2018-2023 Studies on the TEN-T Core Network Corridors and Support of the European Coordinators – Phase 2

BALTIC-ADRIATIC CORRIDOR

Final report on phase 3

Table of content

Figures

Tables

Abbreviations

BAC	Baltic Adriatic Corridor
CNC	Core Network Corridor according to Regulation (EU) 1316/2013
DG MOVE	European Commission – Directorate General for Mobility and Transport
EC	European Commission
EIA	Environmental Impact Assessment
ERTMS	European Rail Traffic Management System
EU	European Union
GDP	Gross Domestic Product
IFI	International Financial Institutions
IWW	Inland waterway
km	kilometre
KPI	Key Performance Indicator
m	metre
mln	Million
MTMS	Multimodal Transport Market Study
MoS	Motorway(s) of the Sea
MS	Member States of the European Union
n.a.	not available / not applicable
p.a.	per year / annual
PIR	Project Implementation Report
RFC	Rail Freight Corridor
SEA	Strategic Environmental Assessment
TEN-T	Trans-European Transport Network
TENtec OMC	TENtec (the European Commission's information system to coordinate and support the Trans-European Transport Network Policy) Open Method of Coordination

Country Codes after ISO 3166:

PL	Poland
CZ	Czech Republic
SK	Slovakia
AT	Austria
IT	Italy
SI	Slovenia

1 Introduction

1.1. Aim and content of this report

This document is submitted by TPLAN Consulting S.r.l. and their sub-contractors, NDCON, Paradigma and the University of Maribor in fulfilment of the requirements of Contract No. MOVE/B1/2018-216, regarding Studies on the TEN-T Core Network Corridors and Support of the European Coordinators – 2018-2023 Corridors' Studies. More specifically this report relates to the delivery of the analysis for LoT 1 of this contract, concerning the development of the Baltic-Adriatic (hereinafter BA) Core Network Corridor (CNC).

The scope of this report is that of providing an updated analysis of the Key Performance Indicators (KPIs) for the years 2021 and 2022 collected for their uploading in the TENtec OMC, focussing on the following parameters: loading gauge, maximum train length, axle load, line speed, track gauge, electrification, and airport connection to rail, for railway transport and airports; and road category for road transport (IWW KPIs were not encoded as they are not applicable to the BA Corridor). The report also assesses the persisting bottlenecks and main gaps toward the completion of the BA Corridor fully at standard in 2030.

Further to this introductory section, the report is structured into the following Chapters:

- Chapter 2 – including an updated Key Performance Indicators (KPIs) analysis with reference to the requirements set in the Regulation (EU) 1315/2013 for the corridor infrastructure focusing on rail and road transport, as well as for rail interconnection to airports;
- Chapter 3 – analysing the persisting bottlenecks and missing links towards a fully at standard BA Corridor in 2030;

1.2. Methodology for the analysis undertaken under the scope of the 2015-2017 study in support of the updating of the work plan

From a methodological standpoint, the content of this report has been prepared based on the following approach:

- The description of the BA Corridor alignment is based on Regulation (EU) 1315/2013, defining the TEN-T core and comprehensive networks (new TEN-T regulation); on Regulation (EU) 1153/2021, establishing the Connecting Europe Facility instrument 2021-2027; and on the information encoded in the TENtec database in 2023, as also integrated, reviewed and commented with the stakeholders and the owners of the infrastructure;
- The description of the BA Corridor infrastructure and the identification of gaps with respect to the standards set in the Regulation (EU) 1315/2013, are based on data provided by the Infrastructure Managers either directly or from their Internet Web Sites, review of publicly available sources including existing studies, as well as professional knowledge of the corridor.

1.3. Presentation of the information by Member State

The information and data included in this report and related annexes, is generally ordered reflecting the alignment of the BA Corridor as listed in the Regulation (EU) 1153/2021:

- Gdynia – Gdańsk – Katowice/Sławków;
- Gdańsk – Warszawa – Katowice/Kraków;
- Katowice – Ostrava – Brno – Wien;
- Szczecin/Świnoujście – Poznań – Wrocław – Ostrava;
- Katowice – Bielsko-Biała – Žilina – Bratislava – Wien;
- Wien – Graz– Villach – Udine – Trieste;
- Udine – Venezia – Padova – Bologna – Ravenna – Ancona;
- Graz – Maribor –Ljubljana – Koper/Trieste.

In line with the above sections, the sequence of the description of the information by Member Sate is as follows: Poland (PL), Czech Republic (CZ), Slovak Republic (SK), Austria (AT), Italy (IT) and Slovenia (SI).

1.4. Maps and tables included in this report and TENtec database

The maps and tables included in this report to describe the BA Corridor rail and road links, are the result of the Contractor's independent analysis of the BA Corridor infrastructure. These have been elaborated with reference to the sections encoded in the TENtec database in 2022.

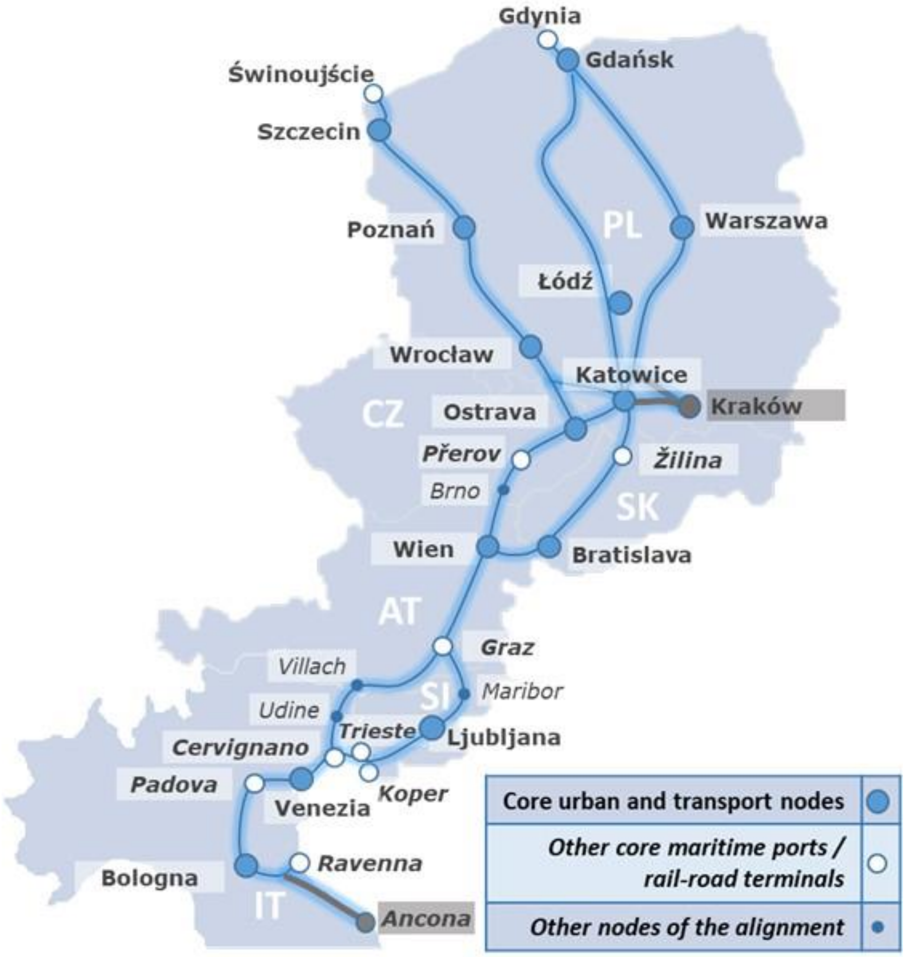
The maps do not represent the infrastructure at transport and urban nodes. "Last mile" sections providing accessibility to core urban and transport nodes are only partially encoded in the TENtec database; only the corridor route within urban nodes is codified in the TENtec database. Given the intermodal nature of the Core Network Corridors and the multimodal definition of the nodes, for the purposes of the BA Corridor study it may be assumed that the alignment within urban nodes may either be represented by the possible existing continuation of the links in urban areas or by other existing city or urban crossing or bypassing infrastructure.

2 Updated KPI analysis at 2022

1.5. The new alignment under CEF 2

The alignment and infrastructure of the Baltic-Adriatic Core Network Corridor are legally defined by Regulations (EU) 1315/2013 (*TEN-T Regulation*) and 1316/2013 (*CEF 1 Regulation*). Recently, Regulation (EU) 1153/2021 (*CEF 2 Regulation*) extended the Corridor to Kraków in Poland and to Ancona in Italy. Crossing six Member States (Poland, Czechia, Slovakia, Austria, Italy and Slovenia), the corridor connects the Baltic ports of Gdynia/Gdańsk and Szczecin/Świnoujście with the following ports in the Adriatic basin, namely; Sistema Portuale del Mare Adriatico Orientale – Porto di Trieste (hereinafter Port of Trieste), Sistema Portuale del Mare Adriatico Settentrionale – Porti di Venezia e Chioggia (hereinafter Port of Venezia), Sistema Portuale del Mare Adriatico Centro-Settentrionale – Porto di Ravenna (hereinafter – Port of Ravenna), Sistema Portuale del Mare Adriatico Centrale – Porto di Ancona (hereinafter – Port of Ancona), Port of Koper.

Figure 1: Alignment of the Baltic-Adriatic Corridor



Source: Baltic-Adriatic corridor study consortium; Note: Corridor extensions introduced by the CEF 2 Regulation are highlighted in grey

The Baltic-Adriatic Corridor interconnects the core urban nodes of Szczecin, Gdańsk, Poznań, Wrocław, Łódź, Warszawa, Katowice, Kraków, Ostrava, Bratislava, Wien, Venezia, Bologna and Ljubljana as well as the airports, ports and rail-road terminals located therein.

A total of 29 regions are crossed by the Baltic-Adriatic Corridor, which are also encompassed in the European Union strategies for the Baltic Sea Region (EUSBSR), the Danube Region (EUSDR), the Alpine Region (EUSALP) and Adriatic and Ionian Region (EUSAIR).

