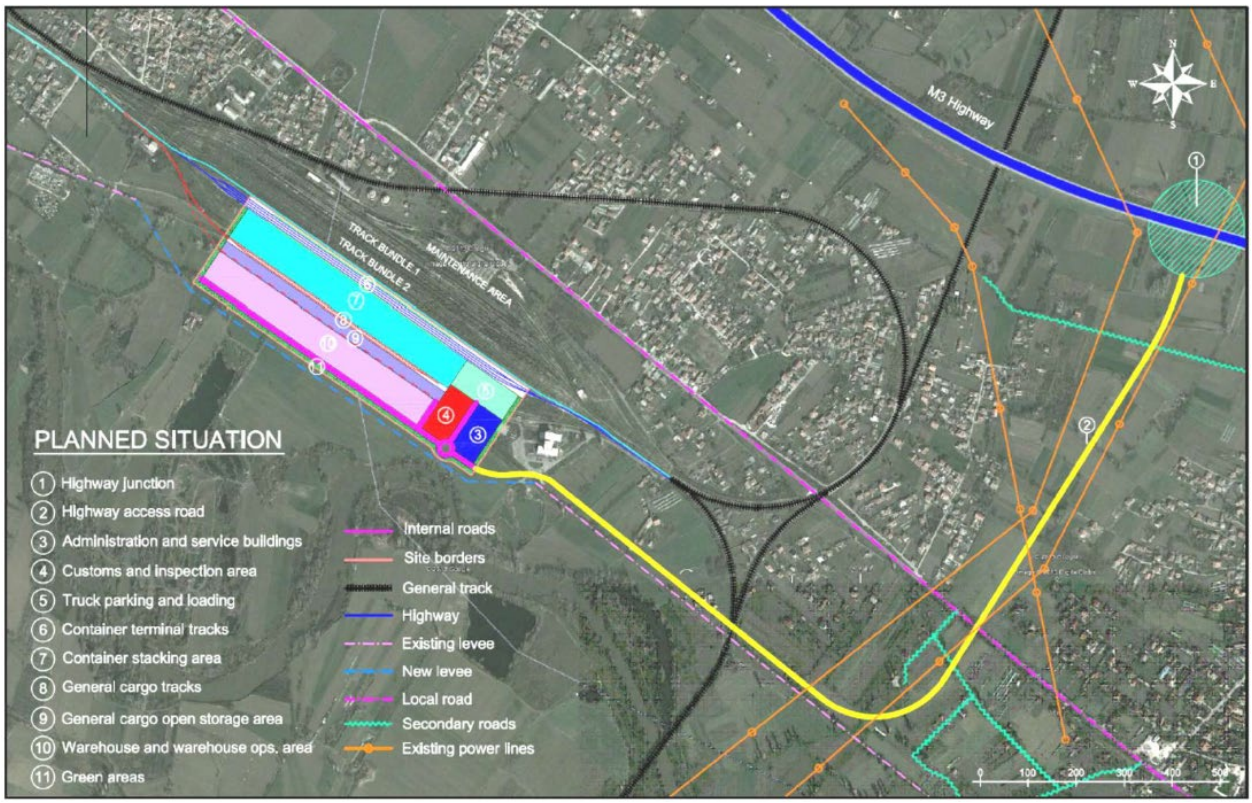

Figure 56 Planned intermodal terminal in the station Trubarevo. (Source: Draft National Transport Strategy)

2.9.2 Proposed objectives and measures

The overall objective of the National Transport Strategy, based on a comprehensive analysis of the Transport sector in the Republic of Macedonia, is to develop a harmonized transport sector that is internationally compatible and integrated in the TEN-T system, that stimulates the economic and social development of the country, preserves the environment, and secures the needs of future generations.

The project identified four **general objectives**[67]:

- GO1: Strengthen EU integration and promote regional cooperation.
- GO2: Contribute to the improvement of the economic sustainability at the national level.
- GO3: To introduce green mobility and logistic focused to environmental performance of the Transport sector.
- GO4: Establishment of reliable and safe transport system.

Each general objective is divided into three further specific objectives, reported below.

Specific Objectives

[67] European Union Framework Contract Beneficiaries 2013-Lot 2, Draft National Transport Strategy, December 2018

1.1. To complete the SEETO/TeTC Core and Comprehensive Network passing through the national territory and upgrade the existing road and rail infrastructure sections to the modern technical and operational standards.

1.2. To reduce border crossing times and procedures.

1.3. To finalise the alignment of the Macedonian transport legislation to the EU acquis.

2.1. To improve the accessibility and quality of the national transport infrastructure and transport services.

2.2. To ensure the socio-economic and financial feasibility of transport development projects & initiatives.

2.3. To improve the administrative and operational capacity of governance structures.

3.1. To develop and improve environmentally friendly and low carbon transport systems.

3.2. To stimulate modal shift.

3.3. To increase the importance of intermodal and multimodal transport in national transport policy.

4.1. To improve transportation safety.

4.2. To improve road traffic and road infrastructure safety.

4.3. To introduce IT technologies and Implementing Intelligent Transport Systems (ITS) in the transport sector.

Infrastructure measures

In accordance with the general and specific objectives, the related infrastructural interventions are proposed, divided into two clusters, hard and soft. they are clustered per transport mode and the measures relating to rail transport are shown below.

“Hard” transport policy measures related to rail transport mode:

Table 65 Infrastructure measures related to rail transport. [Source: Draft National Transport Strategy, December 2018]

N	SO	Mode	Transport infrastructure investments	Priority	Realization period
MI 2	1.2	Rail	Connecting national railway network with the core and comprehensive rail network defined by SEETO (incl. Feasibility studies and technical design)	Short to Long term	1 to 12 years
MI 4	1.2	Rail	Enhancing and improving the railway infrastructure at the existing border crossings with neighbouring countries	Mid term	6 years
MI 7	2.1/3.1	Rail	Technical improvement and modernization of existing railway infrastructure network according to EU-TSI (incl. safety parameters improvement);	Short to Mid term	2 to 6 years
MI 10	3.1	Rail/Air	Infrastructure development and improvements to mitigate the impact of the railways and airports on the surrounding environment (noise)	Mid to long term	6 to 12 years

N	SO	Mode	Transport infrastructure investments	Priority	Realization period
MI 13	3.2	Rail	Improving the freight connectivity between the freight terminal facilities, railway network and airports	Mid term	6 years
MI 16	3.3	Road/rail	Implementing railway/road projects for intermodal/multimodal transport with containers (priority action, construction of Container terminal Trubarevo –Skopje)	Short to long term	1 to 12 years
MI 17	4.1	All modes	Improving traffic safety on level and grade-separated crossings between different modes of transport	Short to Long term	1 to 12 years

"Soft" transport policy measures related to rail transport mode:

Table 66 Infrastructure "soft" measures related to rail transport. [Source: Draft National Transport Strategy, December 2018]

N	SO	Mode	Transport infrastructure related measure	Priority	Realization period
MI 23	1.2	Road/rail	Introducing monitoring of time spent on road/rail border crossings (freight/passengers)	Short to Mid term	2 to 6 years
MI 25	2.3	All modes	Involving of all relevant transport stakeholders (administration, business, universities, civil society etc.) in potential discussion on transport development	Short to Long term	1 to 12 years
MI 26	2.3	All modes	Implement infrastructure IT-based system for transport statistics and information collection	Short to Mid term	2 to 6 years
MI 27	3.2	All modes	Implement infrastructure IT-based system for transport statistics and information collection	Short term	2 years
MI 28	3.3	All modes	Support and stimulate the development of multimodal and intermodal transport	Short to Long term	1 to 12 years
MI 34	4.3	All modes	Provide conditions for introduction of Intelligent Transport Systems and intermodal transport infrastructure and services	Mid to long term	6 to 12 years

2.9.3 Overview of transport project in North Macedonia based on "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans"[68]

This work plan is a Strategic document which represents an important basis for a "common, more focused approach to regional connectivity" for the implementation of the Transport Community Treaty.

[68] "Five-year Rolling Work Plan for Development of the Indicative TEN-T Extension of the Comprehensive and Core Network in Western Balkans", Permanent Secretariat of Transport Community, April 2022

The main purpose is to ensure coordinated development of the TEN-T in the region and achieve transition to a cohesive network, while all regional partners are pursuing their own connectivity goals.

The document provides an overview of the state of play in development of the indicative extension of the TEN-T network, in term of compliance with TEN-T Standards, to the Western Balkans. The status shown is based on data from the Annual Report on the Development of the TEN-T network of the Regional Steering Committee.

Another document's section includes an overview of TEN-T development plans in the region by analysing regional plan, the top priorities for the region in terms of TEN-T network development, a list of concrete actions for Regional Partners to focus on over the next few years.

Finally, The Transport Community Permanent Secretariat has developed a Sustainable and Smart Mobility Strategy for the Western Balkans together with a corresponding GAP analysis. The purpose is also providing a roadmap for digitalisation and decarbonisation of the region's transport sector.

The main objectives identified for the region are summarized below.

Key objectives:

- Enhancing connectivity within the Western Balkans and with the European Union.
- Improving accessibility and mobility on the TEN-T Network.
- Building the transport of the future towards a smart, sustainable, green, safe and resilient TEN-T network.
- EU acquis implementation and associated policy reforms.

2.9.4 Priority projects maturity in North Macedonia

Regulation (EU) No 1315/2013 defines transport infrastructure requirements as well as the specific requirements expanded from the priorities for railway infrastructure development:

- Electrification - railways network to be electrified by 2030 (including sidings where necessary);
- Axle load: Freight lines 22.5 t axle load by 2030;
- Line speed: Freight lines must allow 100 km/h by 2030 (no speed requirement for passenger lines);
- Train length: Freight lines to allow for 740 m trains by 2030;
- Track gauge: Nominal track gauge for new railway lines 1.435 mm;
- European Railway Train Management System (ERTMS) / signalling system: Core network to be equipped with ERTMS by 2030.

