European Commission

Rhine Danube

Third Work Plan of the European Coordinator

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This report represents the opinion of the European Coordinator and does not prejudice the official position of the European Commission.

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1 Towards the Rhine-Danube Corridor updated Work Plan

1.1 Introduction

European Transport policy reached a major milestone in 2013 with the adoption of the TEN-T and CEF Regulations leading to a more efficient transport policy. The **core network approach** linking urban nodes, ports, airports and rail-road terminals is considered as the backbone of a European transport area, which guarantees the efficient connection with all European regions. With the Core Network Corridor Study in 2014 a major effort was achieved to identify missing links and sections of the corridor where missing links or reduced capacity are causing bottlenecks hampering the flow of passengers and freights. These bottlenecks have been the focus of discussion in a number of Corridor Forum meetings with national and regional representatives as well as with infrastructure stakeholders to identify the most urgent interventions and possible projects taking into account the available scarce financing.

This **multimodal network** approach supported by financial instruments shall boost the competitiveness of the European economy and contribute to sustainable growth and the development of the internal market. This new concept of TEN-T core network corridors underlines the need to go further than national visions for transport and encompass a trans-border vision on the way people and goods can move across Europe.

The Rhine-Danube Corridor covers all modes of transport and connects nine Member States, with six benefiting from the Cohesion Funds support. As a result, the Corridor faces several challenges, and, hence, there is absolute necessity for cooperation between Member States independently of their current socio-economic trends.

CEF funding

The EU has endeavoured to support the Corridors' development through the implementation of targeted investments by providing co-funding through the **Connecting Europe Facility** (CEF) instrument, which has completed 3 series of transport calls for proposals between 2014 and 2016.

It is interesting to notice that the first Call of the Connecting Europe Facility (CEF), issued in November 2014, has seen the submission of a large amount of projects from all Member States that, before the technical validity screening, were amounting to three times the available budget and even after the technical validity screening there was a request of funding which was more than double compared to the available European Commission contribution.

CEF Transport is endowed with a total budget of **23.4 billion EUR** from the General and Cohesion envelopes. So far almost 91% of this budget or namely **21.3** billion EUR has been allocated in EU grant support to transport projects most of which are ongoing. It is expected that these investments will create more than 450,000 job years by 2030.

Between 2014 and 2016 4 calls for proposals were launched for CEF Transport, resulting in 604 projects.

Most of the CEF-T funding is allocated to rail (73% of the total funding - **15.7 billion** EUR, **236** projects). Inland waterways projects (IWW) are second (together with road projects) in terms of budget, with the **48** Actions receiving a total of **1.6** billion EUR of CEF funding under funding Objective.

Projects submitted along the Rhine-Danube corridor have resulted in a high level of presentation and have received a high budget for their implementation.

In the course of the 2014 to 2016 CEF Transport calls a total of **117 project proposals** were selected in the Rhine-Danube Corridor. They will receive **4.9 billion EUR** on CEF funding (total investment costs of 8.8 billion EUR).

Furthermore, 10 proposals were submitted under the 2017 CEF Transport Blending Call at the first cut-off date in July 2017.

Need for Action

Still a lot has to be done and a coherent and well substantiated plan is necessary, in the entirety of the corridor across borders to achieve the ambitious transport network that has been drafted for the region.

In this sense, my contribution can help the National authorities to focus their limited funds to what are the most stringent needs and the most mature actions towards the implementation of the Corridor in all of its mode of transport components, making best use of all the financial options that are available and tailored according to actual situations and needs.

I have drafted the Work Plan in its first edition three years ago and it is with the experience and the information gained since then that I am drafting this third issue of the Work Plan.

When considering the transport aspect of rivers like Danube and Sava, it is also mandatory to keep in mind that they are not only a transport axis, but that they are also important as a natural habitat, recreation area, source of energy, water for irrigation and for drinking, etc.

Close cooperation with environmental experts is required from the beginning of all infrastructural projects aiming at improving navigability conditions on the rivers.

In this sense and taking stock from the "Joint Statement on Guiding Principles on the Development of Inland Navigation and Environmental Protection in the Danube River Basin" signed by Members States of the International Committee for the Protection of the Danube River (ICPDR), by the Member States of Danube Commission and by those Members of the International Sava River Basin Committee (ISRBC), I have promoted actions to coordinate activities between Directorate General for Transport and Mobility (DG-MOVE), Directorate General for Environment (DG-ENV) and Directorate General for Regional and Urban Policy (DG-REGIO). On 21 April 2016, these 3 Directorates-General agreed to set up a Mixed Environment and Transport External Expert Team, so called METEET, including waterway transport and infrastructure experts as well as environmental experts to provide advice to competent authorities in developing sustainable strategies, plans and projects in the field of inland navigation in the Danube, taking into account European environmental legislation from the beginning of the drafting process in order to analyse impact, constraints and possible mitigation and compensation measures at a very early stage.

Further than the importance of creating a real European transport area, the setting-up of a modern and functional TEN-T is a key element for EU growth, the creation of jobs and the fight against climate change and other negative externalities.

1.2 Road map to setting up the Corridor WP III

I presented the First Corridor Work Plan to the Member States at the end of 2014 based on the results of the Corridor study performed by a team of recognised consultants and in close consultation with the Corridor Forum through a series of meetings with Member States and infrastructure stakeholders. After consultation

process with the Member States the First Work Plan was adopted and issued in May 2015. Subsequently the work on the updating and refinement of the First Work Plan started in September 2015 with the support of the same external consultants for the second phase of the Corridor study. Three further meetings with the consultation Forum were held between September 2015 and June 2016 presenting and discussing the outcomes in the updating of the study and the Work Plan. I presented the Second Corridor Work Plan to the Member States in July 2016. After consultation process with the Member States this Second Work Plan was adopted and issued in December 2016.

The main issues in the development of the Rhine-Danube Core Network Corridor were presented and discussed in the Corridor Meeting during the TEN-T Days in Rotterdam in June 2016. Subsequently the work on the updating of the Work Plan continued with the support of the external consultant. Four more consultation Fora were held between September 2016 and December 2017. Alongside the Corridor Fora nine Working Group meetings on ports and inland waterways were organised between 2014 and 2017. The following sections include the main findings and conclusions of the activities performed towards an updated version of the Rhine-Danube Corridor Work Plan for 2018. In the closing section I will provide a set of recommendations taking stock of experiences gained and from the results of the study.

Besides technical considerations, it is necessary to draw political conclusions where priorities have to be set and which type of approach has to be taken according to the various political, technical, economic, environmental and social aspects that have emerged during the exploitation of the study and through the implementation of actions.

This Work Plan provides now a clear vision of the deployment of the Rhine-Danube Corridor, identifies where the bottlenecks are and stipulates those areas, where a need for action is required to resolve the bottlenecks.

2 Characteristics of the Rhine-Danube Corridor

2.1 Alignment of the Corridor

The Rhine-Danube Corridor is the main east-west link in continental Europe. It intends to enhance and improve transport interconnections across France, Germany, Austria, Czech Republic, Slovakia, Hungary, Croatia, Romania and Bulgaria all along the Main and Danube rivers to the Black Sea. It includes sections of former Priority Projects 7, 17, 18 and 22. The parts in the Czech Republic and Slovakia are also covered by the Rail Freight Corridor 9.[1]

Bulgaria and Croatia are only included in the Corridor as regards waterborne transport. This concerns ports and inland waterways of the Danube and Sava Rivers. Also, non-EU neighbouring countries are included in the analysis of the core waterway network:

- Serbia: related to inland waterways (Danube, Sava) and two ports (Beograd, Novi Sad);
- Bosnia and Herzegovina: related to inland waterways (River Sava);
- Ukraine: related to inland waterways (Danube).