The Corridor involves 9 rail and 7 road cross-border sections as reported in Table 1 below.

Table 1: Cross-border sections of the Baltic-Adriatic Corridor

Border		Railway	Road
PL	CZ	Opole (PL) – Ostrava (CZ) – Brno (CZ)	Gliwice (Sosnica J. E040/E075) (PL) – Ostrava (CZ)
PL	CZ	Katowice (PL) – Ostrava (CZ) – Brno (CZ)	
CZ	AT	Břeclav (CZ) – Wien (Stadlau) (AT)	Brno (CZ) – Wien (Schwechat) (AT)
PL	SK	Katowice (PL) – Žilina (SK)	Katowice (PL) – Žilina (Brodno) (SK)
SK	AT	Bratislava (SK) – Wien (Inzersdorf) (AT), via Petržalka (SK) - Kittsee (AT)	Bratislava (Petržalka) (SK) – Wien (Schwechat) (AT)
SK	AT	Bratislava (SK) – Wien (Stadlau) (AT), via Devínska Nová Ves (SK) – Marchegg (AT)	
AT	IT	Villach (AT) – Udine (IT)	Villach (AT) – Udine (IT)
AT	SI	Graz (AT) – Maribor (SI)	Graz West (AT) – Maribor Pesnica (SI)
IT	SI	Venezia (IT) - Trieste (IT) - Divača (SI) – Ljubljana (SI)	Trieste (IT) - Divača (SI)

Source: Baltic-Adriatic corridor study consortium

Further to the maritime ports in the Baltic and Adriatic basins, the multimodal corridor infrastructure comprises the inland waterway ports of Bratislava and Wien and a total of 26 core classified rail-road terminals. Most of them are located in Poland: three in Warszawa (Główna Towarowa, Warszawa Praga, Pruszków), two by Łódź (Łódź Olechów, Stryków), one near Katowice (Sławków), one by Kraków (Karpiel Brzesko), four around Poznań (Clip Logistics, Metrans Poznań Gądki, Poznań Franowo, Loconi Poznań), three in Wrocław (Metrans Wrocław, Brzeg Dolny, Kąty Wrocławskie). Three additional rail-road terminals are located in Czechia: two in Ostrava (Paskov, Šenov) and one by Přerov. Two more exist in Slovakia, that is, in Žilina and Bratislava. Two rail-road terminals are furthermore located in Austria by Wien (Inzersdorf) and Graz (Graz Werndorf). Four core terminals are finally located in Italy, namely, in Cervignano, Padova, Bologna and Jesi (near Ancona); and one in Slovenia by Ljubljana.

The alignment of the Baltic-Adriatic Corridor does not involve inland waterway links but intersects with the inland waterway core network in the core ports of Bratislava and Wien as well as in the ports of Szczecin, Świnoujście, Trieste, Venezia, Ravenna, which are also classified as inland waterway logistic nodes.

1.6. Infrastructure compliance with the TEN-T requirements

In order to ensure the interoperability and the proper functioning of the TEN-T, a number of infrastructure requirements for the Core Network are set out in the TEN-T Regulation to be achieved by 2030. With respect to these standards, key performance indicators (KPIs) have been defined for all nine core network corridors. The infrastructure KPI values for the Baltic-Adriatic Corridor are presented in **Error! Reference source not found.** for all transport modes for the period 2013-2022.

Table 2 Supply-Side KPIs for the BA Corridor

Mode	Objectives	Passenger / Freight	KPI	Unit	2013	2015	2016	2017	2018	2019	2020	2021	2022	Target 2030
Rail network	Cohesion	P/F	**Electrification**	%	99%	99%	99%	99%	99%	99%	99%	99%	99%	100%
	Cohesion	P/F	**Track gauge 1435mm**	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
	Cohesion / Efficiency	P/F	**ERTMS implementation**	%	0%	7%	9%	16%	19%	19%	34%	34%	35%	100%
	Cohesion	F	**Line speed (>=100km/h)**	%	67%	70%	71%	71%	72%	72%	76%	76%	81%	100%
	Cohesion	F	**Axle load (>=22.5t)**	%	88%	92%	92%	93%	93%	94%	96%	96%	97%	100%
	Cohesion	F	**Train length (740m)**	%	36%	46%	46%	46%	47%	47%	48%	48%	48%	100%
Road network	Cohesion	P/F	**Express road/motorway**	%	80%	81%	81%	81%	86%	87%	89%	91%	95%	100%
Airport	Cohesion / Efficiency	P/F	**Connection to rail by 2050 (Warsaw, Wien)**	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

*Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued; 4) *In Austria and Slovenia 740 meters long trains are possible to be operated on the corridor lines under normal railway operation conditions*

Rail

The Baltic-Adriatic Corridor is continuous and in operation, except from the missing links at the Alpine crossings in Austria. Currently under construction, the two links encompass 142.1 km of new railway lines (i.e. the Koralmbahn line section Wettmannstätten-Grafenstein within the wider section Graz – Klagenfurt and the Semmering Base Tunnel within the Gloggnitz – Mürzzuschlag section). Also under construction is the 48 km long second track Koper – Divaça. Aimed at adding capacity to the existing line in operation, this section is also classified in Regulation (EU) 1153/2021 as a missing link of the Corridor.

The BA Corridor in operation includes 4,472 km of 1435 mm standard gauge railway infrastructure and it is already fully at standard with reference to this parameter.

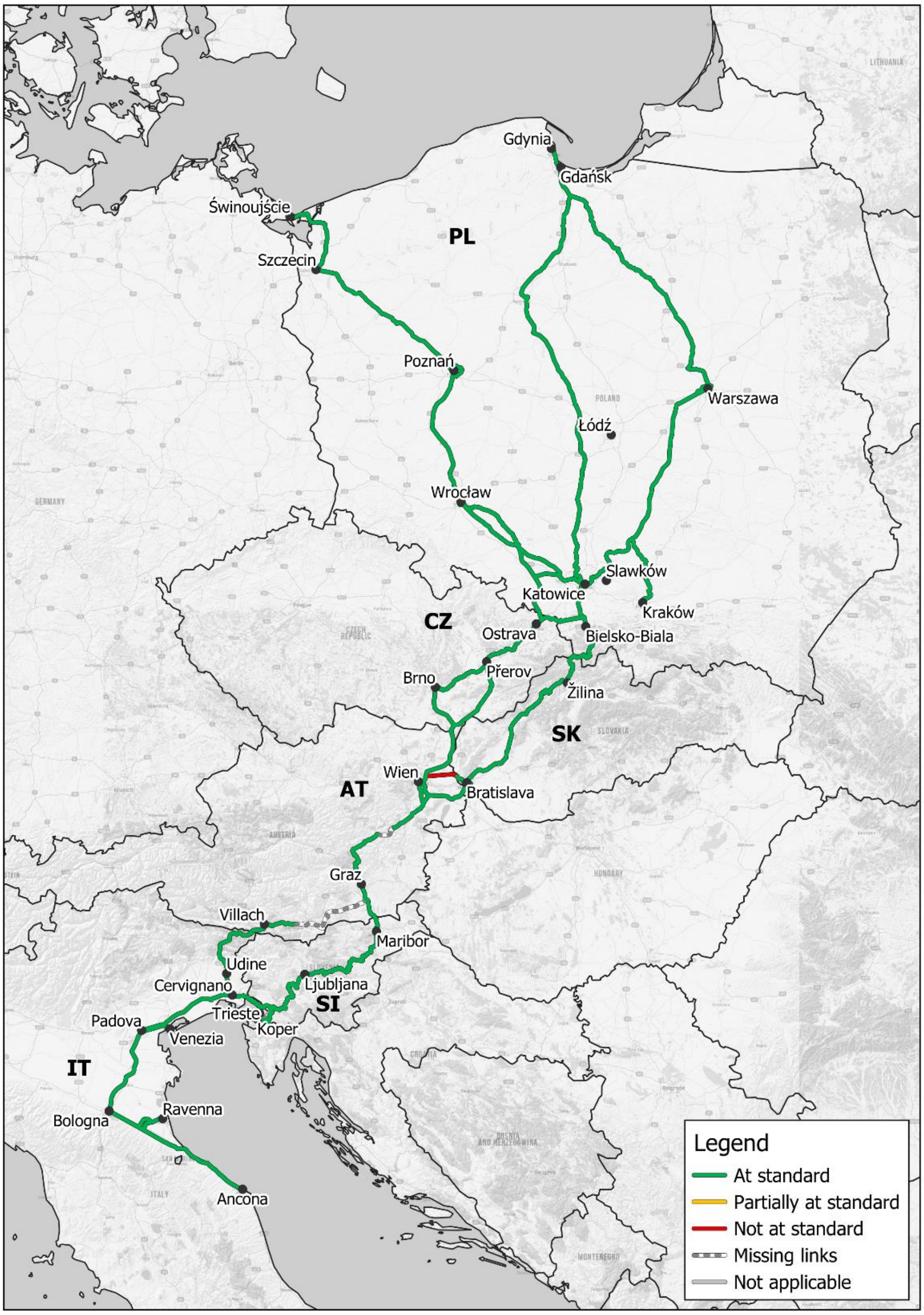
As regards *electrification* (Figure 2), with reference to passenger, freight and mixed use lines, the railway infrastructure along the corridor is also almost entirely electrified with the exception of the diesel passenger cross-border sections between Bratislava and Wien.

With respect to *axle load* (Figure 3), the corridor is mostly at standard (22.5 t). Some corridor sections (4% of the total corridor railway infrastructure) are still not at standard in Poland (several sections on the lines Czechowice-Dziedzice – Zwardoń, Chorzów – Katowice, Wrocław – Jelcz – Opole, Kiekrz – Luboń near Poznań).