Railway electrification compliance of the operational network is already 73% on the Core and 54% on the Comprehensive Network. Certain parts of the networks, mainly in Albania and North Macedonia (Corridor VIII), are still in the construction phase.

The TEN-T railways network consists of two layers: the Core and Comprehensive Networks. The total length of the Comprehensive is 3,895 and 2,602 km of the Core. It consists of three corridors (Vc, VIII and X) and seven routes.

Current projects in the region were examined and detailed in the TEN-T annual report. Based on the expected completion date of these projects, the annual report included a forecast of TEN-T compliance rate for the

year 2027. Summary tables of mature and non-mature TEN-T projects in the region are presented here, with details on location, cost and expected completion times.

Table 67 Railway Transport Project in North Macedonia Based on TEN-T Extension of the Comprehensive and Core Network in Western Balkans – Mature priority projects.

Corridor / Route / Node	TEN-T Network	Regional Partner	Project Name	Project cost (M€)	Expected Completion
ECONOMIC AND INVESTMENT PLAN FOR WESTERN BALKANS					
FLAGSHIP 1 - CONNECTING EAST TO WEST					
Railway projects					
Corridor X	Core	MKD	Construction of Joint Railway Border Crossing Station (JRBS) and access road at Tabanovce between Republic of North Macedonia and Republic of Serbia	5.5	2024
OTHER PRIORITY PROJECTS					
Railway projects					
Corridor VIII	Comprehensive	MKD	Construction works of the railway section along Corridor VIII Kicevo – Albanian Border	426	2030
Corridor X	Core	MKD	Construction of new alignment of railway section along Corridor X Dracevo – Veles	550	2027[23]
Corridor X	Core	MKD	Construction of railway section along Corridor X Kumanovo – Deljadrovce	50	2026[23]

2.9.5 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 68 Rail projects in North Macedonia

ID	Scenario	Type	Name	Main goal
MK1	Baseline 2030	New construction	Construction of a new railway section Kumanovo - Beljakovce (30.8 km) of the rail Corridor VIII (Orient/East-Med Corridor) Kumanovo - Deve Bair	Increasing of East-West connections along Orient/East-Med Corridor: Construction of Rail Corridor VIII, from Kumanovo to Deve Bair

ID	Scenario	Type	Name	Main goal
MK2	Baseline 2030	New construction	Construction of a new railway section Beljakovce - Kriva Palanka (34 km) of the rail Corridor VIII (Orient/East-Med Corridor) Kumanovo - Deve Bair	Increasing of East-West connections along Orient/East-Med Corridor: Construction of Rail Corridor VIII, from Kumanovo to Deve Bair
MK3	Baseline 2030	New construction	Construction of Rail Corridor VIII, section Kriva Palanka-border with Bulgaria	Construction of Rail Corridor VIII, from Kumanovo to Deve Bair: section Kriva Palanka – Deve Bair – Border with Bulgaria
MK4	Project	New construction	Orient/East-Med Corridor VIII: Construction of Rail Corridor VIII,Kicevo to the border with Albania	Orient/East-Med Corridor VIII: Construction of Rail Corridor VIII,Kicevo to the border with Albania
MK5	Project	New construction	Construction of a new railway interconnection North Macedonia - Serbia Rail, Tabanovce Joint Border Station (Corridor X)	North Macedonia – Serbia Rail Interconnection, Tabanovce Joint Border Station
MK6	Baseline 2030	Upgrade	Project for track renewal works on the section Nogaevci - Negotino (Corridor X)	Increasing of East-West connections along Corridor X: track renewal works on Nogaevci-Negotino railway section
MK7	Baseline 2030	New construction	Construction of new alignment of railway section along Corridor X Dracevo – Veles	Increasing of East-West connections along Corridor X: track renewal works on Dracevo - Veles railway section

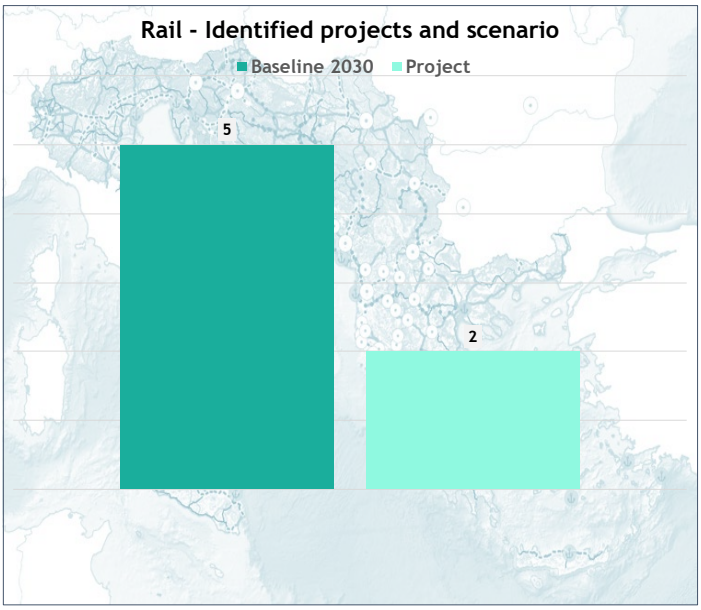

Figure 57 Rail projects by scenario, in North Macedonia

7 rail interventions selected in North Macedonia are now represented in a map in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail project classified by scenario.

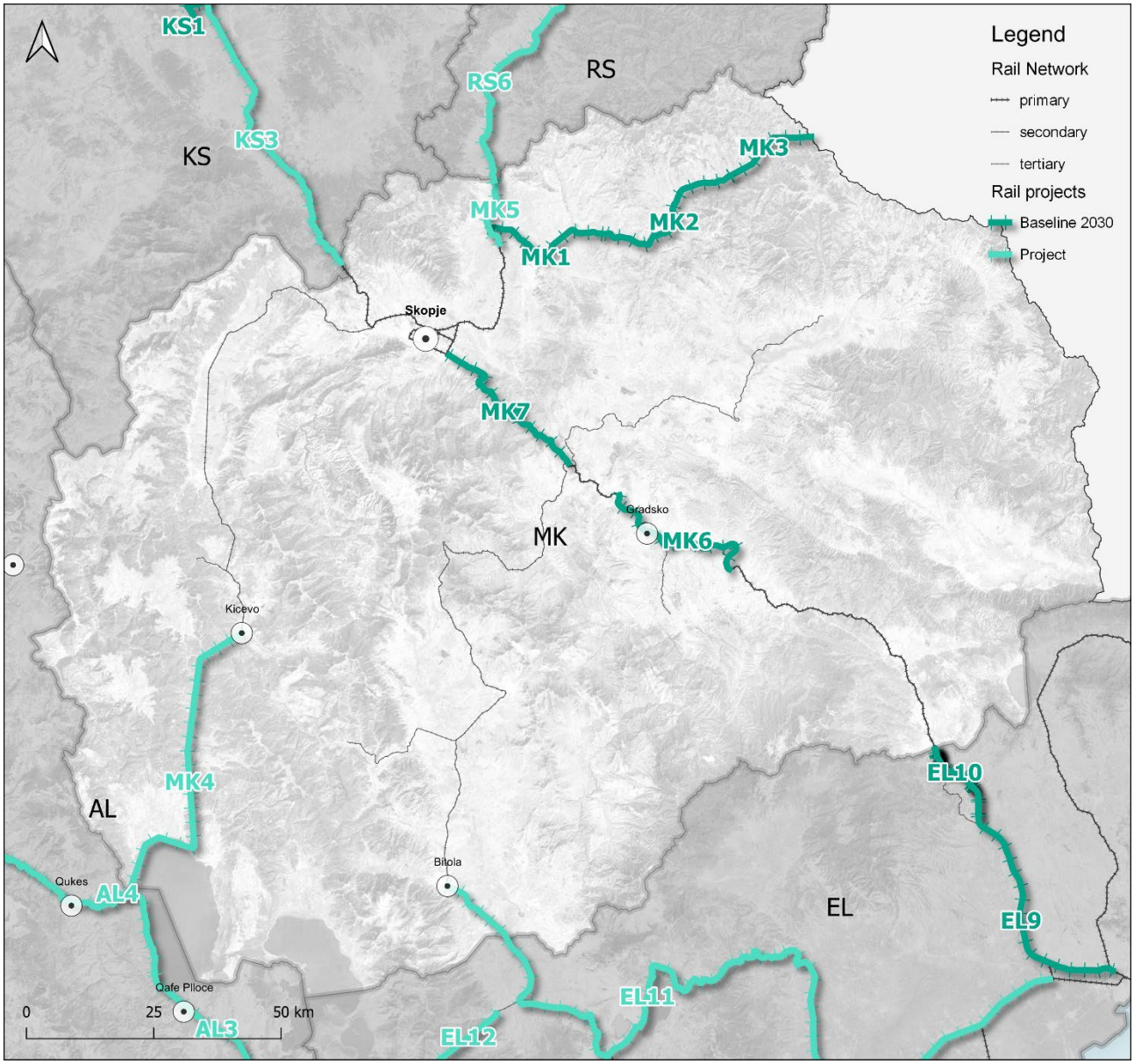

Figure 58 Map of rail project by scenario in North Macedonia

2.10 Italy

2.10.1 National Transport Strategy and Action Plan

The "National Recovery and Resilience Plan" (NRRP)[69] for Italy consists of 132 investments and 58 reforms. They will be supported by € 68.9 billion in grants and €122.6 billion in loans; 37.5% of the plan will support climate objectives and 25.1% of the plan will support the digital transition. All reforms and investments must

[69] PIANO NAZIONALE DI RIPRESA E RESILIENZA - NEXT GENERATION EU REPORT - https://italiadomani.gov.it/it/home.html

be implemented within a tight time frame, as the Regulation on the Recovery and Resilience Facility foresees, they have to be completed by August 2026.