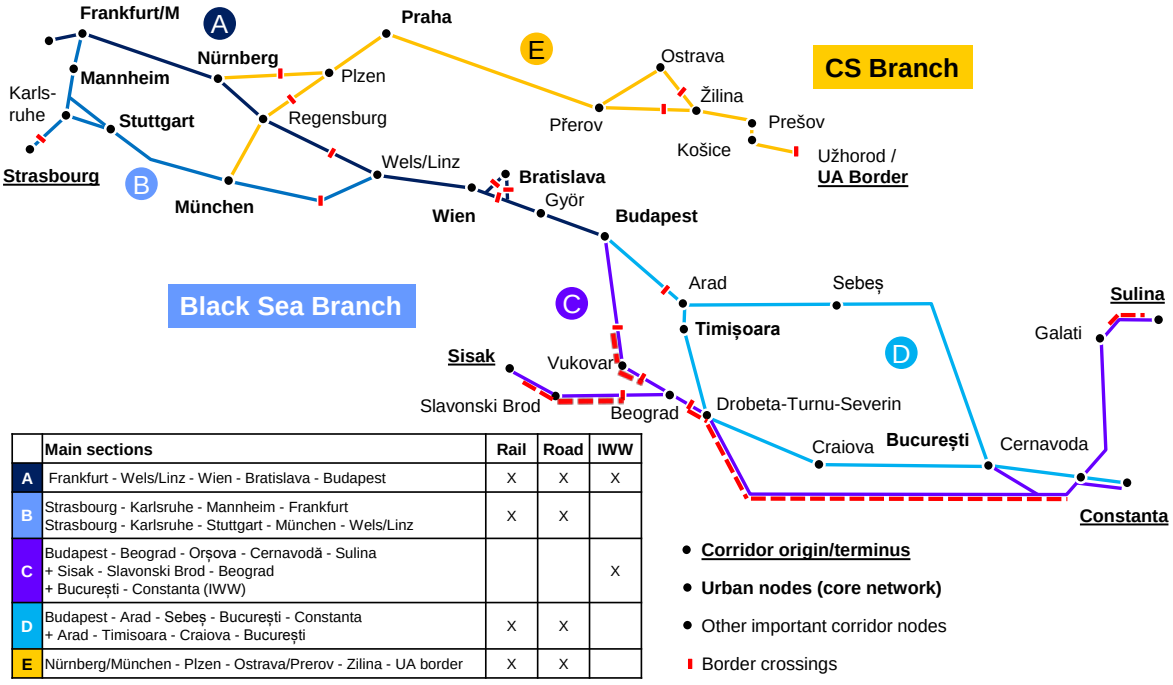
[1] *See Annex 1 of the Regulation (EU) 1316/2013 establishing the Connecting Europe Facility (CEF) RFC9 not yet operative.*[2] *It is however noted that in some stretches the target value is not valid, as it is not achievable by stream regulation and maintenance measures due to physical pre-conditions.*

The alignment of the corridor consists of the following main connections, as reported in the maps of the core and comprehensive network of the TEN-T Guidelines (Regulation 1315/2013) and according to Annex 1 of the CEF Regulation 1316/2013:

- Strasbourg – Stuttgart – München – Wels/Linz;
- Strasbourg – Mannheim – Frankfurt – Würzburg – Nürnberg – Regensburg – Passau – Wels/Linz;
- München/Nürnberg – Praha – Ostrava/Přerov – Žilina – Košice – UA border;
- Wels/Linz – Wien – Bratislava – Budapest – Vukovar;
- Wien/Bratislava – Budapest – Arad – Brasov/Craiova – București – Constanţa – Sulina.

Figure 1 shows the full alignment of the Corridor. In total, the Corridor consists of 5,715 km rail network, 4,488 km roads and 3,656 rkm inland waterways that cross nine EU-Member States and four non-EU Member States. There are 18 inland ports and 1 seaport. 11 airports form part of the Corridor. The Corridor counts 16 trimodal freight terminals and 27 terminals dedicated to rail and road only. 13 urban nodes are part of the Rhine-Danube CNC.

Figure 1: Alignment of the Rhine-Danube Corridor (all modes)



	Main sections	Rail	Road	IWW
A	Frankfurt - Wels/Linz - Wien - Bratislava - Budapest	X	X	X
B	Strasbourg - Karlsruhe - Mannheim - Frankfurt Strasbourg - Karlsruhe - Stuttgart - München - Wels/Linz	X	X	
C	Budapest - Beograd - Orșova - Cernavodă - Sulina + Sisak - Slavonski Brod - Beograd + București - Constanta (IWW)			X
D	Budapest - Arad - Sebeș - București - Constanta + Arad - Timisoara - Craiova - București	X	X	
E	Nürnberg/München - Plzen - Ostrava/Prerov - Zilina - UA border	X	X	

Source: HaCon

The Corridor can be split into two branches: the “Black Sea” branch towards southeast and the Czech-Slovak “CS” branch towards east.

The Black Sea branch has two different routes in Germany and Romania. For Germany there is a northern route via Frankfurt/Nürnberg/Passau and a southern route via Stuttgart/München/Salzburg. In Romania, the Corridor runs via Sebes as well as via Craiova. The section C of the Black Sea branch is exclusively dedicated to inland waterways (i.e. Danube and Sava).

The alignment of inland waterways includes the Main River starting with the confluence with the Rhine, which is connected to the Danube by the Main-Danube Canal at Kelheim and it includes the Danube all the way to the Black Sea. The CEF Regulation includes a pre-identified project on Sava up to the port of Sisak (HR), defined as a comprehensive port.

The CS Branch has two starting points (in München and Nürnberg) and runs via Plzeň and Praha towards Přerov in the Czech Republic. Beyond Přerov at Hranice na Morave the Corridor splits into the line via Ostrava, which is mainly dedicated for passenger traffic and the direct line via Púchov and Žiliná in Slovakia, which is manly used by freight traffic.

The Rhine-Danube Corridor has a number of overlapping and crossing sections with other Core Network Corridors (CNC):

- Orient/East–Med Corridor (starting at Vidin/BG, the western part in RO, HU, in CZ between Brno and Praha, Vienna node/AT and Bratislava node/SK)
- Baltic-Adriatic Corridor (in CZ between Přerov and Ostrava, Žiliná in Slovakia, Vienna node/AT)
- Scan–Med Corridor (in DE Würzburg – Nürnberg, München - Rosenheim)
- RALP Corridor (in DE on the Rhine between Frankfurt and Strasbourg)
- MED Corridor (Budapest node/HU)

In relation to the rail freight corridors (RFCs) overlaps exist mainly with the RFC7 Orient-East Med between the Wien and Craiova regions as well as with the future RFC Rhine-Danube that is currently being set-up.

Table 1 provides the background characteristics on network characteristics and socio-economic statistics of the catchment area for the Rhine-Danube Corridor.

Table 1: Background information on the Rhine-Danube Corridor

Indicator	Remarks/2010	2013	2014	2016
GDP in EUR*)	1,835 billion	1,957 billion (estimated)	2,009 billion (estimated)	--
Employment*)	42.30 million	42.64 mio	43.21 mio	--
Population*)	96.09 million	94.87 mio	94.43 mio	--
Rail network	-	5,715 km	5,715 km	5,715 km
Road network	-	4,470 km	4,470 km	4,488 km
Inland waterway network EU	Without the Tisza River (173 rkm) and the planned Danube–București Canal (112 km)	3,656 rkm	3,656 rkm	3,656 rkm
Seaports	Maritime/ IWW (mixed) port	1	1	1
Inland ports	Total no of ports	18	18	18
Airports	-	11	11	11
RRTs	Only RR/total (RR and trimodal)	27/41	27/41	27/43
Urban nodes	-	13	13	13
Number of missing sections - IWW	Danube - Bucuresti Canal	1	1	1
Number of missing links – high speed	Germany: new high-speed line Stuttgart-Ulm	2	2	2

Indicator	Remarks / 2010	2013	2014	2016
rail	Romania: new high-speed line București – Constanta			
Number of missing sections - road (aggregated)	Czech Republic: border section CZ/SK	1	1	1
	Slovakia: SK/CZ border, Hricovske Podhradie – Ukrainian border	2	2	2
	Romania	3	3	3
Kms of missing infrastructure - IWW	Danube - Bucuresti Canal	112	112	112
Kms of missing infrastructure – high speed rail	Germany: new high-speed line Stuttgart-Ulm	About 60	About 60	About 60
	Romania: new high-speed line București – Constanta**	About 220	About 220	About 220
Kms of missing infrastructure – motorway road	Hungary	-	56	33
	Czech Republic	-	58	58
	Slovakia	-	215	170
	Romania	-	968	720

*) *according to catchment area*

**) *According to EU Regulation 1315/2013, this new line shall be part of the TEN-T Core Network (Rail Passenger) and the Rhine-Danube Core Network Corridor (CNC); the existing line is defined as a CNC (Rail Freight) line. However, according to information provided by CFR-SA to the consultant team in July/August 2017, it is not planned to realise this new line before 2030.*

Source: Panteia Status 05/2016, study 09/2017

2.2 Compliance with the technical infrastructure parameters of the TEN-T Guidelines

Article 4 of the TEN-T Guidelines describes the objectives of the trans-European transport network. They shall lead to the creation of a single European transport area, which is efficient and sustainable, increases the benefits for its users and fosters inclusive growth and social, economic and territorial cohesion. The Member States agreed to the list of specific objectives, which have to be met by the Rhine-Danube Corridor by December 2030, the latest.