In terms of the maximum permitted *length of trains* (Figure 4), there are limitations at several corridor sidings and links which affect the operation of 740 meter long trains in Poland, Czechia, Slovakia and Italy. In Austria and Slovenia, 740 meter long trains can be operated on the Corridor lines under normal railway operation conditions (*operational compliance*).

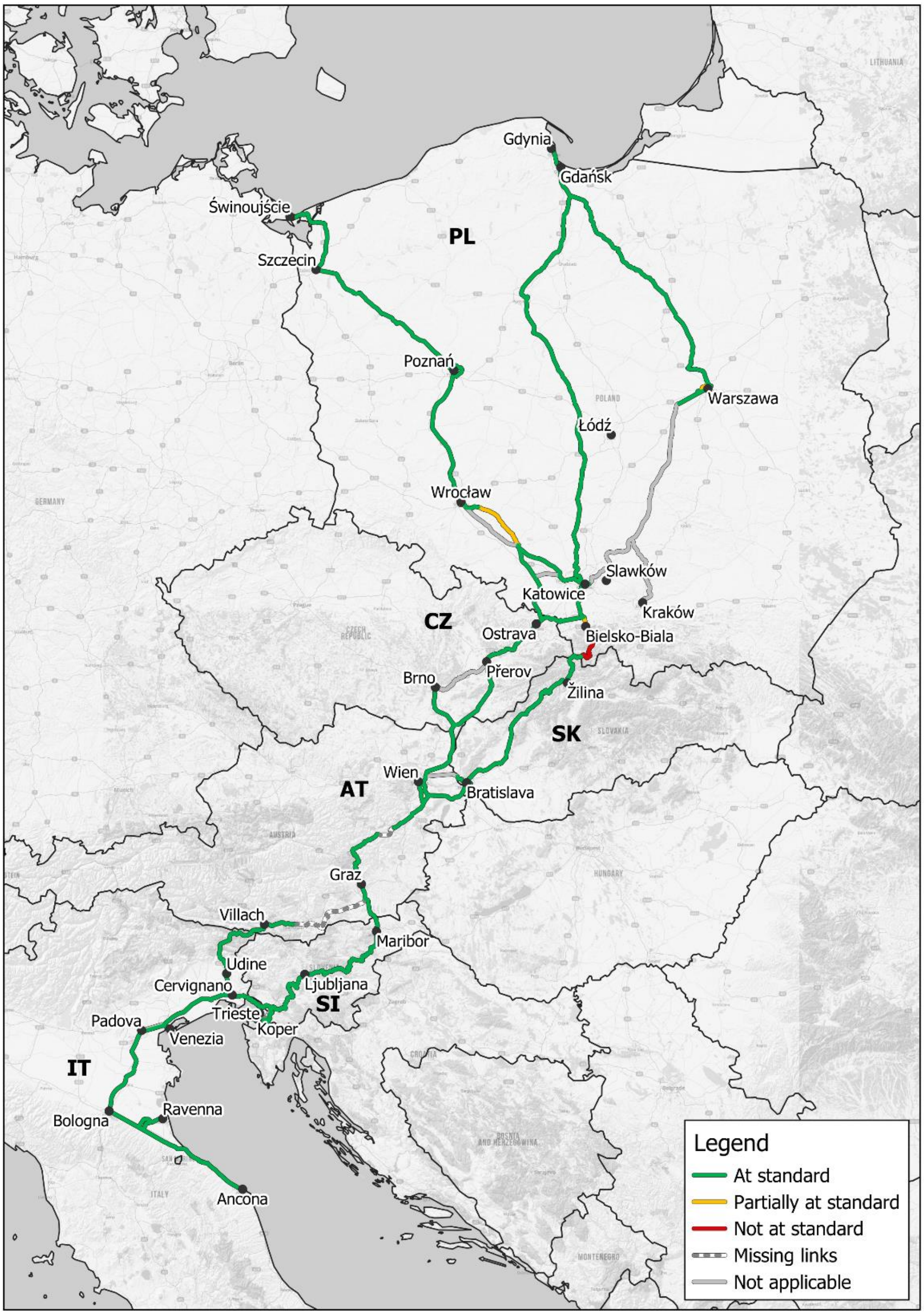
Regarding *Line speed* (Figure 5), 24% of the BA Corridor is also not at standard with bottlenecks particularly affecting the Polish and Slovenian networks, which calls for infrastructure modernisation.

Figure 2: Rail traction compliance map (status at the end of 2022)



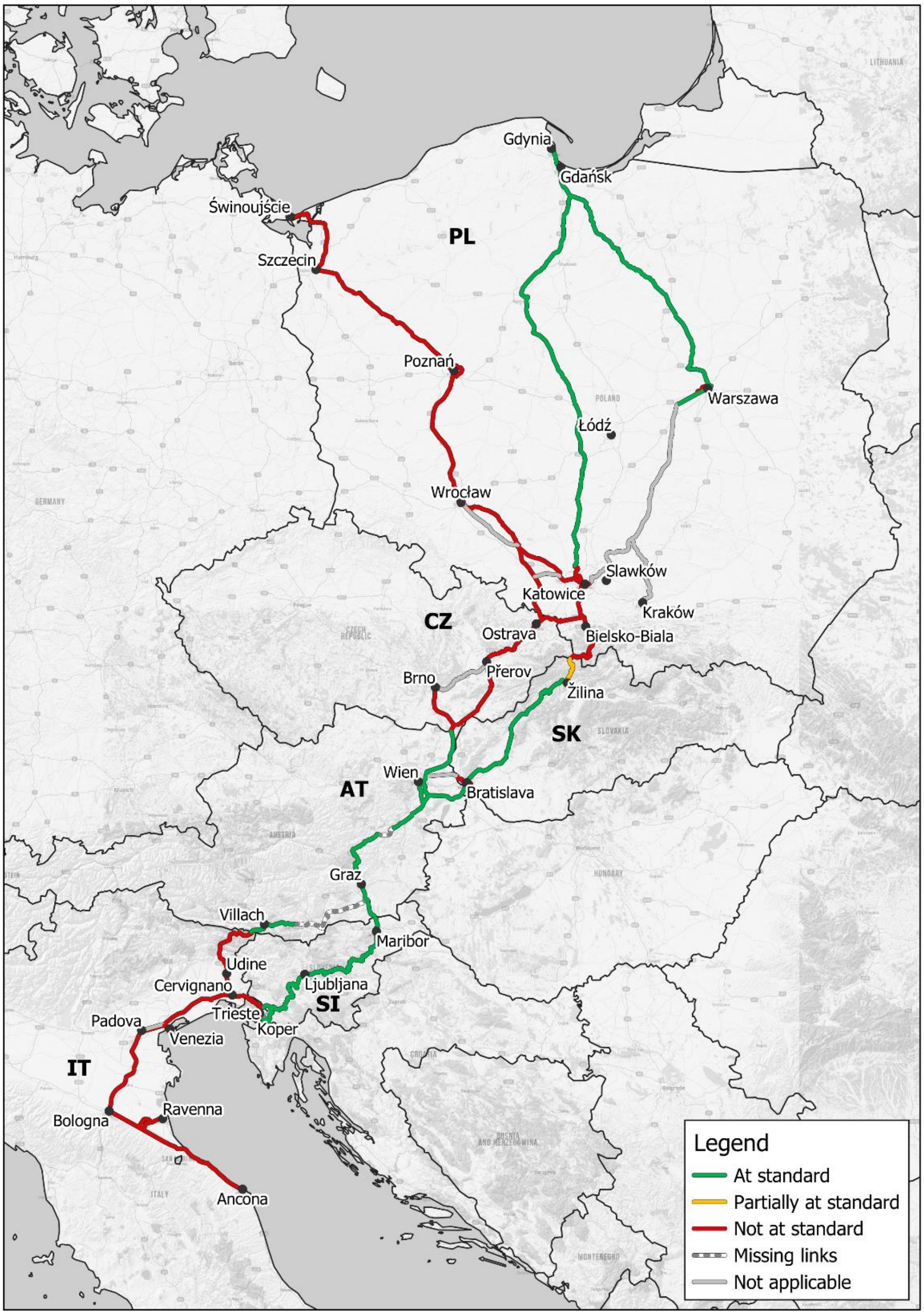
Source: BA Corridor study consortium elaboration based on TENtec data and sections; Notes: the map represents the electrification on the encoded TENtec sections excluding urban nodes; Sections entirely 'at standard' or 'not at standard' have been marked with green and red respectively; The analysis does not apply to the missing links, marked with dotted grey

Figure 3: Maximum axle load compliance map (status at the end of 2022)