Italy's recovery and resilience plan supports the green transition with key investments in energy efficiency in residential and public buildings (€ 15.3 billion), **sustainable mobility (€ 34 billion)** and development of renewable energies and the circular economy and improvement in waste and water management (€ 11.2 billion). Those investments are accompanied by important reforms aimed at improving the efficiency in the use and management of water resources and local public services, increasing recycling rate, deploying of charging points for electric vehicles, increasing competition in the electric market, improving the functioning of concessions in Italian ports, or simplifying the various legal frameworks for the acceleration of energy efficiency interventions and **transport infrastructure projects**.

The components of the plan contribute to the seven European "flagship programs"[70], represented by some key principles:

1) Power up.

2) Renovate.

3) Recharge and refuel.

4) Connect.

5) Modernise.

6) Scale-up.

7) Reskill and upskill.

2.10.2 Proposed objectives and measures

The Guidelines drawn up by the European Commission for the elaboration of the NRRP identify the Components such as the areas in which to aggregate investment projects and the reform of the Plans themselves. Each component reflects reforms and investment priorities in a specific sector or area of intervention, related activities and topics, aimed at addressing specific challenges and forming a coherent package of complementary measures. The components have a sufficient degree of detail to highlight the interconnections between the various measures proposed in them.

The Plan is divided into sixteen Components, grouped into six Missions, two of which are also related to transportation system in Italy.

Mission 2, Green Revolution and Ecological Transition, which consists of four following Components:

- C1. Sustainable farming and circular economy.
- C2. Renewable energy, hydrogen, smart grid and sustainable mobility.
- C3. Energy efficiency and building renovation.
- C4. Protection of the territory and the water resource.

[70] European Commission, Annual Sustainable Growth Strategy, 17 September 2020.

Mission 3, Infrastructure for Sustainable Mobility, divided into two Components:

- C1. Investments in the Railway Network.
- C2. Intermodality and Integrated Logistics.

Mission 2: Green Revolution and Ecological Transition

Regarding Mission 2, the resources dedicated by the plan to Mission 2 are 59,46 billion euro, the majority of which is destined to component number two.

M2C2. Renewable energy, hydrogen, smart grid and sustainable mobility includes the following general objectives:

- 1.Increase in the share of energy produced from renewable energy sources in the system, in line with European and national decarbonization objectives.
- 2.Upgrading and digitization of network infrastructures.
- 3.Promotion of the production, distribution and final use of hydrogen, in line with national community strategies
- 4.Development of more sustainable local transport, not only for the purpose of decarbonization but also as a lever for the overall improvement of the quality of life (reduction of air and noise pollution, reduction of congestion and integration of new services).
- 5.Development of international industrial and research and development leadership in the main transition chains.

Among all the planned investment, let's analyze those related to the rail transport.

M2C2 Investment 3.4: Experimentation of hydrogen fueling for rail transport.

The intervention involves the conversion to hydrogen of the non-electrified railway lines in the regions characterized by high traffic in terms of passengers with a strong use of diesel trains such as Lombardy, Puglia, Sicily, Abruzzo, Calabria, Umbria and Basilicata. The most advanced feasibility projects in Valcamonica and Salento they provide for experimentation in an integrated way of production and distribution and acquired hydrogen trains. In terms of infrastructure, priority will be given to facilities refueling to areas with the possibility of synergies with refueling stations for trucks for a long-time radius, to increase the use and demand of hydrogen and to reduce its production costs. The project includes the production of green hydrogen near fueling stations, through development of the entire hydrogen production, use and storage system.

M2C2 Investment 4.4: Renewal of Bus Fleets, Green Trains

The measure includes three intervention lines:

- Renewal of the bus fleet with low environmental impact vehicles
- Renewal of the train fleet for regional and intercity transport with alternative propulsion vehicles
- Renewal of the vehicle fleet of the Fire Brigade

The renewal of the fleet with low environmental impact buses takes place by accelerating the implementation of the Plan National Strategic for Sustainable Mobility and provides for the progressive renewal of buses for local public transport and the creation of dedicated charging infrastructures. In particular, it is expected the purchase by 2026 of approximately 3,360 low-emission buses. About a third of the resources are earmarked to the main Italian cities.

The investment for the renewal of part of the fleet of trains for regional transport with propulsion vehicles alternative will make it possible to reduce the average age of the regional rolling stock through the purchase of units an electric and hydrogen propulsion. The measure provides for the purchase of 53 trains to replace a number equivalent of old units by 2026. To these must be added 100 newly designed carriages developed with recyclable materials and coated with photovoltaic panels.

Finally, the modernization of the fire brigade vehicle fleet will be financed, specifically with the introduction of approximately 3,600 electric vehicles and gas-powered vehicles for institutional services and the introduction of 200 new vehicles with hybrid electric-endothermic power supply in airports.

Mission 3: Infrastructure for Sustainable Mobility

The mission aims to make the most modern, digital and sustainable infrastructure system by 2026, able to respond to the challenge of decarbonization indicated by the European Union with strategies related to the European Green Deal (in particular the "strategy for smart and sustainable mobility", published on 9 December 2020) and to achieve the sustainable development goals identified by the agenda 2030 of the United Nations.

The resources dedicated by the plan to Mission 3 are 25,4 billion euro, the majority of which is destined to component number one, among all the planned investment, let's analyze those related to the rail transport.

M3C1. Investments in the Railway Network

The component 1 of mission 3 is related to investment in the railway network and includes the following general objectives:

- Decarbonisation and reduction of emissions through the transfer of passenger and freight traffic from road to rail
- Increased connectivity and territorial cohesion by reducing travel times
- Digitization of transport networks
- Increased competitiveness of production systems, especially in the south, through the improvement of railway connections

The proposals for infrastructural and technological interventions in the railway sector consist in:

- Development of high speed / capacity and the speeding up of the railway network for passengers and goods
- Completion of the TEN-T railway corridors
- Completion of the pass sections
- Strengthening of nodes, railway lines and regional networks
- Reduction of the North-South infrastructure gap

The planned interventions will guarantee:

- Greater integration between the national railway infrastructure and the regional railways
- Expansion and integration of rail / road services
- Homogenization of safety standards
- New passenger and freight connections with airports, ports and terminals
- Optimization of the offer with integration between High-Speed services and local public transport

Regarding Mission 3, the resources dedicated by the plan to Mission 2 are 24,77 billion euro, the majority of which is destined to component number one.

Among all the planned investment, we present below an overview of the most important ones.

M3C1 Investment 1.1: High-speed rail links to the South for passengers and freights

The proposed investments in the High-Speed network will allow the development of railway services long-distance passengers and goods, in line with the structure of the Italian territory and with connectivity needs of the southern regions. The proposed interventions will be integrated with the systems transport networks, which play a primary role in supporting the demand for local mobility feeding the high-speed connection system at national level. In particular, the interventions on the High-Speed network envisaged in the South will make it possible to reduce times distance and to increase the capacity of the following sections:

- Napoli-Bari
- Palermo-Catania-Messina
- Salerno-Reggio Calabria

M3C1 Investment 1.2: High Speed Lines in the North linking to Europe.

The interventions proposed for the High-Speed network in the North will make it possible to enhance the services of rail transport, according to an intermodal logic and establishing effective connections with the goods for the existing port system. In particular, to increase rail traffic and ensure transfer modal, in case of interference, from road to rail, even in cross-border trade, is necessary to enhance the capacity of railway connections in Northern Italy and with the rest of Europe, through the following actions:

- Increase in capacity and regularity of traffic on the railway line Brescia-Verona-Vicenza.
- Increase speed on Genova-Milano and Genova-Torino, increase in capacity on the Milan railway junction.
- Upgrading and development of the Verona-Brennero railway line.

M3C1 Investment 1.4: Development of the European Rail Transport Management System (ERTMS)

The coverage of the European rail transport management system, which allows interoperability between European railway networks and an improvement in the performance of railway systems in terms of safety, capacity and maintenance, is currently limited to a few railway sections. Investment sets the goal of updating the existing safety and signaling systems, thus guaranteeing, with ahead of the deadlines set by the EU, full interoperability with the European rail networks e optimization of network capacity and performance.

M3C1 Investment 1.5: Strengthening of metropolitan railway nodes and key national connections.

As envisaged by the national strategy "Italia Veloce", the interventions on the nodes aim to enhance "Metropolitan" or "extra-urban" connections, in order to guarantee capillary services at high frequencies, thus supporting the demand for mobility expressed by large metropolitan cities and urban areas medium size. Furthermore, these interventions will guarantee medium-haul travel services, in support of the demand for mobility expressed by large urban areas, with levels of speed and comfort competitive compared to the use of private cars, also thanks to the creation of "fast regional" connections.

Finally, they will allow the improvement of accessibility and interchange between railway stations and other mass rapid transit mobility systems.

M3C1 Investment 1.7: Upgrade, Electrification and Increase the Resilience of Railways in the South

Several railway lines in Southern Italy have bottlenecks in their connection with the rest of the railway network and in key traffic nodes and consequently need to be electrified and modernized in terms of service quality.

In this sense, specific interventions are envisaged to strengthen the railway network in various critical points of the Southern Italy (for example in Molise, Basilicata, etc.), to carry out the interventions of the last railway mile for the connection of ports (Taranto and Augusta) and airports (Salerno, Olbia, Alghero, Trapani and Brindisi), to increase the competitiveness and connectivity of the intermodal logistics system and to improve railway accessibility to various urban areas of the South.

M3C2: Intermodality and Integrated Logistics

The reform interventions are linked to improving the competitiveness, capacity and productivity of ports, with a view to greater environmental sustainability of the mobility of passengers and goods by sea. Investments are also planned in the digitization of airports and the logistics chain, the latter accompanied by reforms aimed at strengthening strategic planning, at creating the one-stop shop for controls, to implement an interoperable digital platform and to carry out a review of the legislation on port concessions.