The TEN-T Guidelines contain certain priorities and requirements, general and mode-related. These provide the basis of the target values for 2030 on which compliance is checked. The compliance analysis compares the infrastructure baseline values of 2013 with the current parameters and with the target values set for the year 2030. The analysis uncovered the respective deficits on mode sections and nodes. To assist monitoring the achievement of the priorities, Key Performance Indicators (KPIs) have been defined. The results of the compliance analysis in 2014 provide the baseline value of 2013 for the generic supply-side KPIs that were defined (see Table 2).

From the overall RD Corridor perspective the KPI values for the inland waterway network refer to the **entire stretch of the Danube and the Sava River** (Member States, Serbia and Bosnia and Herzegovina) in the following Table 2.

Table 2: Generic supply-side KPI

Mode	KPI	Baseline value 2013
Rail network	Electrification	91%
	Track gauge 1435mm	100%
	ERTMS implementation	7%[1]
	Line speed >=100km/h (relevant for freight traffic)	95%
	Axle load >=22.5t (relevant for freight traffic)	75%[2]
	Train length (740m) (relevant for freight traffic)	47%
IWW network[3]	CEMT requirements for class IV IWW	85%
	Permissible Draught (min 2.5m)	77%
	Permissible Height under bridges (min. 5.25m)	86% (5)[4]
	RIS implementation (minimum requirements set out by the RIS directive are met)	95%
	Targeted depth according to waterway manager reached[5]	45%
Seaport	Connection to rail	100%
	Connection to IWW CEMT IV	100%
	Availability of clean fuels	0%
	Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	100%
	Facilities for ship generated waste	100%
Inland ports	Class IV waterway connection	100%
	Connection to rail	89%
	Availability of clean fuels	0%
	Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	100%
Road network	Express road/ motorway	77%
	Availability of clean fuels	available
Airport	Connection to rail[6]	67%
	Availability of at least one terminal open to all operators in a non-discriminatory way and application of transparent, relevant and fair charges	100%
	Capacity to make clean fuels available to airplanes	0%
	Availability of clean fuels (ground services)	67%
Rail Road Terminals (RRT)	Capability for Intermodal (unitised) transhipment	44%
	740m train terminal accessibility	2%
	Electrified train terminal accessibility	16%
	Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	100%

[1] *Includes level 1, 2 and 3 ERTMS implementation*
[2] *Compliance figures modified due to new information on permitted axle load in Romania, provided by CFR-SA to the consultant team in July/August 2017*
[3] *Member States and Western Balkan*
[4] *Number of bridges, which do not comply with the KPI*
[5] *Corridor specific indicators (It is however noted that in some stretches the target value is not valid, as it is not achievable by stream regulation and maintenance measures due to physical pre-conditions.)*
[6] *Considers only airports, which are to be connected to rail by 2050*

Source: study team 09/2017

Later on the KPI values for the inland waterway network are referring to the Danube River in the Member States only.

Although a high level of compliance of the infrastructure of the Rhine-Danube Corridor with the requirements of the Regulation 1315/2013 in 2013 was identified, important steps will still to be taken to full compliance.

Rail network

91% of the rail lines are electrified and gaps only relate to some sections in Germany (München-Mühldorf-Salzburg), the cross-border sections between Germany and the Czech Republic and in the Czech Republic. The entire rail infrastructure of the corridor provides for standard gauge (1,435 mm). An operating speed of at least 100km/h for freight traffic is enabled at more than 90% of the rail lines. Line sections with insufficient operating speeds are located on the “CS branch” and on the eastern part on the “Black Sea branch” (Romania; Hungary: local speed drops in Budapest node). Lowest compliance rates for rail relate to axle load, train length and ERTMS. 75% of the rail network allows for 22.5 tonnes axle load; this value incorporates new information on Romanian infrastructure provided by CFR-SA to the consultant team in July/August 2017. Line sections not fulfilling the requested standards are mostly located in Hungary and Romania. If speed limitations are accepted, the required axle load may be reached in Hungary. A maximum train length of 740m is permitted at 47% of the rail infrastructure. Sections which only provide for shorter trains are located on the “CS branch” (CZ/SK) as well as in Romania and on some sections in Austria. Operational ERTMS is exceptional at the Rhine-Danube Corridor and restricted to some line sections in Austria and Hungary.

Inland waterway network

85% of the inland waterway network, including Serbia, is classified as a class IV waterway or higher, only the Sava River is assigned to a lower class. A draught of 2.50m is targeted to be reached at 77% of the inland waterways. Shortfalls relate not only to the above mentioned sections of the Sava but also to the Upper Main and the Danube between Straubing and Vilshofen (1.6m at 94% of days per year)[2]. Five bridges offer a clearance below 5.25m; 86% of the sections length complies with the requirement. Two of the bridges can represent a particular challenge for the navigation of passenger vessels and would also represent an obstacle if container transport on the Danube develops. With the exception of the river Tisza (not part of the RD Corridor), Information Services are available along the Inland Waterway Core Network (95%) but to a different extent and quality. International and national exchange of fairway or traffic related data between the RIS operators is not always ensured. The specific indicator showing the percentage of section kilometres on which the targeted fairway depth was met, reveals the particular challenges of the Rhine-Danube Corridor. Achievement of targeted depths varies dynamically as it depends not

[2] *It is however noted that in some stretches the target value is not valid, as it is not achievable by stream regulation and maintenance measures due to physical pre-conditions.*

only on the waterway infrastructure conditions, but mainly on the hydrologic circumstances. Above all at free flowing river sections, they are challenging to be met. In 2013 the targets were met at 45% of the inland waterways sections length, in 2014 at 58%, in 2015 at 42% and in 2016 at 40%.

Ports

The majority of the Corridor core ports comply with the requirements set by Regulation. Only two ports, Vidin (BG) and Cernavodă (RO), do not meet the minimum depth and therefore require dredging activities. All core ports[3] have a road connection but of varying quality in terms of number of lanes and capacities. The situation is similar in view of railway connection; only two ports, Komarom (HU) and Cernavodă (RO), have no fully functional rail connection to the hinterland and the rest of the network. The level of availability of intermodal facilities in ports is varying and, generally, declines further downstream. There are five ports with reported incompliances in the provision of intermodal facilities: Komarom (HU), Slavonski Brod (HR), Drobeta Turnu Severin (RO), Calafat (RO) and Cernavodă (RO), but the ports of Slavonski Brod (HR) and Drobeta Turnu Severin (RO) have reported projects tackling this issue. Plans for alternative clean fuel facilities have been reported by the Port of Constanţa, Port of Bratislava and Port of Enns while some of the remaining core ports on the Corridor took part in the LNG Master Plan on the Rhine-Main-Danube axis, meaning that plans for provision of alternative clean fuels facilities might be considered at a later stage depending on the timing of actual introduction of LNG fuelled vessels into operation on the Danube, creating the initial demand. Irrespective of this project, the Port of Ruse completed a LNG terminal with fuelling facilities for future LNG vessels in 2015. As regards the shore-side (external) supply of electricity to vessels in ports, most of the ports reported the existence of shore-side electricity supply facilities for vessels, except for the ports of Wien (AT) and Galați (RO).

Rail-Road terminals

The compliance of intermodal terminals (rail – road and trimodal terminals), is rather low (see Table 2): in 2013 only 44% of the terminals are able to handle all three types of loading units (containers, swap bodies, semi-trailers). While the focus on single types of loading units might be explained by the past/current market orientation (e.g. focus on maritime or continental transport, key customers with special logistics profiles), the electrified rail access, which is fulfilled by only 16% of the sites and the limited length of the handling tracks, where only two sites fulfil the Regulation target, create a real burden for an efficient supply of intermodal transport services. The largest challenge for the present sites is their historically grown access to the rail infrastructure (single sided, non-electrified, annex to shunting yard or port railway line) and the limitation of the (wagon) train length by either the reception/departure siding or the transhipment track(s). Only Budapest BILK is proving transhipment tracks of ≥740m length, while four sites are covering the present industry standard of 700m. With respect to the criterion “non-discriminatory access” all terminals are basically fulfilling this requirement.

Road network

About 77% (2013) of the total length of roads is classified as motorways (express ways) and 23% (2013) are conventional roads. The majority of conventional roads are still in the eastern part of the corridor, in the Czech Republic, Slovakia and in Romania. Alternative clean fuels along the road corridor are provided to a limited extent; supply stations for compressed natural gas (CNG) and liquefied petroleum gas

[3] *Rhine ports are tackled in the study on Rhine-Alpine Corridor, while the Czech ports are tackled in the Orient-East Med Corridor study.*

(LPG) are available in all Member States at different density. Electric charging station and battery swap station deployment along the corridor is in the early stage of implementation. Different tolling systems are implemented on the road network in the Member States. First improvements in the provision of safe and secure parking areas for trucks have been established. The implementation of Intelligent Transport Systems (ITS) for managing the traffic on motorways has started around the urban nodes and also along the alignment of all motorways currently under implementation.