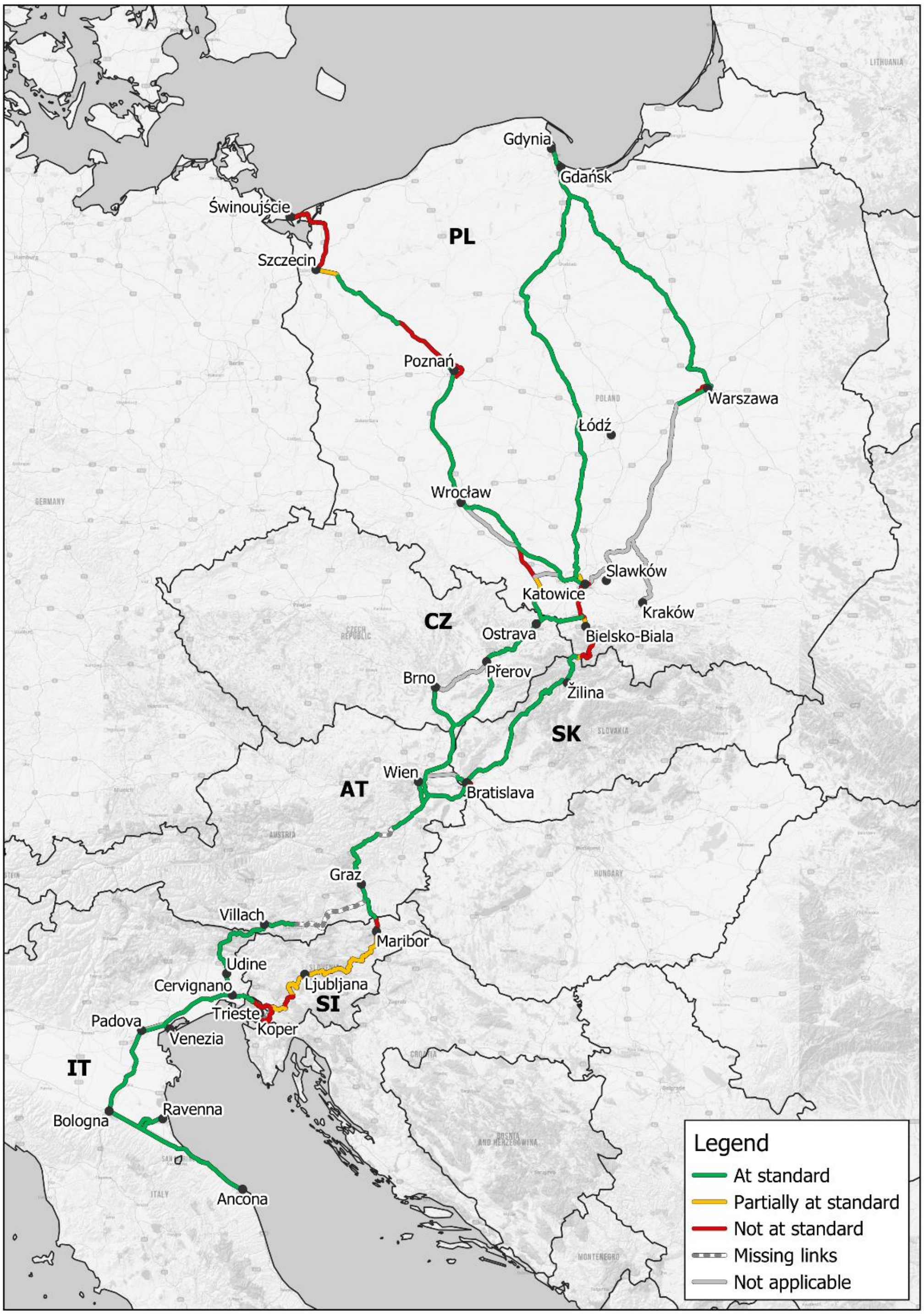
Source: BA Corridor study consortium elaboration based on TENtec data and sections; Notes: the map represents the maximum axle load on the encoded TENtec sections excluding urban nodes; Sections entirely 'at standard' or 'not at standard' have been marked with green and red respectively; The analysis does not apply to the missing links marked with dotted grey, and to the sections classified in the Regulation (EU) 1315/2013 as passenger lines, marked with grey

Figure 4: Maximum train length compliance map (status at the end of 2022)



Source: BA Corridor study consortium elaboration based on TENtec data and sections; Notes: the map represents the maximum train length on the encoded TENtec sections excluding urban nodes; Sections entirely 'at standard' or 'not at standard' have been marked with green and red respectively; The analysis does not apply to the missing links marked with dotted grey, and to the sections classified in the Regulation (EU) 1315/2013 as passenger lines, marked with grey. In Austria and Slovenia 740 meters long trains are possible to be operated on the corridor lines under normal railway operation conditions

Figure 5: Maximum operating speed compliance map (status at the end of 2022)



Source: BA Corridor study consortium elaboration based on TENtec data and sections; Notes: the map represents the maximum operating speed on the encoded TENtec sections excluding urban nodes; Sections entirely 'at standard' or 'not at standard' have been marked with green and red respectively; The analysis does not apply to the missing links marked with dotted grey, and to the sections classified in the Regulation (EU) 1315/2013 as passenger lines, marked with grey; Notwithstanding the presence of speed limitations on the sections represented as partially at standard in Slovenia, 25% of these corridor lines, between Maribor, Zidani Most, Ljubljana and Divača is already compliant concerning the speed parameter for freight transport

Further to the above presented KPIs defined in accordance with the requirements set in Regulation (EU) 1315/2013 for the rail transport infrastructure, the European Commission requested the Consultants to monitor the P400 loading gauge parameter, which will also become a requirement as of 2024, when the new TEN-T Regulation will be adopted.

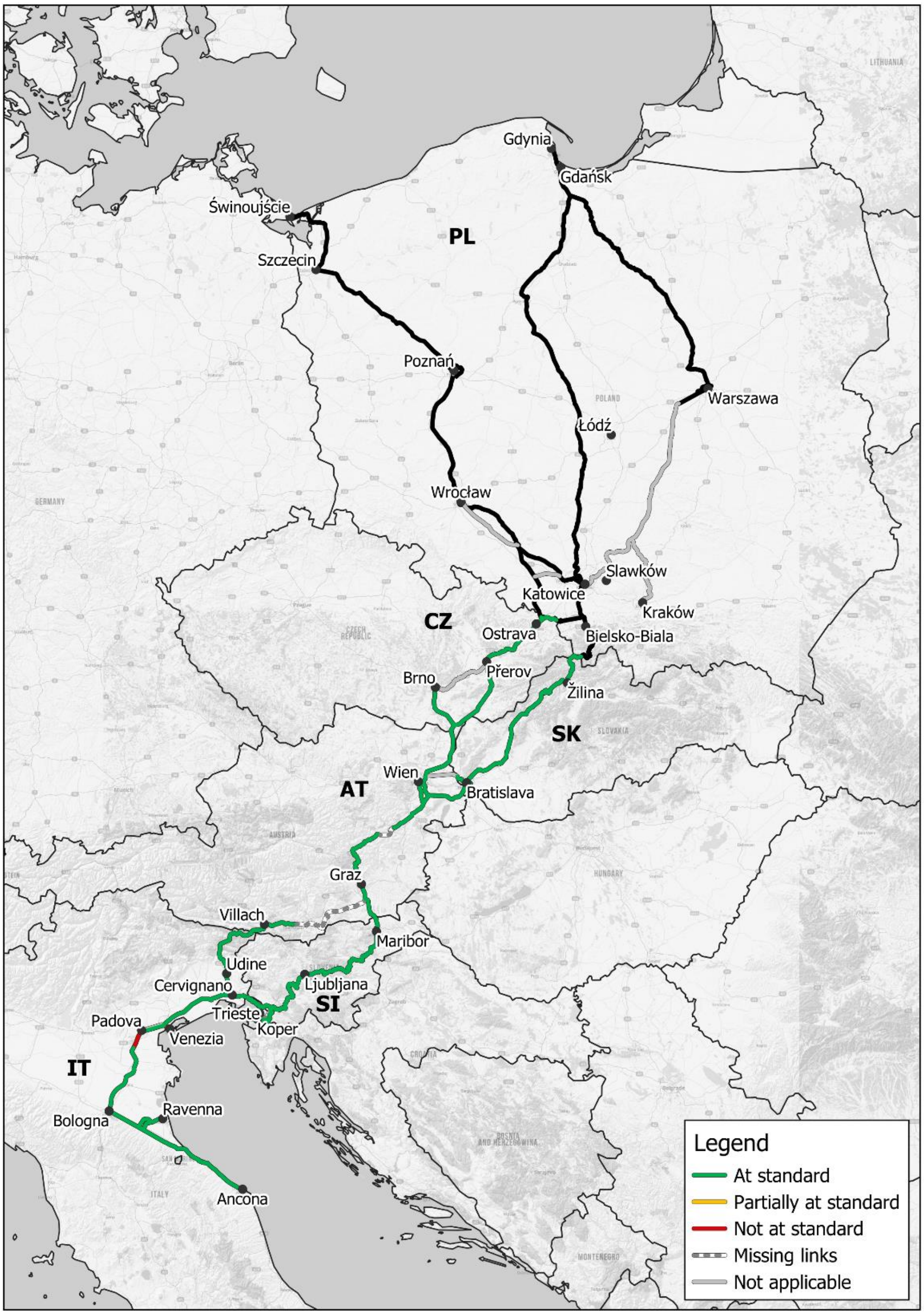
The table below and figure overleaf provide the results of the analysis of this additional parameter for each Member State and the whole BA Corridor. Excluding Poland, for which information is not currently codified, it appears that the standard is available along the corridor with the exception of the Padova-Monselice railway line in Italy. Notwithstanding the fact that the parameter is not codified in Poland, most sections in the country are assumed to be at standard.

Table 3: Loading gauge parameter

	2013	**2022**
PL	n.a.	n.a.
CZ	n.a.	100%
SK	n.a.	100%
AT	n.a.	100%
IT	n.a.	95%
SI	n.a.	100%
BAC	**n.a.**	**n.a.**

Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail network is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines

Figure 6: Loading gauge compliance map (status at the end of 2022)



Source: BA Corridor study consortium elaboration based on TENtec data and sections; Notes: the map represents the P400 loading gauge parameter on the encoded TENtec sections excluding urban nodes; Sections entirely 'at standard' or 'not at standard' have been marked with green and red respectively; The analysis does not apply to the missing links marked with dotted grey, and to the sections classified in the Regulation (EU) 1315/2013 as passenger lines, marked with grey

Further to axle load, speed and train length compliance, which are particularly relevant for freight transport, ERTMS deployment is of importance for both freight and passenger transport. ERTMS deployment is progressing and by 2022 the ERTMS related technology was available on 35% of the Corridor sections.