The component 2 of mission 3 is related to investment in inter-modality and integrated logistics and includes the following general objectives:

- Enhancement of the competitiveness of the Italian port system in a dimension of sustainability and development of intermodal infrastructures on the basis of integrated planning.
- Improvement of environmental sustainability, resilience to climate change and energy efficiency of ports.
- Digitization of the logistics chain and air traffic.
- Reduction of emissions related to the handling of freights.

The digitization of logistics systems, including airport ones, will play an important role in the relaunch of these sectors, thanks to the use of innovative technological solutions aimed at making the e system more efficient also reduce the environmental impact. It is necessary to conceive the logistical infrastructures as a whole of nodes and networks, adequately interconnected, which allow movement loads as smooth as possible and free of "bottlenecks". This is only possible through effective digitization work to ensure:

- "Just in sequence" procedures
- “Industrialization” of the transport chain between airports, seaports, dry ports
- “Modularity” and standardization necessary to manage large numbers of goods unloaded in ports.

The digital revolution and the increase in productivity related to it will be pursued through a significant investment to bring broadband and 5G to the main nodes of the logistics chain. The intervention is therefore transversely connected with the M1C2 digitization mission it contains interventions aimed at spreading broadband and 5G on the white and grey areas of the territory.

2.10.3 Summary of Rail Transport Projects

Considering the analysis of the current transport system (the analysis carried out in the first paragraph), the main existing strategic documents for the area in terms of infrastructure and mobility development and the results of the analysis of existing National and international Strategic Plans presented in the previous paragraph of the volume, are now defined the most relevant rail projects classified with respect to the state of progress and the main objective. Following list of selected interventions also constitutes a geographical database.

The table below includes the rail infrastructural projects identified in the country and characterized by type of project (upgrade or new construction), main goal of the intervention and the belonging scenario (baseline 2030/2040, or project). The Baseline scenario has been defined by selecting the main ongoing and planned projects in the Region with a national/regional relevance, and very mature projects whose implementation is already planned and financed. Project scenario describes interventions which are included in a plan/program/strategy but still not financed or not entirely financed.

Table 69 Rail projects in Italy

ID	Scenario	Type	Name	Main goal
IT1	Baseline 2040	New construction	Construction of Brenner Base Tunnel	New connection in North-South axis along Scandinavia-Mediterranean Corridor: cross-border project linking Austria and Italy
IT4	Baseline 2030	Upgrade	Increase speed on Milano - Genova (lot 1)	Faster connection in North-South axis along Mediterranean Corridor: Milano Rogoredo - Tortona section
IT5	Baseline 2030	Upgrade	Increase speed on Bologna - Rimini railway section	Faster North-South connections along Baltic - Adriatic TEN Corridor: Bologna - Rimini section
IT6	Baseline 2030	Upgrade	Increase speed on Rimini - Ancona railway section	Faster North-South connections along Baltic - Adriatic TEN Corridor: Rimini - Ancona section
IT7	Baseline 2030	Upgrade	Increase speed on Pescara - Termoli - Foggia - Brindisi railway section	Faster North-South connections along Baltic - Adriatic TEN Corridor: Pescara - Brindisi section
IT8	Baseline 2030	New construction	Double track upgrade of Termoli - Lesina railway section	Increasing of North-South connections along Baltic - Adriatic TEN Corridor: doubling of the railway line Termoli - Lesina
IT9	Baseline 2030	New construction	High speed rail connection Naples - Cancello - Frasso Telesino	Faster East-West connections along Scandinavia-Mediterranean TEN Corridor: Napoli - Cancello - Frasso Telesino section

ID	Scenario	Type	Name	Main goal
IT10	Baseline 2030	Upgrade	High speed rail connection Turin - Milan - Venice: Brescia - Verona section	Faster connection in East-West axis along Mediterranean Corridor: Brescia - Verona section
IT11	Baseline 2030	New construction	High speed rail connection Turin - Milan - Venice: Verona - Padova section	Faster connection in East-West axis along Mediterranean Corridor: Verona - Padova section
IT12	Baseline 2030	New construction	High speed rail connection Salerno - Reggio Calabria (lot 1): Battipaglia - Praja section	Increasing of North-South connections across the Region in section between Salerno - Reggio Calabria
IT13	Baseline 2030	Upgrade	Increase speed on Catania - Siracusa railway line	Faster connection in North-South axis along Scandinavia-Mediterranean Corridor: Catania - Siracusa section
IT14	Baseline 2030	New construction	Increase speed on Palermo - Catania railway line and construction of double track Bicocca - Catenanuova	Faster connection in East-West axis along Scandinavia - Mediterranean Corridor: Palermo - Catania section
IT15	Baseline 2030	New construction	Construction of double track Bari S.Andrea - Bitetto	Increasing of North-South connections along Scandinavia-Mediterranean TEN Corridor: doubling of the railway line on Bari S.Andrea - Bitetto section
IT16	Baseline 2030	New construction	Construction of double track Fiumetorto - Cefalù - Castelbuono	Increasing of East-West connections along Scandinavia-Mediterranean TEN Corridor: doubling of the railway line on Fiumetorto - Castelbuono section
IT17	Baseline 2030	Upgrade	Construction of Pescara - Scafa railway section	Increasing of East-West connections across the Region in section between Pescara - Scafa
IT18	Project	New construction	High speed rail connection Salerno - Reggio Calabria (lots 2-3-4): Praja - Tarsia, Tarsia - Cosenza, Cosenza - Lamezia Terme sections	Increasing of North-South connections across the Region in section between Salerno - Reggio Calabria
IT19	Baseline 2030	Upgrade	Electrification of Lamezia - Catanzaro - Sibari railway line	Faster connections across the Region: electrification of Lamezia - Sibari
IT20	Baseline 2030	Upgrade	Upgrade and speeding up of Venice Mestre - Trieste railway line	Faster connection in East-West axis along Baltic - Adriatic TEN Corridor: Mestre - Trieste section
IT21	Baseline 2030	New construction	4 traks upgrade of railway section Rho - Parabiago (lot 1)	New connection along Mediterranean Corridor: Rho - Parabiago section
IT22	Baseline 2030	Upgrade	Upgrade of regional railway line in Saletti industrial area	Baltic - Adriatic TEN Corridor, Saletti industrial area: Regional railway upgrading and logistic hub of freight interchange
IT23	Baseline 2030	Upgrade	Accessibility improvement by rail in the port of Ortona	Baltic - Adriatic TEN Corridor, accessibility improvement by rail to the Port of Ortona

ID	Scenario	Type	Name	Main goal
IT24	Baseline 2030	Upgrade	Improve connectivity to the High-speed railway network through diagonal lines. Modernitation on Taranto-Metaponto-Potenza-Battipaglia, Potenza-Metaponto section.	Increasing of East-West connections across the Region in section between Taranto - Battipaglia
IT25	Baseline 2030	Upgrade	Upgrade of infrastructure of Bari - Bitritto railway line	Faster connections across the Region: upgrading of Bari - Bitritto
IT26	Baseline 2030	New construction	Doubling of the railway line on Bari - Barletta: Andria - Barletta section	Faster connections across the Region: doubling of the railway line on Andria - Barletta section
IT27	Baseline 2030	Upgrade	Electrification of Barletta - Canosa railway section	Faster connections across the Region: electrification of Barletta - Canosa
IT28	Baseline 2030	Upgrade	Modernization of railway line Potenza - Foggia	Faster connections across the Region: upgrading of Potenza - Foggia
IT29	Baseline 2030	New construction	Accessibility improvement by rail in the port of Taranto	Scandinavia-Mediterranean TEN Corridor, accessibility improvement by rail to the Port of Taranto
IT30	Baseline 2030	Upgrade	Electrification of rail corridor Parma - Suzzara - Poggio Rusco	Faster connections across the Region: electrification of Parma - Rusco
IT31	Baseline 2030	Upgrade	Infrastructural and technological projects of Udine - Cividale railway line	Faster connections across the Region: upgrading of Udine-Cividale
IT32	Baseline 2030	Upgrade	Accessibility improvement by rail in the port of Trieste	Baltic - Adriatic, Mediterranean TEN Corridor, accessibility improvement by rail to the Port of Trieste
IT33	Baseline 2030	Upgrade	Electrification of railway line (Rome) Venafro - Campobasso - Termoli	Faster connections across the Region: electrification of Venafro - Termoli
IT34	Baseline 2030	Upgrade	Electrification of railway section Lugo station - Lugo Terminal junction	Baltic - Adriatic, Mediterranean TEN Corridor, electrification of rail section Lugo Station - Lugo Terminal
IT35	Baseline 2030	Upgrade	Upgrade and modernization of regional railway section Bari - Gravina, Maglie - Otranto and Bari - Matera	Increasing of East-West connections across the Region in section between Bari - Matera, Bari - Gravina, Maglie - Otranto
IT36	Baseline 2030	New construction	Accessibility improvement by rail in the port of Venice	Baltic - Adriatic, Mediterranean TEN Corridor, accessibility improvement by rail to the Port of Venice
IT37	Baseline 2030	Upgrade	Accessibility improvement by rail in the port of Venice	Baltic - Adriatic, Mediterranean TEN Corridor, accessibility improvement by rail to the Port of Venice
IT38	Baseline 2030	Upgrade	Upgrade of railway linea Misterbianco - Paternò	Scandinavia-Mediterranean TEN Corridor, improvement of "Circumetnea" railway line