Airports

There are in total 11 airports along the Rhine-Danube Corridor, which can be assigned to Core network nodes. According to part 2 of Annex II of Regulation 1315/2013 there are 6 dedicated main airports that shall be connected with the trans-European rail network by 2050 wherever possible with a high-speed rail network connection: Frankfurt, München, Stuttgart, Praha, Wien and Budapest.

Airports assigned to the core network, which do not fall under the obligation of Art. 41(3) of Regulation 1315/2013 do not have to be connected to the TEN-T rail and road network by 2050; they are the remaining 5 airports of the list, namely: Nürnberg, Ostrava, Bratislava, București and Timișoara.

The airports of Frankfurt, Stuttgart, München and Wien have a rail connection (at least S-Bahn); Bucuresti and Ostrava have also a rail connection. Nürnberg, Praha, Bratislava, Budapest and Timişoara do not have a rail connection. Thus, the airport of Praha (Václav Havel International) and Budapest Airport (Ferenc Liszt International) are to be connected to rail by 2050. Relevant studies for rail connections are under preparation. Frankfurt, Stuttgart, München and Wien started to make provisions for the use of alternative clean fuels for ground services. Charging stations for e-cars are under implementation. No provision for the supply of clean fuels for aircrafts has started. All airports have cargo terminals, which are open to all operators in a non-discriminatory way.

2.3 Progress of Corridor development

Member States have started to implement a number of measures in order to achieve an operational trans-European transport network in line with the provisions of Regulation 1315/2013 by 2030. However, KPI values improved slightly in the period between December 2013 and December 2016.

86 projects with an investment volume of 5.27 bn EUR have been completed in that period (about 15% of the total number of projects - 563 projects).

41% have started before or in the period and are classified as on-going projects with an investment volume of 37.8 bn EUR.

Out of this figure 117 projects receive CEF funding.

The main focal points of the projects completed are studies and infrastructure works (rehabilitation, upgrade and new construction).

Table 3: Scope of work of projects finalised in 2014, 2015 and 2016

Scope of work	Number of projects
Studies	23
Infrastructure works rehabilitation	15
Infrastructure works upgrade	29
Infrastructure works new construction	25
Maintenance equipment IWW	3
Rolling stock, vehicles, barges	5

Scope of work	Number of projects
Clean fuels provision	3
Administrative procedures (IWW ports)	2
Telematics applications (RIS, ITS, ERTMS)	10
Total (multiple scope assignment possible)	86

Source: Project list 2017, status 05/2017

The projects with the largest investment costs are listed in the following Table 4.

Table 4: Largest investment of projects finalised in 2014, 2015 and 2016

Project name	Project category	Member States	Cross-border section	Last-mile section	Pre-identified CEF section	Project end date	Total costs in mio EUR
Vienna Central Railway Station (Wien Hbf)	Rail	AT		x	x	2015	997.10
Works and studies for upgrading the Wien-Bratislava railway line in Austria (6 sub-projects)	Rail	AT	x	x	x	2015	846.60
New motorway construction: Orastie – Sibiu	Road	RO				12/2016	579.49
Modernisation of railway station Salzburg	Rail	AT		x	x	2015	224.30
Construction Nadlac - Arad Motorway	Road	RO	x			07/2015	207.52
St. Pölten Railway station	Rail	AT			x	2015	177.50
Optimisation of the rail stations between Zbiroh - Rokycany	Rail	CZ			x	2014	163.00
New motorway construction: Timisoara – Lugoj	Road	RO				12/2015	160.86
HU Motorway M43: Construction of a 2x2 lanes motorway between Makó-Csanadpalota-Nadlac Border HU/RO	Road	HU	x			07/2015	150.00

Source: project list 2017, status 05/2017

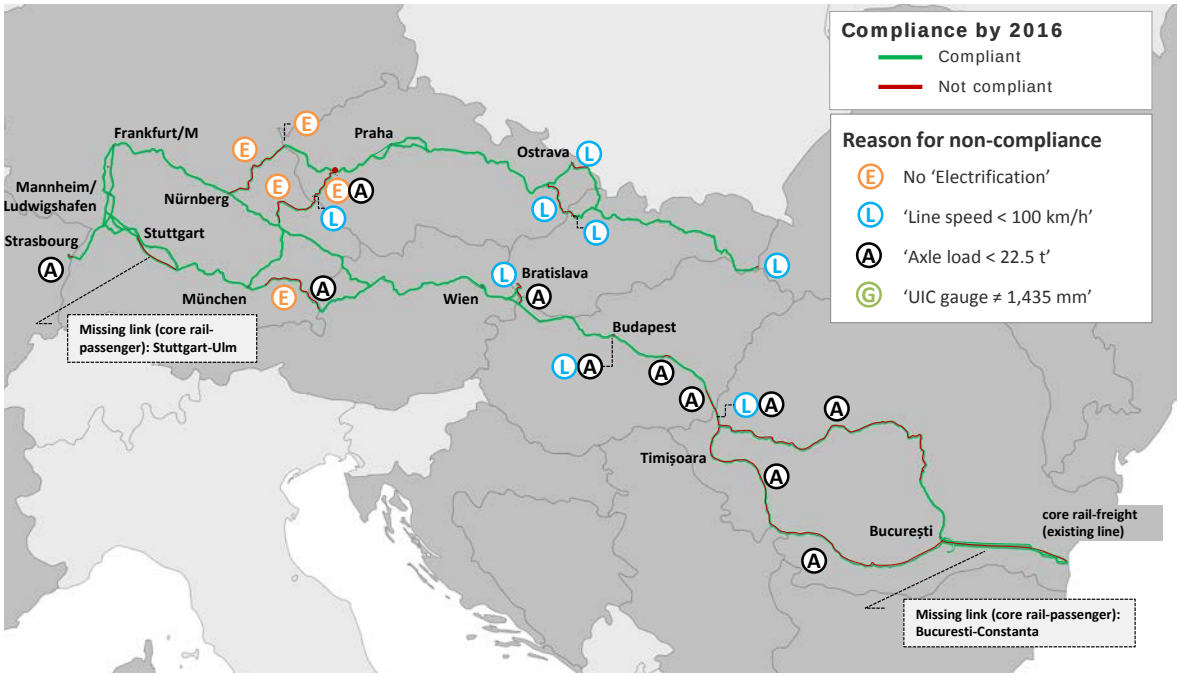
Rail

All recently completed rail projects are located in Austria and in the Czech Republic. Two Austrian projects refer to the new Wien main rail station and its connection to regional and long-haul rail traffic. Another four projects located in Austria deal with upgrades of stations and short sections of the "Westbahn" (Salzburg-Wien). These actions do not remedy non-compliant infrastructure as the requirements of the Regulation have already been fulfilled before. However, they adjust the configuration of rail stations to the demands of high-speed traffic; in this context, they enhance rail capacity and allow for higher speed of passenger trains. Also the finalised Czech Rail projects refer to line upgrades and modernisation of important nodes or station areas (e.g. Plzeň, Praha, Ústí nad Orlicí, Přerov). All these projects achieve and/or improve KPIs, mostly on a very detailed local level, such as upgrade of single tracks or switches in the stations, removal of level crossings or equipment of new passenger stations with up-to-date infrastructure and technology. Due to their small scale, the effects of these projects are not visible in the overall corridor compliance rates. In any case, they contribute to capacity enhancement on the CZ corridor lines by eliminating local bottlenecks. Three Czech rail projects are part of a global project dealing with the improvement of the cross border section and the corridor section between the DE/CZ border and Plzeň.

The corridor's status of compliance regarding the rail parameters 'Electrification', 'Line speed ≥ 100 km/h' and 'Axle load ≥ 22.5 tonnes' achieved by 12/2016 is presented in Figure 2. The figure also incorporates new information on permitted axle load in Romania, provided by CFR-SA to the consultant team in July/August 2017. Furthermore, one railway line between București – Constanta is marked as "missing link". According to EU Regulation 1315/2013, this new line shall be part of the TEN-T Core Network (Rail Passenger) and the Rhine-Danube Core Network Corridor (CNC) in parallel to the existing one (defined as CNC freight rail). However, according to information provided by CFR-SA to the consultant team in July/August 2017, it is not planned to realise this new rail passenger line before 2030[4].