The main sections of the railway infrastructure are therefore still affected by issues pertaining to legacy systems and lack of interoperability. This includes the following cross-border sections, where the achievement of compliance is considered of critical importance for the development of long distance traffic on the TEN-T Core Network:

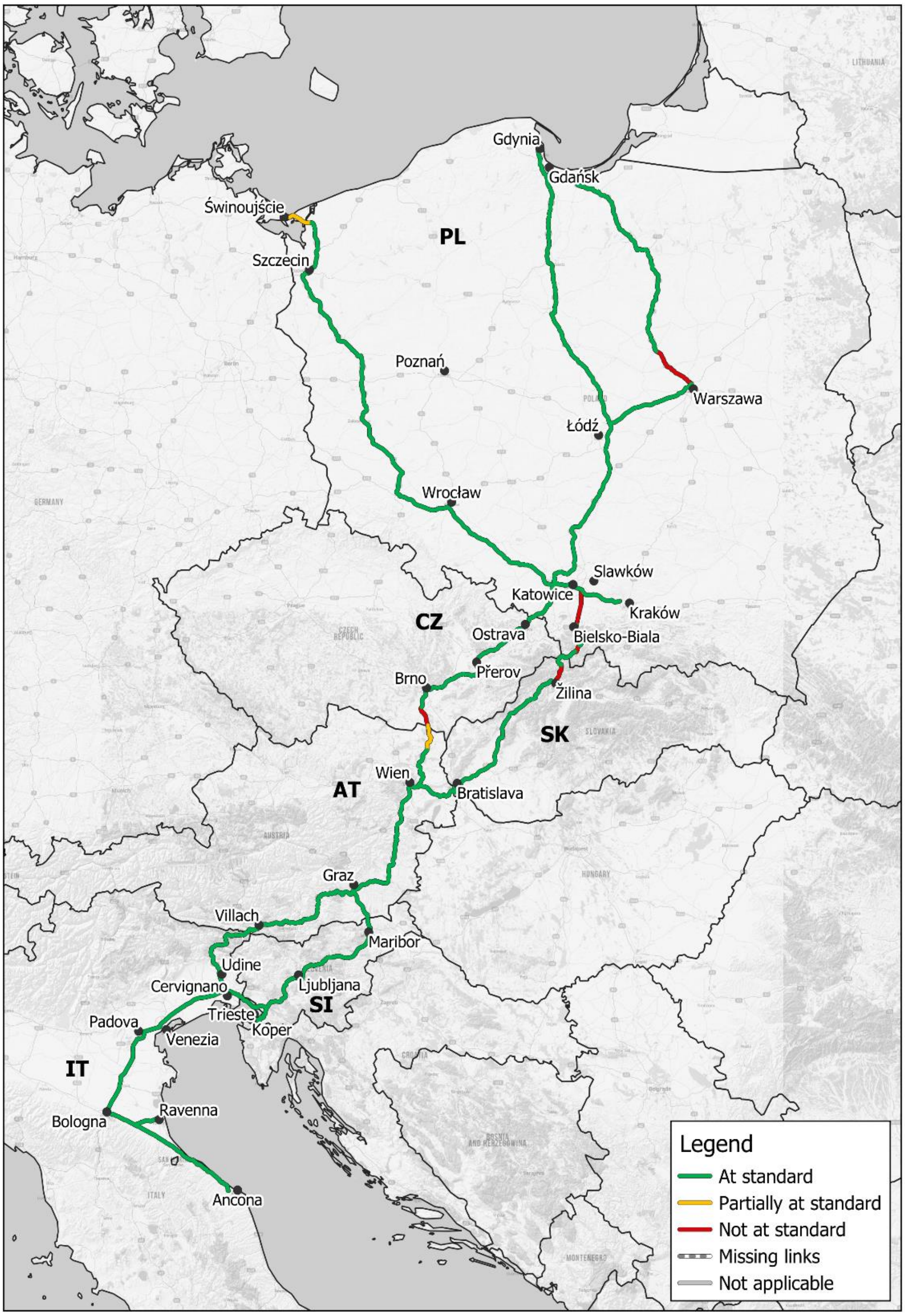
- Opole (PL) – Ostrava (CZ) – Brno (CZ), affected by issues relating to maximum operating speed (on the Polish side), train length and ERTMS;
- Katowice (PL) – Ostrava (CZ) – Brno (CZ), affected by issues relating to maximum operating speed (on the Polish side), train length and ERTMS;
- Katowice (PL) – Žilina (SK), affected by issues relating to maximum axle load, maximum operating speed, train length and ERTMS;
- Bratislava (SK) – Wien (Stadlau) (AT), via Devínska Nová Ves (SK) – Marchegg (AT), lacking electrification and ERTMS deployment;
- Graz (AT) – Maribor (SI), affected by issues relating to maximum operating speed (on the Slovenian side), and ERTMS (partially implemented on the Slovenian side);
- Venezia (IT) - Trieste (IT) - Divača (SI) – Ljubljana (SI), affected by issues relating to maximum operating speed, particularly between Trieste and Ljubljana, as well as train length and ERTMS (on the Italian side).

Road

The 3,795 km road infrastructure on the Baltic-Adriatic Corridor is not entirely compliant with the requirements of the TEN-T Regulation, especially with regard to the standard of the infrastructure (expressway/motorway standard). Currently, about 5% of the road corridor infrastructure is not compliant with this TEN-T requirement, particularly at the following cross-border sections, where the achievement of compliance is considered critical for the development of long distance traffic on the TEN-T Core Network:

- Katowice (PL) – Žilina (Brodno) (SK), particularly sections Bielsko-Biała – Kosztowy and Milówka – Przybędza (PL) and Oščadnica – Žilina-Brodno (SK);
- Brno (CZ) – Wien (Schwechat) (AT), particularly between Pohořelice (CZ) and Poysbrunn (AT).

Figure 7 Road compliance map (status at the end of 2022)



Source: BA Corridor study consortium elaboration based on TENtec data and sections

Airports

In accordance with the requirements of the TEN-T Regulation, the two core airports of Wien and Warszawa (Chopin) are already connected to the Baltic-Adriatic Corridor rail network. In addition, a rail connection exists for the Gdańsk, Kraków, Szczecin, Ostrava and Bologna airports, whereas rail interconnection projects are under development at Bratislava, Katowice and Venezia.

1.7. Evolution over time of the KPI's per Member State

An analysis of the evolution of the infrastructure KPI's by Corridor Member State for all transport modes is provided below. This concerns the parameters related to the requirements set in the Regulation (EU) 1315/2013 relevant for each Member State. This is based on a deviation analysis performed by comparing the infrastructure parameters for the years 2013 and 2020 on the core network, with the 100% target value set in the TEN-T Regulation.

Poland

The infrastructure KPI values for the Baltic-Adriatic Corridor in Poland are presented in Table 4 for the baseline year 2013 and for 2022.

Table 4: Infrastructure KPIs of the Baltic-Adriatic Corridor in Poland (status at the end of 2022)

	Key performance indicator	2013	2022	2022 vs 2013
Rail network	**Electrification**	100%	100%	(=)
	Track gauge 1435mm	100%	100%	(=)
	ERTMS implementation	0%	35%	(+)
	Line speed (>=100km/h)	50%	76%	(+)
	Axle load (>=22.5t)	80%	94%	(+)
	Train length (740m)	28%	46%	(+)
Road network	**Express road/motorway**	66%	93%	(+)
Airports	**Connection to rail by 2050 (Warsaw)**	100%	100%	(=)

Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued

Works for the modernisation and upgrade of the Corridor infrastructure have been completed in Poland since 2013, with significant progress made, in particular, with regard to the rail and road infrastructure. On the other hand, efforts are still required to modernise the critical rail cross-border sections connecting Poland to Czechia and Slovakia, and to resolve persisting issues concerning the infrastructure on the national railway lines. In particular, the following lines are either not at standard or partially at standard in terms of maximum operating speed for freight transport: Line E 30 Opole – Katowice (in particular sections Opole Groszowice – Kędzierzyn Koźle), Line E 59 Świnoujście – Poznań (via the by-pass section Poznań Górczyn - Poznań Starołęka - Poznań Franowo - Swarzędz/Zieliniec - Kiekrz) – Wrocław – Opole. It is still not possible to run 740 meter trains on the Western Corridor branch. ERTMS deployment has so far only concerned the Eastern branch and the Western branch between Wrocław and Opole.

Along the Corridor, stations and junctions are gradually undergoing modernisation and upgrade in Poland, while in core urban nodes speed restrictions persist in Warszawa, Gdańsk, and Kraków. Moreover, the Corridor is not at standard in Łódź, Katowice, Szczecin, Poznań, Wrocław. Concerning the axle load parameter, the network is also not at standard in Łódź and it is only partially at standard in Warszawa, Wrocław, Poznań. Operation of 740 meter trains is only possible across the Gdańsk and Szczecin urban nodes. ERTMS is not deployed at any of the core urban nodes in Poland.

Further to the need to complete the upgrade of the critical road cross-border infrastructure to Slovakia, between Katowice and the State border, the road infrastructure is either not at standard or only partially at standard along the following itineraries:

- S3 Świnoujście – Szczecin;
- S7/S8: Gdańsk – Warszawa;

Concerning transport nodes, the Warszawa airport is already connected to the Corridor rail lines.

Czechia

The Czech rail network has gradually been modernized over the past decades. Train length is the only parameter of the TEN-T standards which is currently not achieved on the Corridor.

Table 5: Infrastructure KPIs of the Baltic-Adriatic Corridor in Czechia (status at the end of 2022)

	Key performance indicator	2013	2022	2022 vs 2013
Rail network	**Electrification**	100%	100%	(=)
	Track gauge 1435mm	100%	100%	(=)
	ERTMS implementation	0%	76%	(+)
	Line speed (>=100km/h)	99%	100%	(+)
	Axle load (>=22.5t)	99%	100%	(+)
	Train length (740m)	0%	0%	(=)
Road network	**Express road/motorway**	78%	85%	(+)

Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued

Constraints on the speed standard for freight transport are currently limited to the Brno node and Ostrava core urban node. It is also important to mention that the 78.8 km long railway section Přerov – Brno, which according to Regulation (EU) 1315/2013 belongs to the core network for passenger transport and to the comprehensive network for freight transport, is not at standard with regard to axle load. In addition, the line is also partially not at standard with respect to maximum operating speed for freight transport. Since the adoption of the current TEN-T Regulation, significant progress was made in the deployment of ERTMS, which, however, is still to be fully installed along the itinerary of one of the two critical cross-border sections with Poland, between Bohumín and Chałupki, as well as on the Brno – Přerov section and in the Brno node.