ID	Scenario	Type	Name	Main goal
IT39	Baseline 2030	Upgrade	Standardisation on european goals of railway line Circumetnea	Scandinavia-Mediterranean TEN Corridor, upgrade to TEN-T standards of "Circumetnea" railway line
IT40	Baseline 2030	Upgrade	Electrification of railway line Palermo - Agrigento - Porto Empedocle	Increasing of North-South connections across the Region in section Palermo - Porto Empedocle
IT41	Baseline 2030	Upgrade	Intermodality and accessibility of Trapani Birgi	Increasing of North-South connections across the Region in section Trapani - Birgi
IT42	Baseline 2030	Upgrade	Construction of a new connection and bypass in the port of Augusta	Scandinavia-Mediterranean TEN Corridor, accessibility improvement by rail to the Port of Augusta
IT43	Baseline 2030	Upgrade	Strengthening of Calabria regional lines. Rosarno-S. Ferdinando line: upgrading of the equipment of the Rosarno and San Ferdinando lines for connection to Gioia Tauro.	Faster North-South connections along Scandinavia-Mediterranean TEN Corridor: Calabria Region
IT44	Baseline 2030	Upgrade	Ugrade and modernisation of the railway line Cosenza - Catanzaro	Increasing of North-South connections across the Region in section Cosenza - Catanzaro
IT45	Baseline 2030	New construction	Construction of a new railway line Potenza Santa Maria - San Carlo Hospital	Faster connections across the Region: new railway line Potenza Santa Maria - Ospedale San Carlo
IT46	Baseline 2030	New construction	Completion of railway line Ferrandina - Matera	Increasing of North-South connections across the Region: section Matera - Ferrandina
IT47	Baseline 2030	Upgrade	Increase speed on Orte - Falconara railway line	Faster East-West connections across the Region: section Orte - Falconara
IT48	Baseline 2030	Upgrade	Upgrade and modernization of regional railway line Terni - Sansepolcro	Faster North-South connections across the Region: section Terni - Sansepolcro
IT51	Baseline 2030	New construction	Construction of a new railway line to the Noth pier of the port of Ortona	Accessibility rail improvement to the port
IT53	Baseline 2030	New construction	Construction of a new Passo Corese - Rieti railway line	Increasing of North-South connections across Abruzzo Region
IT54	Project	New construction	Construction of a new connection for passengers (SEVEL)	Increasing of urban railway service
IT55	Baseline 2030	New construction	Construction of a new railway connection to Santa Maria delle Grazie Hospital (Bari - Matera railway line)	Increasing of railway connection in Matera node
IT58	Project	Upgrade	Upgrade of the metropolitan area of Potenza (Ferrovie Appulo Lucane)	Increasing of urban railway service
IT59	Project	New construction	Construction of the new metropolitan railway service of Matera	Increasing of urban railway service

ID	Scenario	Type	Name	Main goal
IT60	Baseline 2030	New construction	Construction of the 2nd track of Albairate - Abbiategrasso railway line	Faster East-West connections across the Region: section Albairate - Abbiategrasso
IT61	Baseline 2030	New construction	Construction of the 2nd track of Codogno - Cremona - Mantova (Iphase)	Faster East-West connections across the Region: section Codogno - Mantova
IT62	Baseline 2030	New construction	Construction of a new Trento bypass (priority lot Verona - Brennero)	Increasing of North-South connections along Scandinavia-Mediterranean TEN Corridor: Trento railway bypass

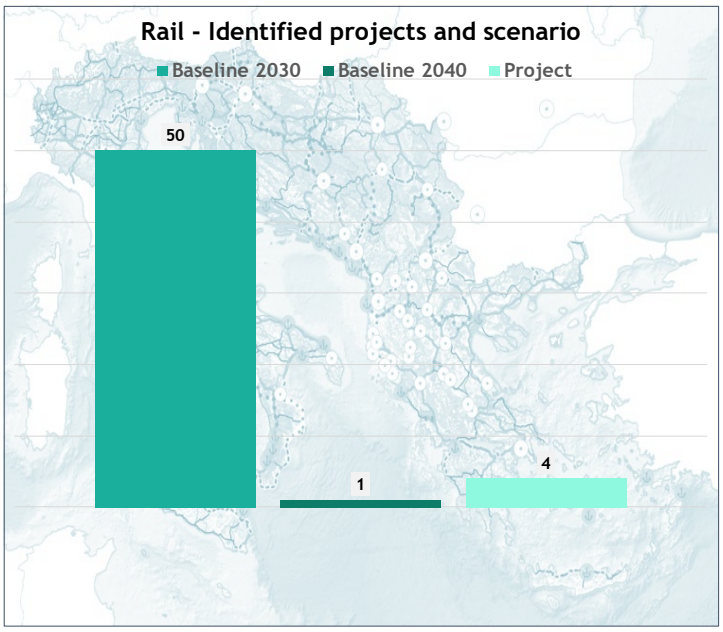

Figure 59 Rail projects by scenario, in Italy

55 rail interventions selected in Italy are now represented in four maps in which is possible to recognize functionally classified current rail network (primary, secondary, tertiary) and rail projects classified by scenario.

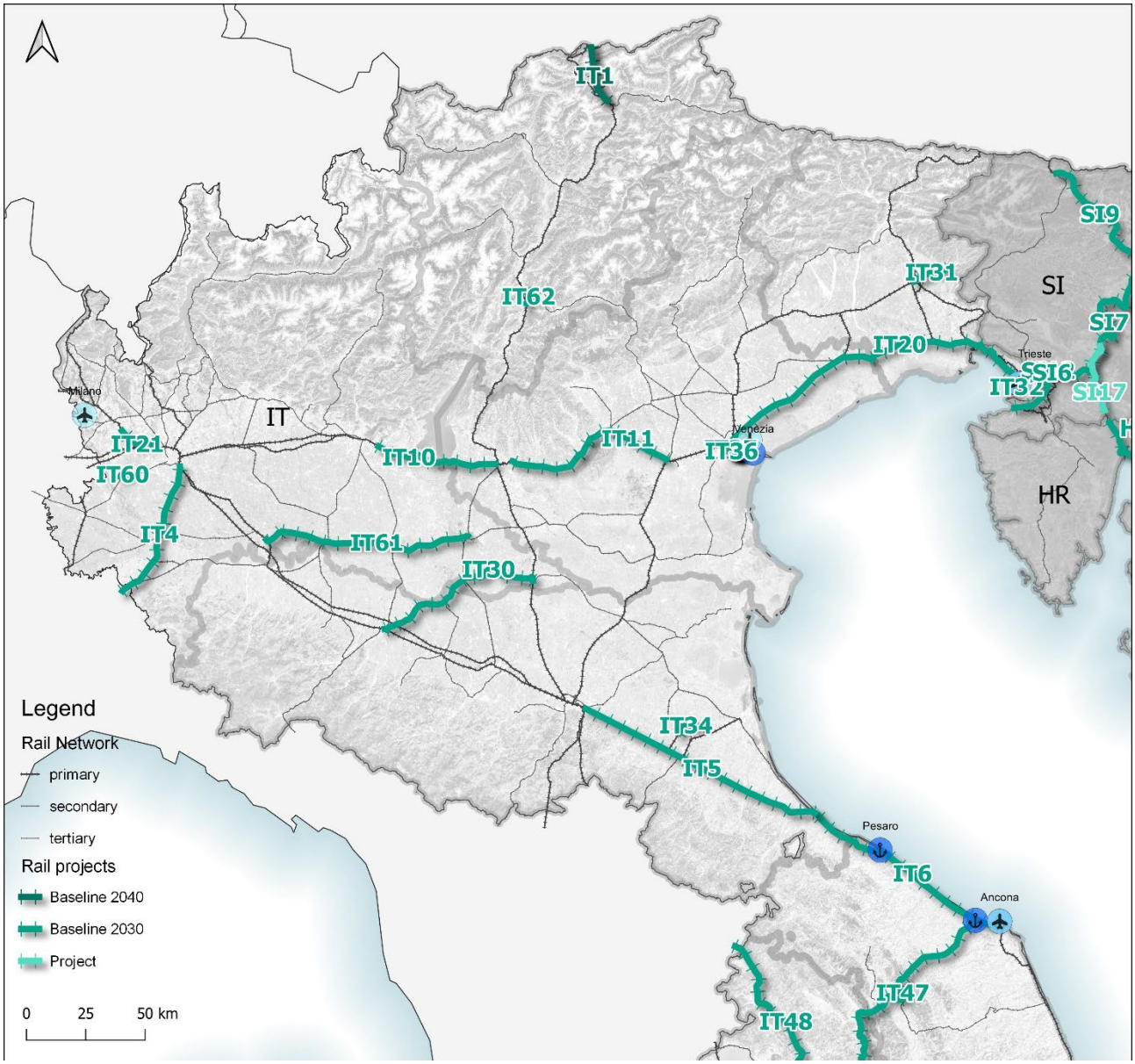

Figure 60 Map of rail project by scenario in Italy – Northern area.

Figure 61 Map of rail project by scenario in Italy – Central-southern area.

Figure 62 Map of rail project by scenario in Italy – Southern area.

Figure 63 Map of rail project by scenario in Italy – Southern area and islands.

2.11 Summary

After analyzing the existing projects for each country, this paragraph presents an overview of the entire EUSAIR region. In the map below are summarized all rail interventions distinguished by scenario.

Figure 64 Rail Project interventions

The following figure shows all identified projects belonging to Baseline or Project scenario for all countries.