[4] *The existing railway line București – Constanta allows mixed traffic of passenger and freight trains. This line has been upgraded until 2013; the maximum line speed for passenger trains is 160 km/h.*

Figure 2: Rail compliance by 2016

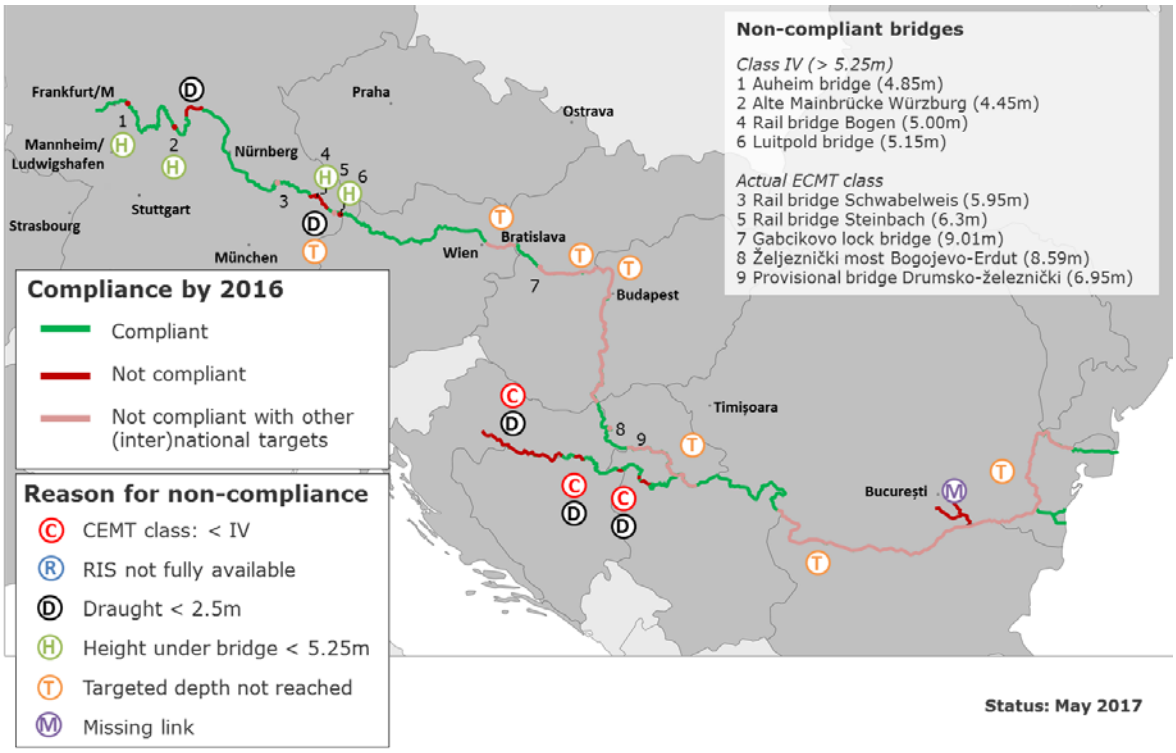


Source: HaCon, status 09/ 2017

Inland waterways

None of the implemented inland waterway projects (7) had an influence on the static KPIs. Only the dynamic indicator measuring the achievement of the targeted depth according to the waterway manager varies from year to year, depending on both, hydrological and infrastructure conditions. In the past shortcomings were tackled mostly on national level and often with limited success. Since the first CEF Transport Call progress was made through the realization of a number of activities (mainly studies with pilot activities having now not an impact to the KPIs), which prepare the works for the future, the improvement of fairway availability, add to the reliability of locks and most important support the coordination of national approaches towards the provision of a concerted infrastructure quality. Implementation of RIS at the Sava was finalized by the end of 2016. Works at the Upper Main to increase the allowed draught in line with the requirements of the TEN-T regulation are consistently progressing. Between Straubing and Vilshofen a decision to increase the draught to 1.80m was taken (but which is below the requirement of 2.50m), building permissions for the first part are still pending. Experiences from the "Integrated River Engineering Project East of Wien" are to be capitalised during the next implementation step and will contribute to the achievement of the targeted depths. River Training and Dredging Works between Bačka Palanca and Beograd (Serbia) have been prepared and approved in 2014; works and their supervision have been contracted in 2017. The on-going preparatory study "Fairway Danube" aims at improving navigation conditions through providing a better foundation for fairway related improvement measures.

Figure 3: IWW compliance by 2016



Source: viadonau, status May 2017

Ports

Ports KPIs have not changed since 2013 except for the positive change in terms of the availability of clean fuels. In 2015, the private company Bulmarket Ltd. completed a LNG terminal and LNG bunkering facility in the inland port in Ruse (Bulgaria). So far, there were no initiatives towards in-depth analysis (e.g. master plan similar to the "LNG Master Plan for the Rhine-Main-Danube") for large scale introduction of electric propelled vessels or vessels using any other type of alternative clean fuels other than LNG. Therefore, no considerations have been made on the possible provision of electric charging stations, or any other alternative clean fuels supply facilities in ports. Although not related to the defined KPI, a number of projects contributed to the qualitative improvements of port capacity, road and rail connections or intermodal capacities and thus added to the list of port development projects of the Rhine-Danube Corridor. Examples for such projects are the increase of rail capacity of the Port of Constanţa (RO), the restoration of the quay wall in the Port of Regensburg (DE) and the rehabilitation and development of the waterside infrastructure in the Port of Budapest/Csepel (HU). The study phase for the flagship project "High-Performance Green Port Giurgiu" was finalized; the construction phase is now under implementation, with the completion planned by the end of 2018. Aiming at further integration of inland ports into the multimodal logistic chains the "Expansion of the tri-modal inland port of Wien by land recovery" was completed in 2015.

Rail-Road terminals

Facilities of the Rail-Road Terminals München-Riem Ubf, Linz Stadthafen, Ennshafen, Žilina–Teplička have been extended and improved. Preparatory steps to build an intermodal terminal in Ruse have been completed in 2015. However, the newly built terminal in Žilina, which was completed end of 2015, is the only of the present 43 terminals of the Rhine-Daube Corridor, which fully complies with all three KPI (see

Table 2). Works at the hub terminals –Wien South and Budapest - Metrans for two additional large size Rail-Road Terminals were completed in 2016/17.

Road

Between 2013 and 2016 road infrastructure on the Rhine-Danube Corridor in terms of the KPI motorway/express road improved slightly by the completion of 10 roads and one ITS project, located in four Member States – Austria, Hungary, Slovakia and Romania: New construction projects (4 projects) as well as capacity enhancements (4 projects), 1 project with safety installations and *the motorway section between Arad and Timisoara is currently under operation*.

Due to the completion of short sections of road projects there is only a slight improvement of the KPI on motorways from 76.6% (2013) to 77.4% (2015) and 78.1% (2016). Of particular importance is the removal of the cross-border bottleneck between Mako (HU) and Nadlac (RO), providing a continuous motorway connection between both Member States. The availability of clean fuels along the road network is a dynamic commercial process depending on various factors such as the number of operative vehicles suited for alternative drive technology, petrol price and other incentive factors. Alternative fuels (CNG, LPG and LNG and electric charging stations) are widely available in all RD countries although the density of stations along the Corridor differs from section to section and country to country. The majority of the stations are located in the vicinity of urban nodes.

Airports

Airport related KPI did not change since 2013, although five projects have been completed. Most relevant are the completion of rail connection of Airport Wien to the Wien Main Station, the adaptation of the rail platforms at the Airport Wien and the connection of the Ostrava Airport to the railway network. Other projects include studies on rail connections to the airports of Frankfurt and München.

Table 5 presents the development of the corridor measured by the agreed KPIs between the baseline year and end of 2016 in the Member States.

Table 5: Generic supply-side KPI – Member States only

Rail KPI	Baseline 2013	Status 2015	Status 2016
Electrification	91%	91%	91%
Line speed ≥ 100 km/h	95%	95%	95%
Axle load ≥ 22.5 t	75%*)	75%*)	75%*)
Train length ≥ 740 m	47%	47%	47%
Track gauge = 1,435 mm	100%	100%	100%
IWW KPI	**Baseline 2013**	**Status 2015**	**Status 2016**
CEMT requirements for class IV IWW	89%	89%	89%
Permissible Draught (min 2.5m)	80%	80%	80%
Permissible Height under bridges (min. 5.25m)	83% (5)	87% (4**)	87% (4)
RIS implementation (minimum requirements set out by the RIS directive)	100%	100%	100%
Targeted depth according to waterway manager reached	51%	43%	44%