The road transport infrastructure requires upgrades on the critical road cross-border section between Brno and the border with Austria, and on the 10.6 km D1 section between Přerov and Říkovice.

Slovakia

The railway infrastructure between Púchov – Považská Teplá – Žilina, and between Žilina – Krásno nad Kysucou and Čadca – Zwardoń has been modernised. Further to the need to complete the electrification of the network on the critical cross-border section with Austria, limitations persist with regard to the speed standard for freight transport on the itinerary of the critical cross-border section with Poland, between Žilina and the State border, as well as within the Bratislava node. Progress has been made concerning the 740 meter train length standard for freight transport and, in particular, with regard to ERTMS deployment. On both parameters, the gaps in the infrastructure primarily concern the two critical cross-border sections with Poland and Austria, Žilina node and Bratislava core urban node.

Table 6: Infrastructure KPIs of the Baltic-Adriatic Corridor in Slovakia (status at the end of 2022)

	Key performance indicator	2013	2022	2022 vs 2013
Rail network	**Electrification**	99%	99%	(=)
	Track gauge 1435mm	100%	100%	(=)
	ERTMS implementation	0%	79%	(+)
	Line speed (>=100km/h)	84%	93%	(+)
	Axle load (>=22.5t)	100%	100%	(=)
	Train length (740m)	29%	77%	(+)
Road network	**Express road/motorway**	81%	91%	(+)

Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued

On the road cross border section with Poland, there has been progress over the past years in the upgrade of the existing infrastructure. Gaps are currently limited to the sections between Žilina and Čadca.

Austria

The Corridor railway lines in Austria are complete and in operation. The Corridor is overall at standard, with the exception of the two Alpine crossings. There is also the need to complete the electrification of the critical cross-border section with Slovakia, between Wien and the State border. Speed restrictions for freight transport are present on the Wien Meidling – Wien Inzersdorf section, however, since the section is 4.5 km and located in an urban area, this is not considered to be critical for the functioning of the Corridor. Since 2013, some progress was achieved concerning the deployment of ERTMS. In Austria it is possible to run 740 meters trains on the Corridor lines under normal railway operation conditions (*operational compliance*).

Table 7: Infrastructure KPIs of the Baltic-Adriatic Corridor in Austria (status at the end of 2022)

	Key performance indicator	2013	2022	2022 vs 2013
Rail network	**Electrification**	92%	92%	(=)
	Track gauge 1435mm	100%	100%	(=)
	ERTMS implementation	0%	18%	(+)
	Line speed (>=100km/h)	99%	99%	(=)
	Axle load (>=22.5t)	100%	100%	(=)
	Train length (740m) *	100%	100%	(=)
Road	**Express road/motorway**	94%	99%	(+)

network				
Airports	**Connection to rail by 2050 (Wien)**	100%	100%	(=)

*Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued; 4) *In Austria 740 meters long trains are possible to be operated on the corridor lines under normal railway operation conditions*

The road critical cross-border section with Czechia is the only section where upgrades are still required to achieve the standards of the TEN-T Regulation. However, these are limited to the short 9 km section between Poysbrunn and Drasenhofen/State border with Czechia, which is currently foreseen to be completed by 2031. The transport nodes KPI's show that the Wien airport is connected to the Corridor rail lines.

Italy

Overall, the Corridor rail network in Italy is at standard, with the exception of the cross-border section between Italy and Slovenia. The 1 km long Venezia Mestre – Portogruaro connection and the 8.9 km long Granarolo – Faenza (on the Ravenna – Faenza route) are also not at standard in terms of operating speed. Both are not considered critical for the functioning of the Corridor as the former is located in the Venezia urban area while the latter presents a speed standard of 90 km/h while being used for capacity management purposes with the existing parallel line Castel Bolognese – Ravenna. ERTMS is not deployed on any Corridor line. Finally, 740 meter train operation is not possible on the Corridor.

Table 8: Infrastructure KPIs of the Baltic-Adriatic Corridor in Italy (status at the end of 2022)

	Key performance indicator	2013	2022	2022 vs 2013
Rail network	**Electrification**	100%	100%	(=)
	Track gauge 1435mm	100%	100%	(=)
	ERTMS implementation	0%	0%	(+)
	Line speed (>=100km/h)	96%	96%	(=)
	Axle load (>=22.5t)	100%	100%	(=)
	Train length (740m)	0%	0%	(=)
Road network	**Express road/motorway**	100%	100%	(=)

Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued

The road corridor infrastructure was already at standard in 2013.

Slovenia

The Corridor railway lines in Slovenia are complete and in operation. The second track between Koper and Divača is also under construction, which will add capacity to the existing line. Though, the Corridor railway lines in Slovenia are either not at standard or partially at standard in terms of maximum operating speed, including at stations and main nodes, i.e. Zidani Most and Ljubljana. Modernisation works are ongoing and since 2013 significant progress has been achieved concerning axle load and ERTMS deployment. In Slovenia operation of 740 meter long trains is possible on the Corridor lines under normal railway operation conditions (*operational compliance*).

Table 9: Infrastructure KPIs of the Baltic-Adriatic Corridor in Slovenia (status at the end of 2022)

	Key performance indicator	2013	2022	2022 vs 2013
Rail network	**Electrification**	100%	100%	(=)
	Track gauge 1435mm	100%	100%	(=)
	ERTMS implementation	0%	95%	(+)
	Line speed (>=100km/h)	18%	25%	(+)
	Axle load (>=22.5t)	76%	100%	(+)
	Train length (740m) *	100%	100%	(=)
Road network	**Express road/motorway**	100%	100%	(=)

*Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued; 4) *In Slovenia 740 meters long trains are possible to be operated on the corridor lines under normal railway operation conditions*

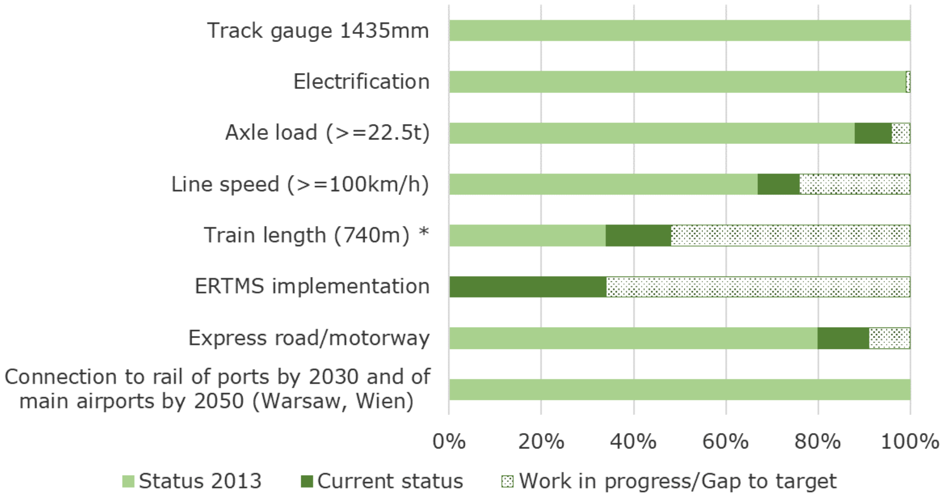
The Corridor road network is at standard, with the exception of the cross-border section between Villa Opicina and Sežana that requires works for the removal of customs and check point buildings, still present on the road.

3 Persisting bottlenecks and missing links

1.8. Gap to target analysis

With reference to the set of KPIs subject of appraisal in this report, a gap to target analysis has been performed for the whole corridor, which compares the infrastructure parameters for the years 2013 and the status in 2022, with the 100% target value set in the TEN-T Regulation for the core network by 2030.

Figure 8: KPI based *gap to target* chart



*Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued; 4) *In Austria and Slovenia 740 meters long trains are possible to be operated on the corridor lines under normal railway operation conditions*

The following table also compares the KPIs values in 2022 with the ones included in the 5th BA Corridor Work Plan, representing the status of the corridor infrastructure in 2020.

Table 10: Infrastructure KPIs of the Baltic-Adriatic Corridor (2022 vs 2020)

KPIs	5th WP (2020)	2022	Change
Electrification	99%	99%	(=)
Track gauge 1435mm	100%	100%	(=)
ERTMS implementation	34%	35%	(+)
Line speed (>=100km/h)	76%	81%	(+)
Axle load (>=22.5t)	96%	97%	(+)
Train length (740m) *	48%	48%	(=)
Road network Express road/motorway	89%	95%	(+)
Connection to rail by 2050 (Warsaw, Wien)	100%	100%	(=)

*Source: Baltic-Adriatic corridor study consortium; Notes: 1) Latest KPIs data refer to December 2022; 2) The elaboration of the KPIs of the rail and road networks is based on the sections encoded in the TENtec database as of 2022, corresponding to a total length of the corridor links of the rail network of 4,472 km, of which 3,855 km classified as freight or mixed passengers and freight railway lines; and 3,795 km of roads; 3) According to the criteria adopted in the ERTMS Deployment Plan (EDP), ERTMS related percentages refer to the length of the sections where ETCS is already in operation, i.e. where an authorisation of the trackside by the national safety authority has been issued; 4) *In Austria and Slovenia 740 meters long trains are possible to be operated on the corridor lines under normal railway operation conditions*

The analysis shows that progress was made on the modernisation and upgrade of the Corridor rail infrastructure. Nonetheless, gaps still exist in terms of ERTMS deployment and the capability to run 740 meter freight trains. This later concerns more than 50% of the Corridor. The maximum speed standard for freight transport is not met on nearly 20% of the Corridor lines, which mostly concern Poland and Slovenia, whereas a small portion of the network is not a standard with respect to maximum axle load for freight transport, in Poland. The Corridor, moreover, is not electrified between Bratislava and Wien. Six out of nine rail cross-border sections along the Corridor are affected by one or more of these limitations, which are considered critical for the development of long distance traffic across the Union Member States:

- Opole (PL) – Ostrava (CZ) – Brno (CZ);
- Katowice (PL) – Ostrava (CZ) – Brno (CZ);
- Katowice (PL) – Žilina (SK);
- Bratislava (SK) – Wien (Stadlau) (AT), via Devínska Nová Ves (SK) – Marchegg (AT);
- Graz (AT) – Maribor (SI);
- Venezia (IT) - Trieste (IT) - Divača (SI) – Ljubljana (SI).