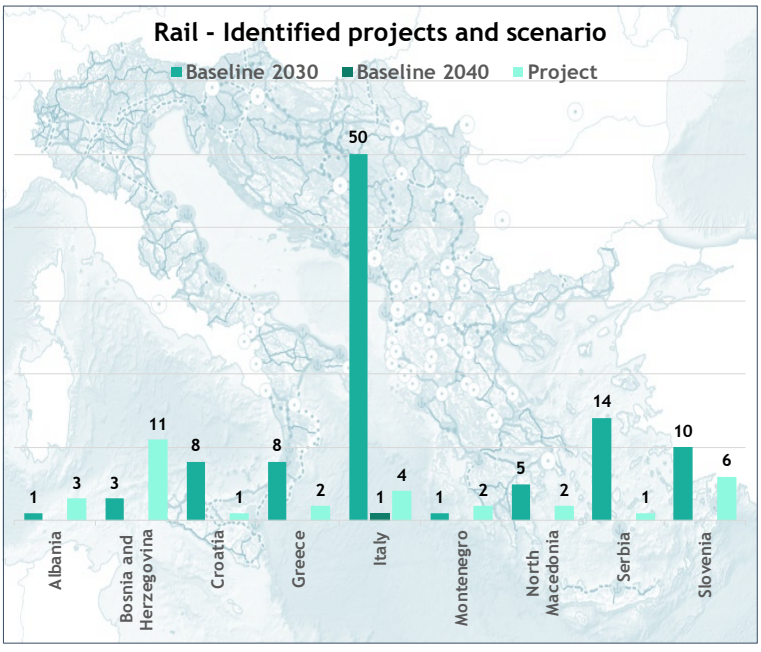

Figure 65 Rail projects by scenario, for States

Considering only the "Project" scenario, the identified rail interventions are 33. These have been associated also to a specific rail corridor, if possible.

The following table shows all rail interventions belonging to the Project scenario, described by typology, level of advancement, country of belonging and identified on the basis of the corridor to which they belong (indicated in the last column as "Node").

Table 70 Rail interventions in EUSAIR region – "Project" scenario

ID	Object	Level	Country	Project	Node
AL2	New construction	Planned	Albania	Rehabilitation of Vora/Vorë - Han i Hotit railway line	
AL3	New construction	Planned	Albania	Construction of a new railway line Pogradec - Korçë border to Greece (Krystallopigi)	Corridor VIII
AL4	New construction	Planned	Albania	Rehabilitation of Durrës - Pogradec - Lin railway line and construction for a new railway line Lin - border to North Macedonia (part of rail Corridor VIII)	Mediterranean Corridor (Rail CVIII)
BA1	New construction	Planned	Bosnia and Herzegovina	Construction of a new railway line BanjaLukaPrijedor - Novi and Grad - Dobrljin (Route 9a - parallel to Corridor X)	Route 9a
BA10	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation of Šamac - Doboj section (Corridor Vc)	Corridor Vc
BA11	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation (2 tracks) of Doboj - Maglaj section (Corridor Vc)	Corridor Vc
BA12	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation (2 tracks) of Maglaj - Jelina section (Corridor Vc)	Corridor Vc
BA13	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation of Jelina - Zenica section (Corridor Vc)	Corridor Vc
BA14	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation of Zenica - Podlugovi section (Corridor Vc)	Corridor Vc
BA2	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation of Doboj - PetrovoNovo - Tuzla (Route 9a - parallel to Corridor X)	Route 9a
BA3	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation of Živinice - Caparde - Zvornik incl. tunnel Križevići (Route 9a - parallel to Corridor X)	Route 9a
BA4	Upgrade	Planned	Bosnia and Herzegovina	Rehabilitation of Brčko - Banovići (Route 9a - parallel to Corridor X)	Route 9a
BA8	Upgrade	Planned	Bosnia and Herzegovina	Overhaul of Sarajevo - Podlugovi railway section (Mediterranean Corridor - Rail CVc)	
BA9	New construction	Planned	Bosnia and Herzegovina	Construction of a new railway line ČapljinaTrebinje - Nikšić as a part of Adriatic Ionian Corridor	
EL11	New construction	Planned	Greece	Reconfiguration of railway line Thessaloniki - Florina - North Macedonia on the existing Thessaloniki - Platy - Edessa - Florina - Neos Kafkasos railway line	
EL6	New construction	Planned	Greece	Construction of new double railway line between Kiato and Patra (sections Rododafni - New Port of Patra) of Athens - Patras railway line	Orient/East-Med Corridor
HR9	New construction	Planned	Croatia	Construction of a new railway line Dugo Selo - Novska	
IT18	New construction	Planned	Italy	High speed rail connection Salerno - Reggio Calabria (lots 2-3-4): Praja - Tarsia, Tarsia - Cosenza, Cosenza - Lamezia Terme sections	

ID	Object	Level	Country	Project	Node
IT54	New construction	Planned	Italy	Construction of a new connection for passengers (SEVEL)	
IT58	Upgrade	Planned	Italy	Upgrade of the metropolitan area of Potenza (Ferrovie Appulo Lucane)	
IT59	New construction	Planned	Italy	Construction of the new metropolitan railway service of Matera	
ME2	Upgrade	Planned	Montenegro	Reconstruction and electrification of Podgorica - Tuzi - border with Albania and Route 4	
ME3	New construction	Planned	Montenegro	Construction of a new Capljina - Trebinje - Niksic railway line	
MK4	New construction	Planned	North Macedonia	Orient/East-Med Corridor VIII: Construction of Rail Corridor VIII,Kicevo to the border with Albania	Orient/East-Med Corridor (Corridor VIII)
MK5	New construction	Planned	North Macedonia	Construction of a new railway interconnection North Macedonia - Serbia Rail, Tabanovce Joint Border Station	Corridor X
RS6	Upgrade	Planned	Serbia	Upgrade of railway section Nis - Presevo - Border between two States of the Serbia - North Macedonia CX Rail Interconnection (Orient/East-Med Corridor)	Corridor X
SI11	New construction	Planned	Slovenia	Upgrade of R5 - Ljubljana–Zidani Most	
SI13	Upgrade	Planned	Slovenia	Upgrade of R7 - Pragersko - Pukonci and Pukonci - Hormoz (HU)	
SI16	Upgrade	Planned	Slovenia	Upgrade of R10 - Zidani Most - Pragersko	
SI17	Upgrade	Planned	Slovenia	Upgrade of R11 - Postojna - Ilirska Bistrica - Šapjane (HR)	
SI2	New construction	Planned	Slovenia	Preparation of design documentation for upgrading of railway sections and railway stations in Ljubljana Hub	Baltic - Adriatic, Mediterranean
SI5	Upgrade	Planned	Slovenia	Upgrade of existing rail track on the Maribor - Šentilj - national border section	

Figure 66 Map of rail interventions in the EUSAIR region – "Project" scenario.

Looking at the "Baseline" Scenario, identified interventions are 103. Below, these are represented in a summary table describing the type of intervention (upgrade/new construction), the level of advancement (when information is available), the Country they belong to, and the node/road corridor interested. The table is followed by a summary map showing Baseline scenario in the region.

Table 71 Rail interventions in EUSAIR region – "Baseline" scenario

ID	Object	Level	Country	Project	Node
AL1	New construction	Planned and financed	Albania	Rehabilitation of Tirana - Durrës railway line (34.5km) and construction for a new railway line Tirana - Rinas Airport (7.4km)	Route 2
BA5	Upgrade	Under construction	Bosnia and Herzegovina	Modernization of the signaling equipment of Sarajevo - Bradina and Doboj - Banja Luka railway lines: Miljacka railway station and Stup freight station	
BA6	Upgrade	Completed	Bosnia and Herzegovina	Modernization of the signaling equipment of Sarajevo - Bradina and Doboj - Banja Luka railway lines: Banja Luka - Doboj line	
BA7	Upgrade	Completed	Bosnia and Herzegovina	Rehabilitation of Sarajevo - Bradina railway line	
EL1	New construction	Completed	Greece	New double high speed (160-200 km/h) railway line Tithorea - Lianokladi - Domokos (106 km)	Orient/East-Med Corridor

ID	Object	Level	Country	Project	Node
				along the Athens - Thessaloniki axis, replacing the existing single line (122 km)	
EL10	Upgrade	Under construction	Greece	Upgrade of railway section Polikastro - Idomeni	
EL2	New construction	Under construction	Greece	Construction of a railway infrastructure in section Rododafni (Km 91,5) - Psathopirgos (Km 113) of the new railway line Athens - Patras (part of Orient/East-Med Corridor)	Orient/East-Med Corridor
EL3	Upgrade	Completed	Greece	Electrification of existing Kiato - Rododafni railway line (71 km) (project expected to start by December 2020)	Orient/East-Med Corridor
EL4	New construction	Completed	Greece	Construction of new double track Kiato - Diakopto of Athens - Patras railway line	Orient/East-Med Corridor
EL5	New construction	Completed	Greece	Construction of new double track Diakopto - Rododafni of Athens - Patras railway line	Orient/East-Med Corridor
EL8	Upgrade	Under construction	Greece	Standardisation and electrification of railway link Isthmos - Loutrak	
EL9	New construction	Completed	Greece	Construction of a new railway line Thessaloniki - Idomeni - North Macedonia	
HR1	New construction	Under construction	Croatia	Upgrade and construction for a 2nd track on the Križevci - Koprivnica - state border railway section	
HR2	New construction	Completed	Croatia	Preparation for construction of 2nd track, upgrade and modernisation of Škrljevo - Rijeka - Jurdani railway section	Mediterranean Corridor
HR3	New construction	Under construction	Croatia	Upgrade of Dugo Selo - Križevci railway line and construction for a 2nd track	
HR4	Upgrade	Planned and financed	Croatia	Upgrade of existing railway line Hrvatski Leskovac - Karlovac	
HR5	New construction	Under construction	Croatia	Reconstruction of railway line on the section Zagreb Zapadni Kolodvor - Savski Marof	
HR6	Upgrade	Under construction	Croatia	Upgrade of railway line Vinkovci - Vukovar	
HR7	New construction	Under construction	Croatia	Modernization of railway section Zaprešić - Zabok	
HR8	New construction	Under construction	Croatia	R3 - Karlovac - Port of Rijeka	
IT1	New construction	Under construction	Italy	Construction of Brenner Base Tunnel	Scandinavia-Medterranean TEN Corridor
IT10	Upgrade	Under construction	Italy	High speed rail connection Turin - Milan - Venice: Brescia - Verona section	Mediterranean TEN Corridor
IT11	New construction	Under construction	Italy	High speed rail connection Turin - Milan - Venice: Verona - Padova section	Mediterranean TEN Corridor
IT12	New construction	Under construction	Italy	High speed rail connection Salerno - Reggio Calabria (lot 1): Battipaglia - Praja section	
IT13	Upgrade	Under construction	Italy	Increase speed on Catania - Siracusa railway line	Mediterranean TEN Corridor
IT14	New construction	Under construction	Italy	Increase speed on Palermo - Catania railway line and construction of double track Bicocca - Catenanuova	Mediterranean TEN Corridor
IT15	New construction	Under construction	Italy	Construction of double track Bari S.Andrea - Bitetto	Mediterranean TEN Corridor
IT16	New construction	Under construction	Italy	Construction of double track Fiumetorto - Cefalù - Castelbuono	Mediterranean TEN Corridor