Inland ports KPI & TP	Baseline 2013	Status 2015	Status 2016
CEMT Class IV waterway connection (KPI)	100%	100%	100%
Connection to rail (KPI)	89%	89%	89%
Availability of clean fuels (KPI)	0%	6%	6%
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges (KPI)	100%	100%	100%
Intermodal facilities (TP)	72%	72%	72%
Minimum draft (TP)	89%	89%	89%
Shore-side power supply facilities (TP – non-compulsory)	89%	89%	89%
Seaports KPI & TP	**Baseline 2013**	**Status 2015**	**Status 2016**
Connection to rail (KPI)	100%	100%	100%
CEMT Class IV waterway connection (KPI)	100%	100%	100%
Availability of clean fuels (KPI)	0%	0%	0%
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges (KPI)	100%	100%	100%
Facilities for ship generated waste (KPI)	100%	100%	100%
Intermodal facilities (TP)	100%	100%	100%
Shore-side power supply availability (TP)	100%	100%	100%
Road KPI	**Baseline 2013**	**Status 2015**	**Status 2016**
Express road/ motorway	77%	77%	78%
Availability of clean fuels	available	available	available

**) Compliance figures modified due to new information on permitted axle load in Romania, provided by CFR-SA in July/August 2017*

***) The recalculation of the High Navigable Water Level in Hungary revealed its decrease and lead to a higher bridge clearance of the Margit-híd in Budapest in compliance with Regulation 1315/2013.*

Airport KPI	Baseline 2013	Status 2015	Status 2016
Connection to rail*)	67%	67%	67%
Availability of at least one terminal open to all operators	100%	100%	100%
Capacity to make available clean fuels to airplanes Availability of clean fuels for ground services	available 67%	available 67%	available 67%

**) The KPI includes only those airports, which are to be connected to rail by 2050.*

Rail Road Terminals	Baseline 2013	Status 2015	Status 2016
Capability of handling intermodal transport units	44%	44%	44%
Accessibility by trains of 740m train length	2%	2%	5%
Accessibility by electrified trains	16%	16%	21%
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	100%	100%	100%

Source: Study team analysis, status 09/ 2017

3 Transport Market Analysis

3.1 Results of the Transport market Study

In this section a brief summary of the Transport Market Study including future transport volumes and the KPI demand side data is presented.

In the 2014 study detailed data of the transport market has been collected and presented. For detailed transport statistics on region and on corridor basis the 2014 work is seen as the most recent and complete data.

As a new exercise, data were collected on generic demand side KPIs under the KPI framework. These are more recent data (when available) on country level. This work was completed in 2016. One of the difficulties that are present in this type of work is that data need to be available for all corridor countries, for all modes. Only in this way, the complete picture of the corridor can be presented on a year-to-year basis. This was not always the case for the data of 2014 or 2015.

Both for passenger and freight transport road has grown as a transport mode in the period up to 2013. Looking in detail at the period 2010-2013 it can be seen that passenger and freight transport volume by road is growing, but that the relative modal share is no longer growing. This is the case for both passenger and freight transport. For passenger transport it should be noted that air travel has increased as well in the time period as can be seen in table 6. The stabilisation of modal share is visible in Germany, where a lot of transport takes place. In fact German transport volumes have a large influence on the transport performance of the whole corridor. The effect is not limited to Germany. In the other Member States the road mode share is also not growing.

Table 6: Demand side KPI

Node	KPI	Unit	2010	2013	2014
Core seaports	Total passenger flows	# of trips per year	21,286	54,226	64,861
	Total freight flows	Million tonnes per year	43.0	47.2	46.6
Core inland ports	Total freight flows	Million tonnes per year	54.8	56.0	55.8
Core airports	Total passenger flows	Million passengers per year	150.2	161.4	165.6
Core airports	Total freight flows	Million tonnes per year	2.8	2.6	2.8

Source: Panteia, April 2016

Freight transport volume on IWW varied nonlinearly since 2009 but remains with 38.3 million tonnes transported on the Danube in 2015 more than 10 million tonnes below the level before the financial crisis. Container transport on the Danube amounts to only 0.5%, which is compared to 13.5% on the Rhine a particularly low level. Passenger transport on the Danube steadily increased, due to the sharp raise of cruise vessels on the Upper Danube between Passau and Budapest. Even if comprehensive statistics on Inland Waterway Passenger Transport for the whole Corridor are scarce, steady increases in cruise vessels have been reported at several spots in the last years: for example, between 2010 and 2016 river cruise vessel passengers increased

by 40% in Passau (314,000 passengers in 2016) and by 70% in Vienna (415,000 passengers in 2016). In particular, the number of cruising vessels increased from 70 vessels (2010) to 170 vessels (2015)[5].

The amount of passengers handled at the airports is growing in the time frame 2010-2014 (see table 6). 10% more passengers used the Corridor airports in 2014 compared to 2010, leading to a total of 166 million passengers in 2014. Frankfurt was and is the largest airport. Frankfurt airport has also grown the most in the time period. Freight volume for air is stable in the period 2010-2014. The trend is to make less use of dedicated freight airplanes and more of passenger airplanes. This is facilitated by the increase of passenger flights.

Freight volume for seaports has increased in the period 2010-2014 (see table 6). There was a decline of volume in 2014 compared to 2013 due to the economic downturn. The port of Constanța is the largest seaport with about 46 million tonnes volume. Galați is considered as inland waterway port with maritime access with a volume of about 1.3 million tonnes. The largest growth in the period 2010-2014 was identified for Constanța. Freight transport plays a far bigger role compared to the passenger function.

The volume of inland ports shows a similar freight pattern as the seaport. In the period 2010-2014 the volume increased and there was a decline of volume in 2014 compared to 2013. The growth in the period 2010-2014 is 2%. This is calculated over all ports. Individually, the ports grow and decline in volume frequently. There is no specific pattern over the years.

International transport volumes and modal share

The existing transport pattern indicates that road is the most used cross-border transport mode for both passenger and freight. This is the result of the current market conditions, most notably the transport costs and travel time.

For **passenger transport** road covers 83% of the total trips, followed by rail with 13% and air with 4%.

- For all modes combined the bidirectional passenger flow between Austria and Germany is the largest traffic flow.
- The single French Strasburg region on the Corridor has high transport volumes related to the corridor; furthermore it has a high number of road traffic.
- For rail the largest flow is between Austria and Hungary.
- For road the bidirectional traffic flow between Austria and Slovakia is the second highest.
- For rail the highest intensity is the flow between Germany and Austria.

The **freight transport** volume in tonnes within the Rhine-Danube Corridor is dominated by road. However due to the alternative modes present, the share of road is lower compared to passenger transport. In percentages the modal freight shares are: 56% for road, 27% rail and 17% IWT.

- International freight transport demand is concentrated on the western part of the Corridor. The transport in between the areas of Austria, Germany, Czech Republic and Slovakia accounts for 82% of the total Corridor transport.

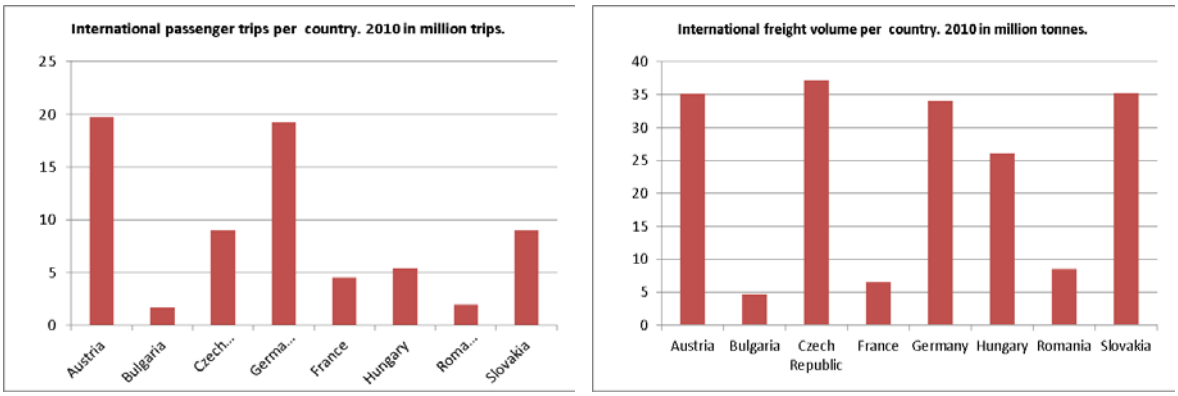
[5] *Danube Commission, Market observation report 2016*

- The Czech Republic has the highest rail and highest road volume of the Corridor countries.
- The IWT freight pattern presents an imbalance in loads. For example the load from Hungary to Romania is twice the volume of the load from Romania to Hungary. The load from Slovakia to Austria is also a considerable volume, but the flow from Austria to Slovakia is not.
- In terms of IWW transport volume on the Danube Romania ranks highest.
- For rail, the connection between the Czech Republic and Slovakia transport represents a significant volume. The Czech-Slovak connection accounts for about 34% of the volume.