On some of these critical cross-border sections, capacity constraints are also present or may arise in the future due to the mixed use of passenger and freight traffic. The most important priority to be addressed in view of completing the Single European Transport Area is the modernisation as well as the physical and technological upgrade of the railway critical cross-border sections. Lack of interoperability issuing from compliance gaps is, however, not limited to railway cross-border sections. They extend to several parts of the network and are also present at railway nodes, including within core urban areas. The strengthening of interoperability at the cross-border sections will only pay off if these gaps are bridged on the entire network, and it is thus a priority to complete the modernisation of the railway infrastructure, in particular, in Cohesion Member States along railway lines, including the nodes.

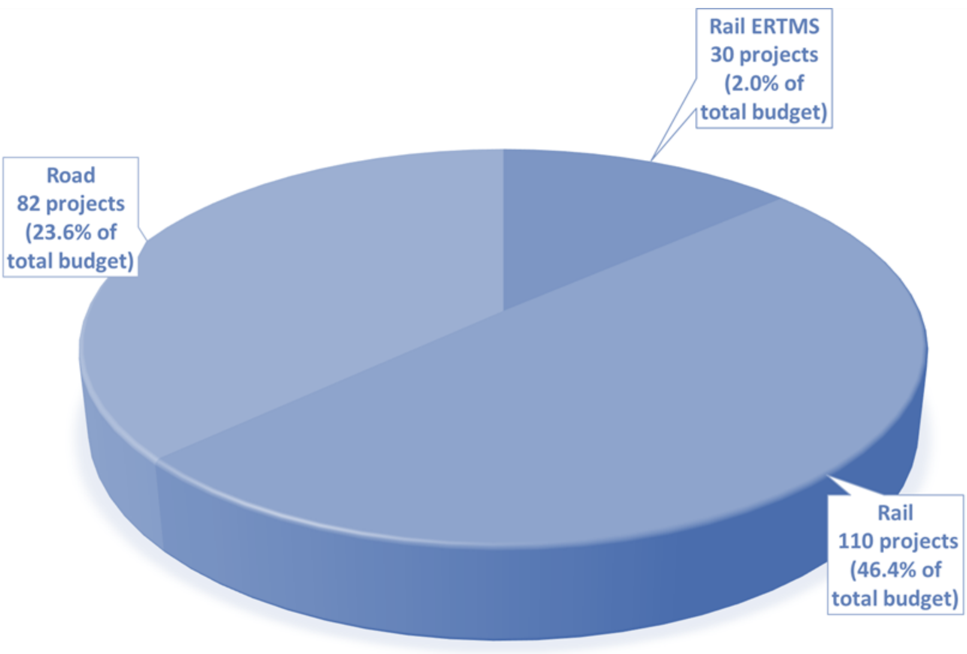
A complete and interoperable Corridor also requires the completion of the modernisation and upgrade of the road infrastructure. In fact, about 5% of the road network fails in meeting the standard required by the TEN-T Regulation. Compliance issues particularly affect the following road cross-border sections, which concern projects of high European added value:

- Katowice (PL) – Žilina (Brodno) (SK), particularly sections Bielsko-Biała – Kosztowy and Milówka – Przybędza (PL) and Oščadnica – Žilina-Brodno (SK);
- Brno (CZ) – Wien (Schwechat) (AT), particularly between Pohořelice (CZ) and Poysbrunn (AT).

1.9. Likely status of the Corridor in 2030

The following figures include details on the ongoing and planned projects related to the development of the rail and road transport infrastructure, from the Core Network Corridors' common project list updated in March 2023, annexed to the project Implementation Report 1/2023.

Figure 9: Rail and road ongoing and planned investments



Source: Core Network Corridors Common Project List – March 2023

Figure 10: Rail and road ongoing and planned investments

Source: Core Network Corridors Common Project List – March 2023

140 projects with a total value of more than EUR 40 billion and over 80 projects with a value of about EUR 20 billion are ongoing or planned, which are generally expected to improve the standards of the railway and road networks in view of achieving the requirements of the TEN-T Regulation. These projects are not only related to the improvement of the standards set out in the TEN-T Regulation, but also aimed at increasing capacity by means of physical and technological upgrade for both freight and passenger transport, including high-speed solutions for rail transport.

Based on the review of the ongoing and planned investments as of March 2023, the technical compliance maps for the railway and road infrastructure included in the 5th BA Corridor Work Plan (see Figure 11 and Figure 12 below) to represent the likely status of the Corridor by 2030, seem still valid overall.

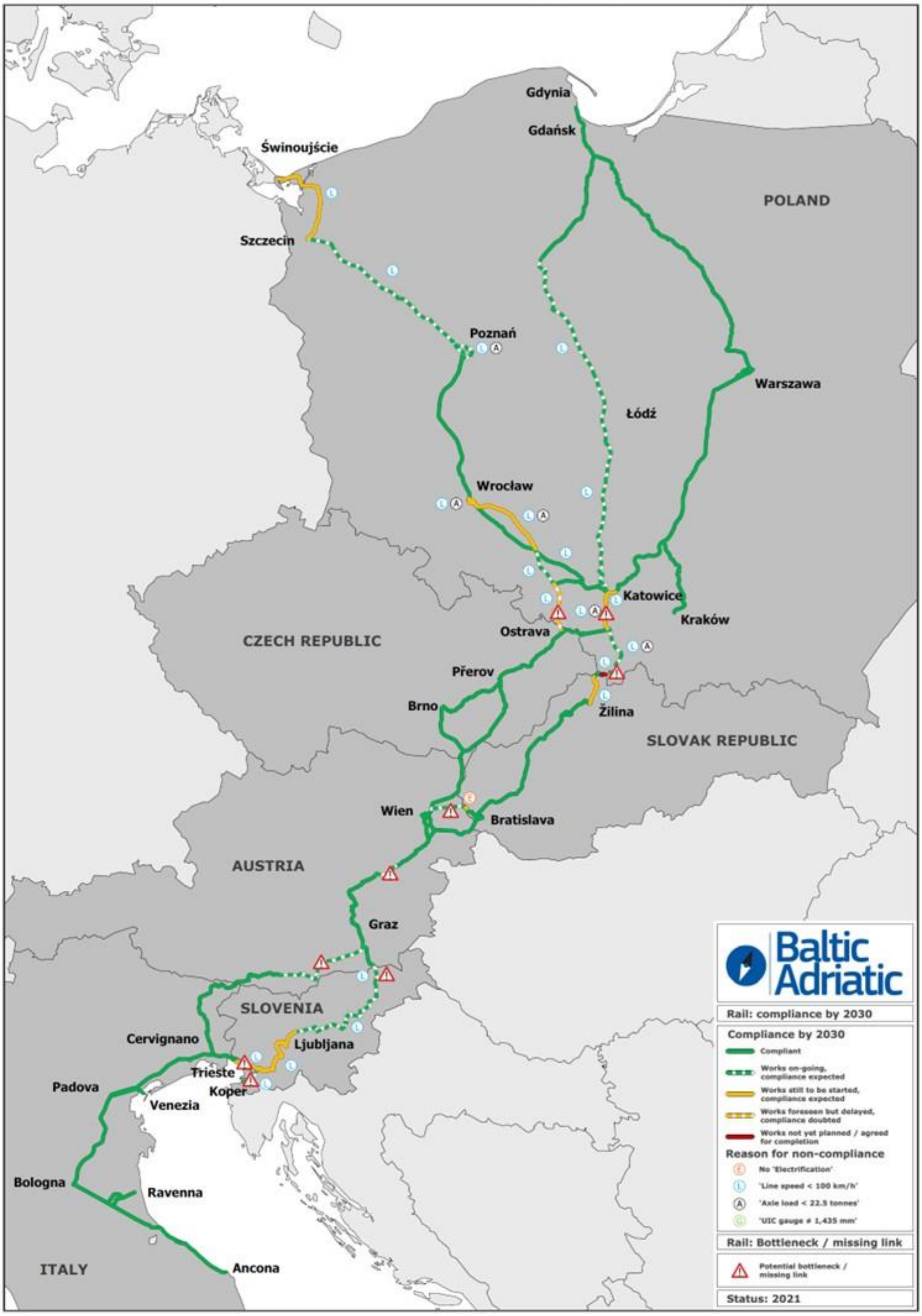
Based on current plans and foreseen projects, the rail network of the Baltic-Adriatic Corridor will be complete by 2030, including the two Alpine crossings in Austria and the second track Koper – Divača. In general, the Corridor is also expected to be at standard by 2030. This, however, is under the presumption that, for certain outstanding sections, Member States proceed to identify all necessary projects, define the scope of the projects, their costs, their time-schedule for implementation and secure financing. While this work has to be carried out with a view to reaching full compliance by 2030, the analysis of the corridor project list vis-à-vis the functioning of the Corridor rather points to the need to turn the plans and the project list into a more mature and stable pipeline of projects.

The investment analysis also shows that for some projects required to reach the standards foreseen in the TEN-T Regulation, costs or implementation dates are not defined, or delayed until after 2030. Furthermore, based on a gap analysis developed as part of the corridor study, assessing the effectiveness of the investments included in the corridor project list in achieving the TEN-T standards by 2030, several rail investments that are not defined at present would be required.