ID	Object	Level	Country	Project	Node
IT17	Upgrade	Planned and financed	Italy	Construction of Pescara - Scafa railway section	
IT19	Upgrade	Planned and financed	Italy	Electrification of Lamezia - Catanzaro - Sibari railway line	
IT20	Upgrade	Under construction	Italy	Upgrade and speeding up of Venice Mestre - Trieste railway line	Baltic - Adriatic TEN Corridor
IT21	New construction	Planned and financed	Italy	4 traks upgrade of railway section Rho - Parabiago (lot 1)	Mediterranean TEN Corridor
IT22	Upgrade		Italy	Upgrade of regional railway line in Saletti industrial area	Baltic - Adriatic TEN Corridor
IT23	Upgrade		Italy	Accessibility improvement by rail in the port of Ortona	Baltic - Adriatic TEN Corridor
IT24	Upgrade		Italy	Improve connectivity to the High-speed railway network through diagonal lines. Modernitation on Taranto-Metaponto-Potenza-Battipaglia, Potenza-Metaponto section.	
IT25	Upgrade		Italy	Upgrade of infrastructure of Bari - Bitritto railway line	
IT26	New construction		Italy	Doubling of the railway line on Bari - Barletta: Andria - Barletta section	
IT27	Upgrade		Italy	Electrification of Barletta - Canosa railway section	
IT28	Upgrade		Italy	Modernization of railway line Potenza - Foggia	
IT29	New construction		Italy	Accessibility improvement by rail in the port of Taranto	Scandinavia-Mediterranean TEN Corridor
IT30	Upgrade		Italy	Electrification of rail corridor Parma - Suzzara - Poggio Rusco	
IT31	Upgrade		Italy	Infrastructural and technological projects of Udine - Cividale railway line	
IT32	Upgrade		Italy	Accessibility improvement by rail in the port of Trieste	Baltic - Adriatic, Mediterranean TEN Corridor
IT33	Upgrade		Italy	Electrification of railway line (Rome) Venafro - Campobasso - Termoli	
IT34	Upgrade		Italy	Electrification of railway section Lugo station - Lugo Terminal junction	Baltic - Adriatic, Mediterranean TEN Corridor
IT35	Upgrade		Italy	Upgrade and modernization of regional railway section Bari - Gravina, Maglie - Otranto and Bari - Matera	
IT36	New construction		Italy	Accessibility improvement by rail in the port of Venice	Baltic - Adriatic, Mediterranean TEN Corridor
IT37	Upgrade		Italy	Accessibility improvement by rail in the port of Venice	Baltic - Adriatic, Mediterranean TEN Corridor
IT38	Upgrade		Italy	Upgrade of railway linea Misterbianco - Paternò	Scandinavia-Mediterranean TEN Corridor
IT39	Upgrade		Italy	Standardisation on european goals of railway line Circumetnea	Scandinavia-Mediterranean TEN Corridor
IT4	Upgrade	Under construction	Italy	Increase speed on Milano - Genova (lot 1)	Mediterranean TEN Corridor

ID	Object	Level	Country	Project	Node
IT40	Upgrade		Italy	Electrification of railway line Palermo - Agrigento - Porto Empedocle	Scandinavia-Mediterranean TEN Corridor
IT41	Upgrade		Italy	Intermodality and accessibility of Trapani Birgi	
IT42	Upgrade	Under construction	Italy	Construction of a new connection and bypass in the port of Augusta	Scandinavia-Mediterranean TEN Corridor
IT43	Upgrade		Italy	Strengthening of Calabria regional lines. Rosarno-S. Ferdinando line: upgrading of the equipment of the Rosarno and San Ferdinando lines for connection to Gioia Tauro.	Scandinavia-Mediterranean TEN Corridor
IT44	Upgrade		Italy	Ugrade and modernisation of the railway line Cosenza - Catanzaro	
IT45	New construction		Italy	Construction of a new railway line Potenza Santa Maria - San Carlo Hospital	
IT46	New construction	Planned and financed	Italy	Completion of railway line Ferrandina - Matera	
IT47	Upgrade		Italy	Increase speed on Orte - Falconara railway line	
IT48	Upgrade		Italy	Upgrade and modernization of regional railway line Terni - Sansepolcro	
IT5	Upgrade	Under construction	Italy	Increase speed on Bologna - Rimini railway section	Baltic - Adriatic TEN Corridor
IT51	New construction		Italy	Construction of a new railway line to the Noth pier of the port of Ortona	
IT53	New construction		Italy	Construction of a new Passo Corese - Rieti railway line	
IT55	New construction		Italy	Construction of a new railway connection to Santa Maria delle Grazie Hospital (Bari - Matera railway line)	
IT6	Upgrade	Under construction	Italy	Increase speed on Rimini - Ancona railway section	Baltic - Adriatic TEN Corridor
IT60	New construction		Italy	Construction of the 2nd track of Albairate - Abbiategrasso railway line	
IT61	New construction		Italy	Construction of the 2nd track of Codogno - Cremona - Mantova (Iphase)	
IT62	New construction		Italy	Construction of a new Trento bypass (priority lot Verona - Brennero)	Scandinavia-Mediterranean TEN Corridor
IT7	Upgrade	Under construction	Italy	Increase speed on Pescara - Termoli - Foggia - Brindisi railway section	Baltic - Adriatic TEN Corridor
IT8	New construction	Under construction	Italy	Double track upgrade of Termoli - Lesina railway section	Baltic - Adriatic TEN Corridor
IT9	New construction	Under construction	Italy	High speed rail connection Naples - Cancello - Frasso Telesino	Scandinavia-Mediterranean TEN Corridor
ME1	Upgrade	Under construction	Montenegro	Reconstruction and modernization of railway line Vrbnica - Bar (Orient/East-Med Corridor R4)	Orient/East-Med Corridor (Corridor R4)
MK1	New construction	Under construction	North Macedonia	Construction of a new railway section Kumanovo - Beljakovce (30.8 km) of the rail Corridor VIII (Orient/East-Med Corridor) Kumanovo - Deve Bair	Orient/East-Med Corridor (Corridor VIII)
MK2	New construction	Planned and financed	North Macedonia	Construction of a new railway section Beljakovce - Kriva Palanka (34 km) of the rail	Orient/East-Med Corridor (Corridor VIII)

ID	Object	Level	Country	Project	Node
				Corridor VIII (Orient/East-Med Corridor) Kumanovo - Deve Bair	
MK3	New construction	Planned and financed	North Macedonia	Orient/East-Med Corridor:Construction of Rail Corridor VIII,Kicevo to the border with Albania	Orient/East-Med Corridor (Corridor VIII)
MK6	Upgrade	Under construction	North Macedonia	Project for track renewal works on the section Nogaevci - Negotino (Corridor X)	Corridor X
MK7	New construction	Under construction	North Macedonia	Construction of new alignment of railway section along Corridor X Dracevo – Veles	Corridor X
RS1	New construction	Under construction	Serbia	High speed rail connection Novi Sad - Subotica	Corridor X
RS10	New construction	Planned	Serbia	Construction of the by-pass railway line Beli Potok – Vinca – Pancevo with road-railway bridge over the Danube River near Vinca	
RS11	New construction		Serbia	Reconstruction of the railway bypass around Belgrade, Batajnica – Ostruznica – Beograd Ranzirna	
RS12	New construction	Planned	Serbia	Reconstruction and modernization of single-track railway Belgrade – Nis	Corridor X
RS13	New construction	Under construction	Serbia	Reconstruction and modernization of the railway line Kraljevo – Rudnica	Corridor X
RS14	New construction	Under construction	Serbia	Reconstruction and modernization of the railway line Stalać – Kraljevo	Route 11
RS15	New construction	Under construction	Serbia	Reconstruction and modernization of the Belgrade Podgorica railway line (section Valjevo – Vrbnica)	Corridor X
RS16	New construction	Under construction	Serbia	Reconstruction and modernization of the railway line Pančevo – Vršac	
RS17	New construction	Completed	Serbia	Modernization of the railway line Ruma – Sabac – Donja Borina – State Border with Bosnia and Herzegovina	Route 9a
RS18	New construction	Under construction	Serbia	Modernization and reconstruction of the existing railway line Subotica – Horgos – state border with Hungary (Segedin)	
RS2	New construction	Under construction	Serbia	High speed rail connection Belgrade - Stara Pazova	Corridor X
RS7	Upgrade	Under construction	Serbia	Upgrade of railway section Niš - Dimitrovgrad - Border with Bulgaria of the Serbia - Bulgaria CXc Rail Interconnection (Orient/East-Med Corridor)	Corridor X
RS8	New construction	Under construction	Serbia	Construction works on the Main Railway station - phase 2	
RS9	Upgrade	Planned	Serbia	Reconstruction and modernization of the two-track railway line Stara Pazova – Šid – border with Croatia and section Golubinci – Inđija	Corridor 10
SI10	Upgrade	Under construction	Slovenia	Upgrade of R4 - Ljubljana Railway Hub (LRH)	
SI12	Upgrade	Under construction	Slovenia	Upgrade of R6 - Divača - Sežana (IT)	
SI15	Upgrade	Under construction	Slovenia	Upgrade of R9 - Pragersko - Maribor	
SI18	Upgrade	Under construction	Slovenia	Deployment of ERTMS/ETCS on the Dobova - Zidani Most and Pragersko - Maribor - Sentilj railway lines	

ID	Object	Level	Country	Project	Node
SI3	Upgrade	Completed	Slovenia	Upgrade of railway line Poljčane - Slovenska Bistrica, including railway stations Poljčane and Slovenska Bistrica	
SI4	Upgrade	Under construction	Slovenia	Upgrade of railway line Zidani Most - Celje	
SI6	New construction	Under construction	Slovenia	Construction of new tunnels T1-T7 of second track Divača - Koper	
SI7	Upgrade	Under construction	Slovenia	Upgrade of R1 - Koper - Ljubljana (HSL)	Baltic-Adriatic TEN-T corrido
SI8	Upgrade	Under construction	Slovenia	Upgrade of R2 - Zidani Most - Dobova (HR)	
SI9	Upgrade	Under construction	Slovenia	Upgrade of R3 - Ljubljana - Jesenice (AT)	

Figure 67 Map of rail interventions in the EUSAIR region – "Baseline" scenario.