Figure 4: Modal Split 2010

Source: Study on the Rhine-Danube Corridor (2014)

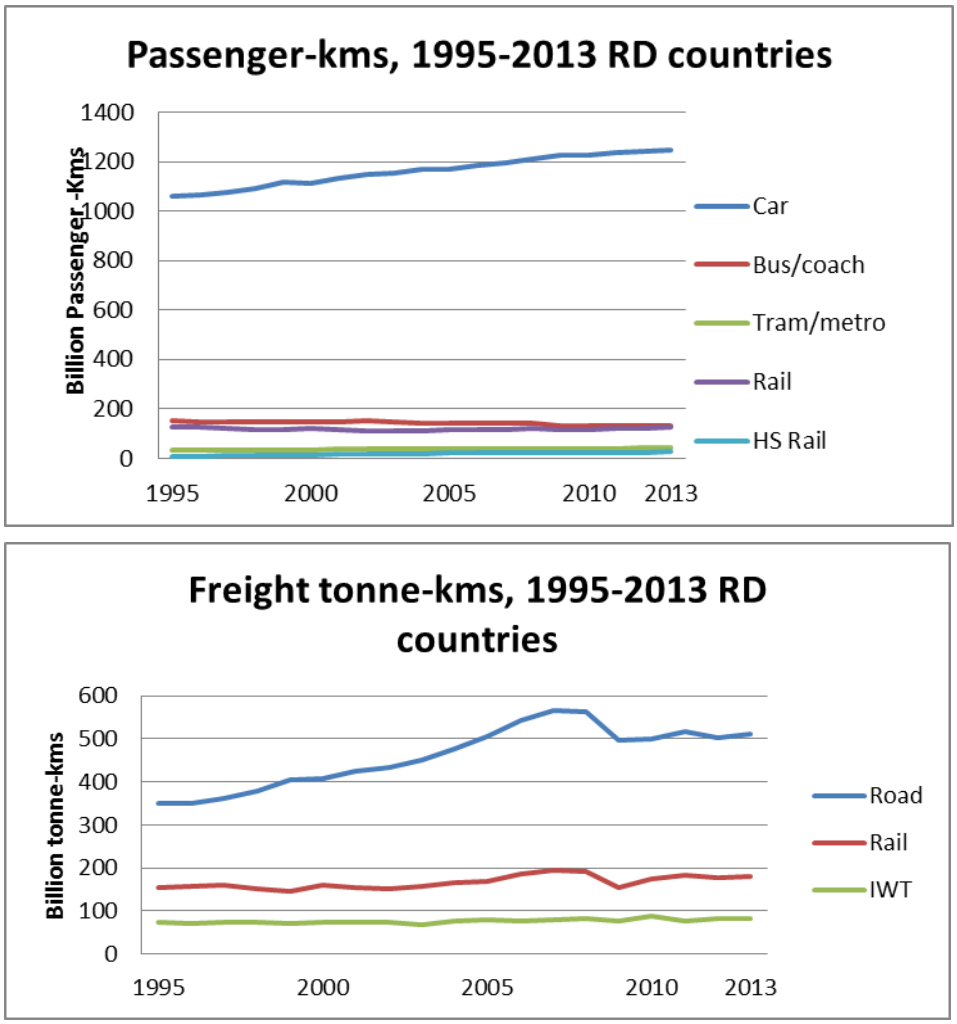
Figure 5: International passenger trips and freight volume 2010



Source: Study on the Rhine-Danube Corridor (2014)[6]

[6] *With reference to the Corridor alignment in chapter 2.1, Croatia is not included in this statistics.*

Figure 6: Evolution of passenger- and tonne-kms



Source: Eurostat 2016.

Traffic forecast

The conclusion on the demand side is that road transport would be dominant in the future market in the baseline scenario. Currently road is dominant and the position can be expected to strengthen practically Corridor wide in the baseline situation. This is the case for international and national traffic, passenger and freight. In a number of cases the *growth rates are higher for alternative modes of transport*, but *the net volume growth* is generally highest for road.

Passengers are forecasted to have more individual wealth, to own more cars and, in certain countries, to face deteriorating public transport. In the existing public baseline scenarios for freight, a continued trend is generally assumed; if a mode shift has not taken place in the past years, no future shift can be forecasted. This strengthens the results for road transport, relative to the other modes. In scenarios of higher road costs and improved alternatives, road would still be expected to remain dominant. This leads to the conclusion that there is a need to strengthen the rail and inland waterway transport modes on the Corridor to take over future transport volumes through the improvement of the rail and the inland waterway network and not to stop there to support modal shift. International traffic, import, exports and transit is expected to grow according to all forecasts. This would provide a larger playing field

for intermodal operations. The traffic of the Eastern part of the Corridor will grow at a higher rate, roughly twice as much. On the other hand, the Member States Austria, Czech Republic, Germany and entry/exit node France (Strasbourg) on the Corridor are expected to maintain the high transport demand by 2030. In Germany the latest forecast of 2016-2030 indicates a more moderate transport growth compared to that of 2007-2025. For Germany, both freight and passenger transport especially road transport has more moderate growth. This result in lower volume growth, but also in a more favourable modal split compared to the previous forecast.

3.2 Capacity Issues

Capacity issues are defined as a lack of traffic throughput at a location, or congestion. The capacity is closely related to the transport demand and focusses on the development of the supply side of the infrastructure. This is a summary of the 2014 results and overall understanding on the corridor.

Information on capacity and the level of utilisation of the infrastructure has been analysed. This is called the supply side of infrastructure. The main findings are:

- Road currently has short distance capacity issues around urban nodes, this also influences the long distance travel. Germany has the most urban areas and also the most utilised road infrastructure. In the expected implementation plan Germany has the highest number of capacity upgrades projects. Slovakia also has a high number of capacity projects in the implementation plan. Other supply characteristics presented in the TMS are border waiting time and infrastructure charges.
- Rail faces capacity issues on short and long distance areas. This does include cross border sections, but is not limited to them. Future capacity supply is foreseen in the implementation plan for rail. For Germany the implementation plan will improve the capacity and lower the critical utilisation rates, leading to fewer expected capacity bottlenecks in 2030. For the Czech Republic and Slovakia rail free capacities are expected to remain stable. The added capacity is to be consumed by the higher transport demand. In Hungary the most relevant capacity issue is at the Budapest node. Due to large increase of traffic, the node is expected to become a significant bottleneck. The lack of a second track between Hungary and Romania may become an important bottleneck in the future although for the time being the existing traffic is handled properly.[7]
- IWT would have sufficient capacity if the parameters according to fairway ECMT classifications were observed. However, this is not the case. Existing locks on the sections have sufficient capacity for the near future but some are in a bad state of maintenance and have therefore become a bottleneck. Lock projects are identified in the implementation plan. Furthermore, the Danube freight fleet is operating under low water conditions and therefore the barges cannot use their full loading capacity. This has significant consequences for the transport costs. All free-flowing sections on the Corridor are problematic in terms of fairway depth, depending on the season. Icing periods, which commonly occur between January and February, limit the capacity as well. The operation of larger ships and convoy arrangements may increase the capacity of the Danube fleet. To improve the IWW capacity supply in the future all bottlenecks are to be relieved and all fairway maintenance needs to be coordinated until 2030 and beyond.

[7] *A preparatory project is currently running to upgrade the railway line Bekescsaba –Lokoshaza – HU-RO border including construction of a second track. A related works project needs to be added in future versions of the corridor project list (Information provided by Hungarian Ministry of National Development, 01/2018)*

- Core and comprehensive ports have been evaluated. For a number of ports, intermodal connections in particular with rail have to be improved. Air passenger traffic is the overall fastest growing transport mode in the reviewed forecasts of the TMS. The current air volume is low, both for freight and passengers. Capacity expansions at the largest air nodes of Germany, Austria and the Czech Republic are considered as needed and are ongoing. Hungary also has a large air node, but further capacity is not needed immediately.

The German part of the corridor (South of Germany) has the busiest infrastructure for road and rail. Expected infrastructure investments will help increase supply. In the latest German national transport plan BVWP 2016-2030 a capacity analysis was performed on the future transport volumes and the current network was compared with the 2030 network. In Germany the same locations are problematic in 2030 as in 2010 for both road and rail. However, the current road congestion around München and Nürnberg nodes is forecast to decrease to more acceptable levels by 2030, as a result of the ongoing road projects. The node of Stuttgart will remain congested despite the road projects taking place. For rail the Frankfurt – Nürnberg – Passau section is presently considered the most congested section in 2030. Ongoing projects are funded to reduce such forecast. The rail section Frankfurt – Nürnberg will improve, but congestion will remain a topic on this section. The section East of München is also congested, however it is expected that this rail bottleneck will be solved by 2030.