Provided that the plans for ERTMS deployment after 2023 will be confirmed, most of the identified gaps do not appear to represent major bottlenecks as concerns network interoperability, since they are assumed to be related to i) short segments of the Corridor, in particular, in urban areas or at stations where the speed target of 100 km/h for freight transport may not be achieved; and/or ii) to the achievement of the 740 meter train length parameter for freight transport on certain sections that might also be reached by means of operational solutions associated with the gradual implementation of infrastructure investments on other links; or iii) to the improvement of the parameters within the terminals at logistic nodes. Nonetheless, uncertainty persist about the scope of several planned projects, currently under definition/preparation, and their impact on the parameters of the infrastructure by 2030.

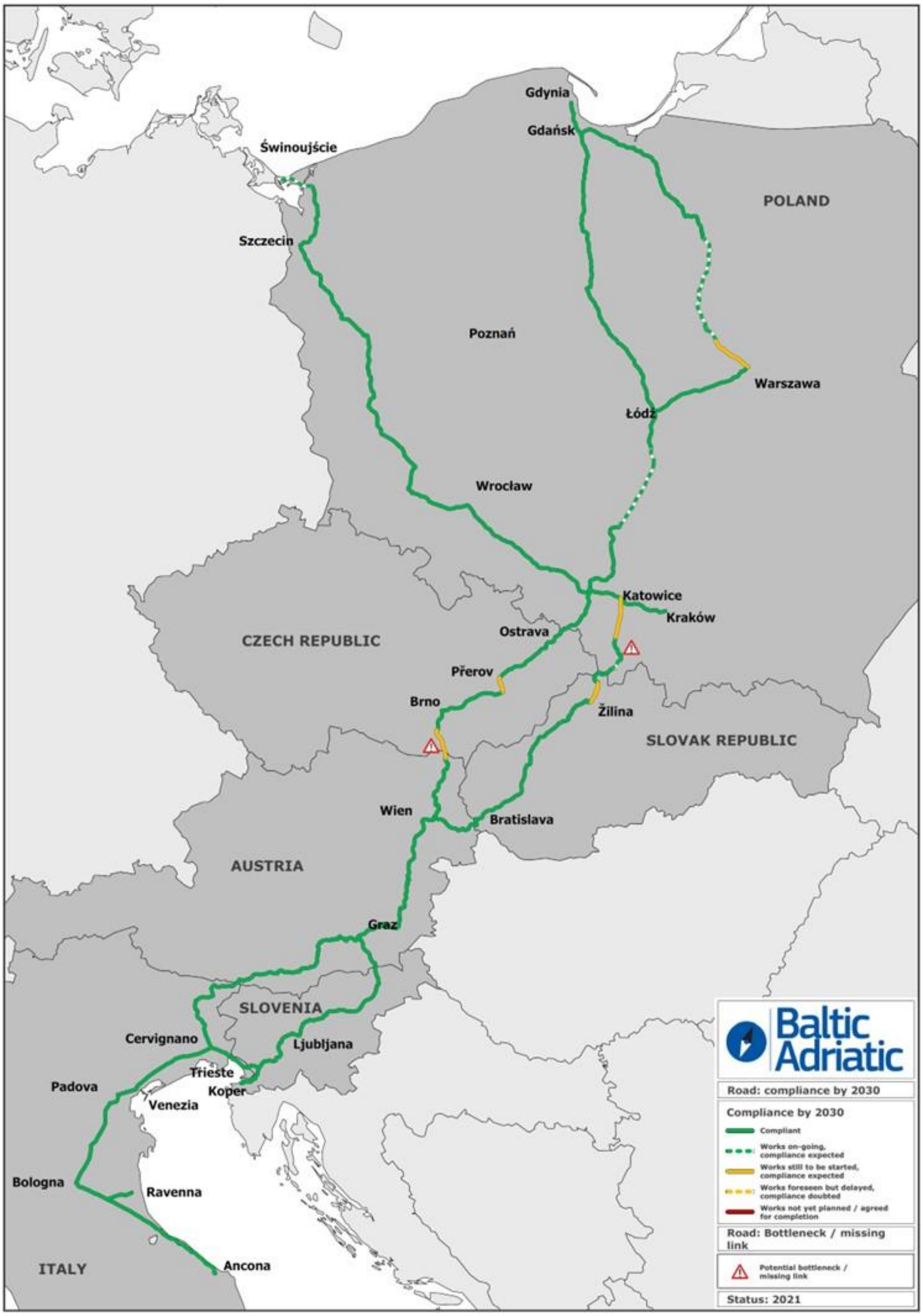
According to the planned investments, the BA Corridor road infrastructure is also expected to be fully compliant with the motorway/expressway standard by 2030, including the critical cross-border sections, except from the short 9 km section between Poysbrunn and Drasenhofen/State border, in Austria, along the cross-border itinerary Brno-Wien, where works are currently foreseen to be completed by 2031.

Figure 11: Rail compliance map by 2030 overview



Source: Baltic-Adriatic corridor study consortium; Notes: 1) For some projects in the list improving but not achieving the speed standard of 100 km/h for freight transport, information on the extent of the remaining gaps has not been provided/is not yet available. Accordingly it has currently been assumed that the gaps will be limited to short subsections that are not graphically represented; 2) Where at least a line crossing a urban node is at standard, the whole network in the same node is represented as such

Figure 12: Road compliance map by 2030 overview



Source: Baltic-Adriatic corridor study consortium

The tables overleaf provide details on the issues that are potentially affecting the implementation of the BA Corridor fully at standard by 2030, referring to the set of actions impacting on KPIs and related to the following BA Corridor Work Plan priorities:

- The modernisation and upgrade of the critical rail and road cross-border sections, including the deployment of digital cross-border links for the exchange of traffic data and provision of information services;
- The completion of the modernisation of the railway infrastructure, in particular, in Cohesion Member States;
- The interconnection between long distance, regional and local transport in urban nodes;
- The digitalisation of transport, including ERTMS deployment.

Based on the review of the Corridor project list and consultation with the concerned infrastructure managers and stakeholders, the development of a compliant Corridor by 2030 is challenged by financial constraints, technical difficulties and costs associated with the solutions to be adopted to meet the required standards. In turn, this also has an impact on the economic viability of the projects. This is particularly the case for the infrastructure within urban nodes, but it also affects the modernisation of main Corridor lines and cross-border sections. Requests for derogation from the speed standard in accordance with Art. 39, point 3 of the TEN-T Regulation are under consideration in Member States, in particular in Poland and Slovenia, with a view to achieving compliance. However, no information is currently available on the exact location and extent of the sections for which a possible derogation would be requested. Therefore, the compliance outlook, as depicted in the above maps, could not be elaborated with certainty, adding an element of risk to the achievement of a compliant Corridor by 2030.

Table 11: Gaps towards a fully at standard corridor in 2030 - Rail cross-border sections

Rail cross-border sections	Possible Gaps
Upgrading of the corridor cross-border connection: Opole (PL) – Ostrava (CZ) – Brno (CZ), between Opole and Ostrava	▪ Funding not secured ▪ Possible additional investments needed for speed (PL) and train length (PL-CZ)
Further upgrading of the cross-border connections Katowice (PL)/Opole (PL) – Ostrava (CZ) – Brno (CZ) in the Czech Republic, including upgrading to HS of the Brno - Přerov (Ostrava) rail line	▪ Completion after 2030 ▪ Possible additional investments needed for train length between Ostrava and Přerov
Upgrading of the corridor cross-border connection: Katowice (PL) – Žilina (SK) [Zwardoń (PL) – Skalité (SK)]	▪ Funding not secured and costs not defined (PL) ▪ Project solution to be fully defined (SK) ▪ Possible additional investments needed for speed (PL-SK) and train length (SK)
Further upgrading of the corridor cross-border connection: Brno (CZ) – Wien (Stadlau) (AT)	▪ Project costs not defined (CZ) ▪ Possible additional investments needed for train length between Brno and Břeclav
Upgrading of the corridor cross-border connection: Bratislava (SK) – Wien (Stadlau) (AT) [Devínska Nová Ves (SK) – Marchegg (AT)]	▪ Possible additional investments needed for train length (SK)
Upgrading of the corridor cross-border connection: Venezia (IT) - Trieste (IT) - Divača (SI) – Ljubljana (SI), between Trieste and Divača	▪ Completion date after 2030 (SI) ▪ Possible additional investments needed for speed

Source: Baltic-Adriatic corridor study consortium based on project list 2021 updated in March 2023

Table 12: Gaps towards a fully at standard corridor in 2030 – National railway lines

Railway lines	Possible Gaps
Upgrading and modernization of the Corridor lines in Poland	▪ Project solution still to be fully defined for line speed and train length between Świnoujście-Szczecin Port Centralny
Upgrading of the corridor lines in the Czech Republic (including the Brno node)	▪ Completion date unknown (Brno node) ▪ Possible additional investments needed for train length between Přerov and Ostrava
Upgrading of the corridor lines in Austria*	▪ ERTMS investment costs to be fully defined and completion date after 2030 (Wien)
Upgrading and modernisation of the Corridor lines in Slovenia*	▪ Completion date after 2030 (Ljubljana-Zidani Most) ▪ Possible additional investments needed for speed
Railway investments in urban nodes	▪ Completion after 2030 for Ostrava and Bratislava ▪ Possible additional investments needed in Poznań, Warsaw, Wien for speed and in Wroclaw for speed, axle load, train length

*Source: Baltic-Adriatic corridor study consortium based on project list 2021 updated in March 2023; *In Austria and Slovenia 740 meters long trains are possible to be operated on the corridor lines under normal railway operation conditions*

Table 13: Gaps towards a fully at standard corridor in 2030 – Road cross-border sections

Road cross-border sections	Possible Gaps
Road section Brno (CZ) – Wien (AT): Road section Pohořelice (CZ) – Schrick (AT)	▪ Completion date after 2030 (AT)
Road section Katowice (PL) – Žilina (SK)	▪ Investment costs not fully defined (SK)

Source: Baltic-Adriatic corridor study consortium based on project list 2021 updated in March 2023