3 Conclusions and policy recommendations for the Rail transport sector

In this chapter a recap of the findings of the previous chapters is proposed, in order to highlight the main issues of the sector in the macro-region and its outlook. Moreover, suggestions for development guidelines are being proposed.

3.1 Key issues

This paragraph presents in very short terms the most relevant issues highlighted by the analysis carried out on the EUSAIR rail network, classified by the main strategic objectives as per the common structure applied in the present Masterplan. It has to be considered that some interventions may cause more than one a single impact on, for instance, accessibility of safety and security, therefore the table blow shows the most relevant impact the identified key issues may produce.

Table 1 Identified Key Issues by type of impact.

IMPACT	KEY ISSUE	ALBANIA	BOSNIA AND HERZEGOVINA	MONTENEGRO	SERBIA	CROATIA	SLOVANIA	GREECE	NORTH MACEDONIA	ITALY
SAFETY AND SECURITY	Steep gradients in some sections	■								
	ERTMS not implemented on the whole network	■	■	■	■	■	■	■	■	■
	High share of single track lines	■	■	■	■	■	■	■	■	
SUSTAINA-BILITY	Sub-par share of electrified network	■		■	■	■				
	Maximum train length does not reach 750m in all the network	■	■	■	■	■	■	■	■	■
	Lacking rail connection to/from one or more major ports					■		■	■	■
CONNECTI-VITY	Limited extension of the rail network	■	■	■					■	
	High share of single track lines	■	■	■	■	■	■	■	■	
	Sub-par share of electrified network	■		■	■	■				
	Low maximum speed in major shares of the network	■	■	■	■	■				
	Axle loads not up to standards in relevant shares of the network	■								■
	Low interoperability within the network and/or with bordering countries	■					■	■	■	

3.2 Outlook

The main interventions for the improvement of the rail sector in the region are presented in this paragraph.

As concerns projects to improve **safety, security and resilience of the rail transport system**: looking at the baseline scenario of rail interventions, described in the summary of chapter 2, all countries in the region have developed such projects. Many interventions aim to standardize with European objectives and significant attention is dedicated also to projects including green and digital elements.

Many projects will contribute to a modal shift from road to rail, with environmental benefits and benefits for road safety and from rail to ports, improving the **connectivity and intermodality of transport networks**. Projects in the baseline also contribute to **climate change mitigation and sustainability** by enhancing the attractiveness of rail transport and of the modal shift from road. The following projects can be underlined (see Chapter 2, Table 71).

- **Albania** is working on the reconstruction of Durres to Rrogozhine section of the railway Corridor VIII (ID AL1). This project, with an estimated cost of 78 million € and a length of 34 km, is a strategic project. The overall objective of the project is to contribute to the upgrade of the TEN-T railway network in Albania, which will result in improved transport connectivity, increased railway traffic (and decrease of road traffic), thus contributing to railway modal shift, reduction of environmental impact, strengthening of green economy, reduction of rail and road accident rates. Benefits expected are first of all the completion of Corridor VIII on the Albanian side. The project will establish for the first time a direct railway connection between Rrogozhina, Lekaj, Kavaja, and Golem to Tirana, via connection to the new Durres-Tirana line which is contracted for construction. Conversely, the inhabitants of Tirana would for the first time be able to access the very pretty and developed coastal area of Albania between Durres, Golem and Kavaja by train, without changing mode of transport. This is expected to significantly change current transport patterns between the most populous city of Albania and its most important tourist destination. Green and digital elements included are electrification, ERTMS, ETCS Level 1.
- **Bosnia and Herzegovina** is carrying out the upgrade and reconstruction of the Doboj-Rasputnica Miljacka on Railway Corridor Vc (BA5), with an estimated cost of 500 million €. This project of 172 km covers two main sections. The first one includes the 95 km Srpska Kostajnica – Doboj – Maglaj – Jelina double track and 77 km of Jelina – Zenica – Podlugovi – Rasputnica Miljacka single track section. Envisages upgrade and reconstruction of the Doboj-Rasputnica Miljacka railway line, including the Zenica and Podlugovi freight and passenger stations, as well as the construction of doubled track along the existing one for sub-section Jelina – Zenica – Podlugovi – Rasputnica Miljacka. Expected benefits are savings in vehicle operating costs, transport time and maintenance costs, and will enhance the capacity and reliability of the railway sections and traffic safety. It is expected to contribute to a modal shift from road to railway, yielding environmental and road safety benefits. The project also contributes to climate change mitigation by including electrification.
- **In Montenegro** the main rail project is the ongoing teconstruction and modernization of railway line Vrbnica - Bar (Orient/East-Med Corridor R4) (ID ME1).
- **Serbia** is focusing on the modernisation and reconstruction of existing Subotica – Horgos – Hungarian border (Segedin) railway line, a strategic project with estimated cost of 100 million € and a length of

27 km (ID RS). The Subotica-Segedin line is a single track, unelectrified regional railway link connecting the north of Serbia with southern Hungary. The project envisages reconstruction of 26 km for speeds of up to 120 km/h, including interventions on substructure and superstructure, telecommunications and signalling system devices. Implementation of this project will mean better connectivity between Hungary and Serbia and two large cities in that region (Subotica and Segedin). Green and digital elements included are electrification, ERTMS, ETCS Level 1.

- In **Croatia**, various projects aim to endow single track lines with a 2nd track, and the realisation of a new line between Karlovac and the port of Rijeka is ongoing (HR8).
- In **Slovenia**, a lot of interventions aimed at upgrading railway line sections, e.g. in the relevant Koper – Ljubljana section (SI7), are ongoing.
- In **Greece** various new parts of the Orient/East-Med Corridor are ongoing such as the construction of a railway infrastructure in section Rododafni (Km 91,5) - Psathopirgos (Km 113) of the new railway line Athens – Patras (EL2).
- **North Macedonia** is working on the construction of the Kicevo – Albanian Border railway section along Corridor VIII (MK3), with an estimated cost of 426 million €. The objective of this project is to build a railway line from Kicevo to the border with the Republic of Albania.
- **In Italy,** the number of projects to improve the efficiency of the rail network is wide; the main interventions involving regions in the EUSAIR area regard the construction of the Brenner Base Tunnel (IT1); and the realisation of a high speed rail line between Salerno and Reggio Calabria (IT12), aimed at completing the North-South high speed axis.

3.3 Development guidelines

Taking into account the above-mentioned objectives and the status of EUSAIR rail transport system, the following development guidelines are recommended, grouped into three main policy areas, as for the other transport modes.

Safety, security and resilience	Environmental and social Sustainability	Connectivity and traffic development
• Increase the resilience of rail infrastructure to extreme weather events • Boost the diffusion of ERTMS/ETCS in the rail network • Implement EU Acquis in the field of dangerous goods transport	• Explore the viability of hydrogen-based pilot solutions for rail transport	• Increase rail transport capacity and quality (speed, electrification, completion of rail reforms) in Western Balkan countries • Provide continued and interoperable international rail links between countries • Define specific Multimodal Transport Plans in Western Balkan countries to support its diffusion

Further indications on the **development of the rail network infrastructure-wise** have emerged from the application of the EMTM (European Multimodal Transport Model) within the present Masterplan, wherein the Baseline scenario projects (those which are already ongoing or in an advanced state of planning) particularly improve the core network corridor sections, although some gaps remain in the Western Balkan

region and Greece, especially along the Adriatic coast; the planned projects not included in the Baseline scenario are relevant to solve these gaps and further improve the rail network. Albeit relevant to modernise the network, the impact of the planned projects may not result in the achievement of the TEN-T speed standards for freight (100 km/h) and passenger transport (160 km/h) according to the new TEN-T Regulation; further to the Baseline and planned projects, additional projects have been identified to complete the core and extended core networks and their modernisation, with a focus on areas presenting low accessibility indexes. However, upon completion of the Masterplan projects' scenarios gaps will remain in terms of accessibility, only in the areas not linked to the rail network and in Western Greece, where gaps may be solved by investments on the comprehensive lines.

Table 72: Additional projects completing the Masterplan scenario – Rail network

TYPE OF INTERVENTION	COUNTRY	PROJECT
Upgrade	Bosnia and Herzegovina / Croatia	Upgrade of Sarajevo - Ploce railway line
New construction	Greece	Kalambaka - Igoumenitsa new railway line
New construction	Greece	Thessaloniki - Xanthi new railway line
Upgrade	Greece	Upgrade of Kalambaka - Palaiosarfalos railway line
Upgrade	Montenegro	Upgrade of Niksic - Podgorica railway line

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