3.3 Potential market uptake

The Rhine Danube corridor demonstrates available shift capacity for rail and inland waterways. Both are environmentally friendly modes of transport when compared to road per tonne transported. When looking at the whole corridor the shift capacity for rail is limited. The rail conditions differ from country to country, but since rail is an efficient medium distance mode of transport more capacity for international relations is needed. Inland waterways' capacity remains abundant. Due to this reason IWW potential has been analysed in more detail. Specifically, the potential market uptake of IWT was analysed from two angles:

- In-depth analysis of specific high-potential commodity groups
- Macro analysis of modal shift potential for containers

Commodity groups showing a moderate (some renewables and steel) to a high (the other commodity groups) IWT potential are: Renewable resources, chemical products, ores, building materials, mineral resources and petroleum products, recycling products and high & heavy cargo. Attested potentials result from the present transport volumes, demand prospects, handling and storage facilities in ports, transport and storage requirements, stowage factors and time sensibility.

According to model calculations a significant modal shift potential for container transport from roads to waterways exists and as much as 42.0% to 43.3% of the potential tonnes can be transported more cheaply by IWT.

In order to seize this potential, several measures can be taken. Providing a more reliable inland waterway infrastructure is the absolute precondition for further development of inland waterway transports. But also market related activities, such as cooperation platforms on national and international basis, targeted provision of information or promotion of industrial sites near ports and terminals. Further, simplification and harmonisation of administrative processes for inland waterway transports will increase the competitiveness of waterway transport. These activities, which are related to logistics as well as the transport infrastructure, are of great importance to shifting transport towards environmentally friendly inland waterways.

4 The identified projects to be realised by 2030

In order to improve compliance with the requirements of Regulation 1315/2013, Member States and other stakeholders initiate number of projects to address bottlenecks on the Rhine-Danube Corridor. A first compilation of these activities has been provided in Work Plan I, followed by an update within Work Plan II. The updated version of the project list has been submitted in spring 2017. It is the basis for measuring progress regarding KPI compliance (compare chapter 5.2) and requirements of the market (chapter 3).

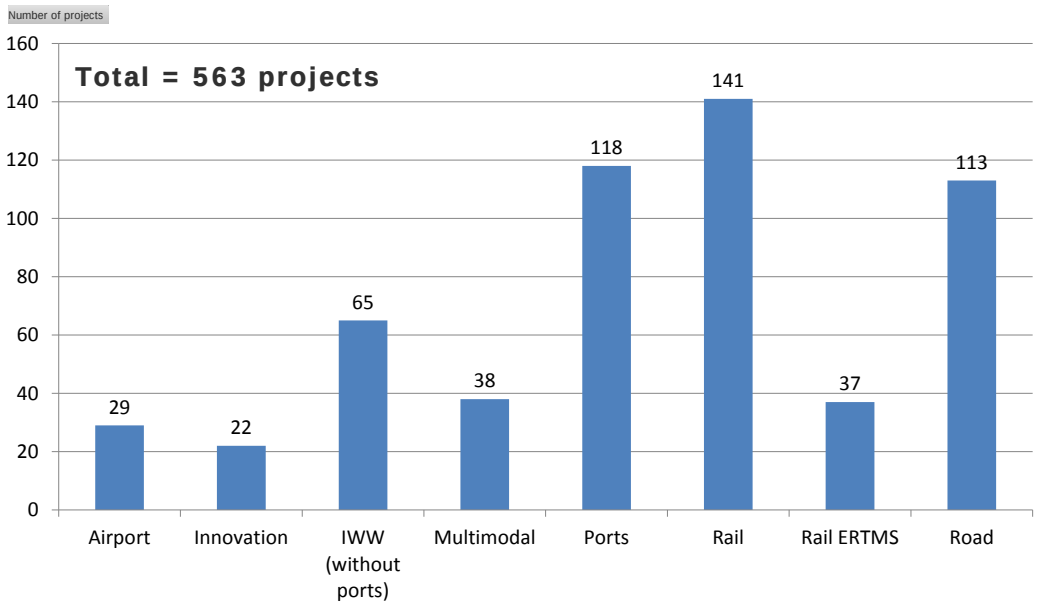
In principle, the update of the project list 2017 follows the same procedure as already performed for the project list 2016, forming the basis for the Work Plan II. Basis for the 2017 update was the project list with status of June 2016 including the project proposals of the 2014 and the 2015 CEF Transport calls. Project proposals of the 2016 CEF Transport call were only incorporated in the case, when the respective project promoter had submitted directly the project data by March 2017. Otherwise, such project proposals may be considered in the project list for the next update in 2018.

4.1 General Overview

At the end of March 2017, the Rhine-Danube project list contains 563 projects altogether. This figure comprises all projects that have been concluded between 2014 and 2016 (i.e. since 11th December 2013, when the TEN-T Regulation was published) and all projects that will conclude in 2017 or later. Compared to the first version of the Work Plan in 2014, this means an increase by 225 projects (+67%).

Figure 7 shows the distribution of the projects according to several categories. The overall picture shows no significant differences to the 2014 work plan structure: The lion´s share (178 projects = 32%) refers to Rail (incl. ERTMS). The number of Port projects increased substantially (almost double compared to 2014), raising this category to the second place of the ranking (21% share), followed by Road (20% share) and Inland waterways (without ports) representing 12% of corridor projects. Multimodal, Airport and Innovation projects contribute only with minor shares to the overall sum of projects.

Figure 7: Total number of corridor projects by category



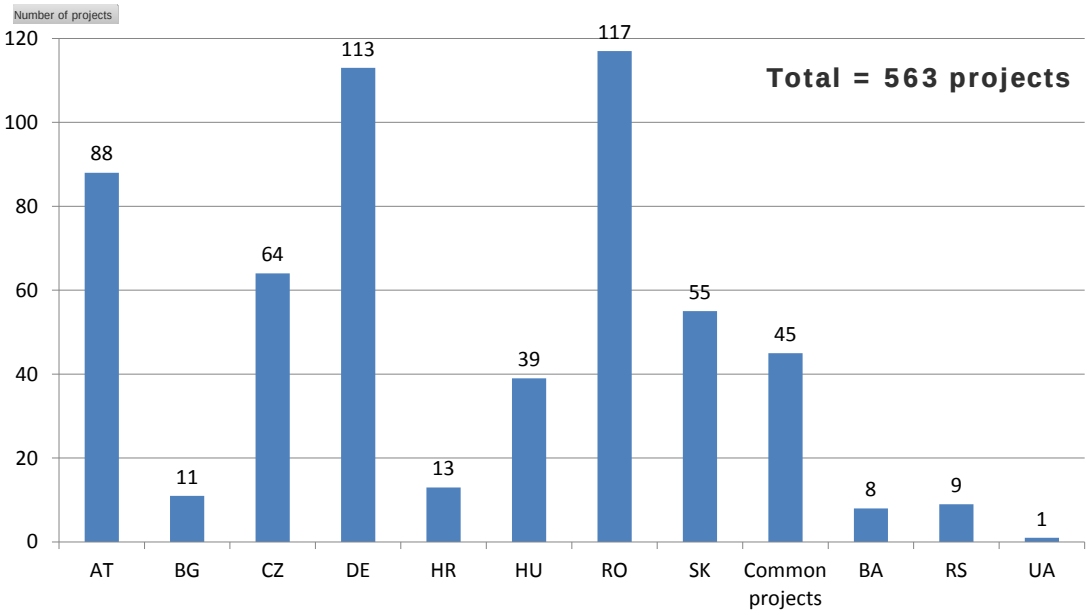
Source: HaCon, based on project list, status 05/2017

Projects with innovation components can be found in the category "Innovation", but also in the mode specific categories; the latter applies for all those projects that integrate one or more innovation components into the infrastructure part (e.g. upgrade of a rail line, including ERTMS installation). Innovation projects can be identified by dedicated project attributes in the project list such as "Clean fuels", "Telematics application" or "Sustainable freight transport services". In this sense, 142 projects (=25% of all RD projects) show innovation components. The majority (119) of these projects refers to Telematics applications (ERTMS, ITS, RIS, SESAR and others). 19 further projects deal with the provision of clean fuels and the remaining four projects with sustainable freight transport services.

As Figure 8 shows, the geographical distribution of projects is led by Romania, representing 21% of all projects; more than half of these Romanian projects refer to port related measures. Germany follows closely with 113 projects; this number has increased particularly since the 2016 version of the project list due to the new German Transport Masterplan (BVWP 2030); Austria, Czech Republic and Slovakia each contribute by 16-10% to the total number of projects.

Looking at the costs, all 563 projects sum up 91.9 bn EUR, which means an increase by 22 bn EUR (+31%) compared to the 2016 project list version and even by 27.2 bn EUR (+42%) compared to the 2014 work plan. 47% of these overall costs are allocated to Germany (with only 20% share of project quantity) meaning that particularly German projects show an above-average volume. About 80% of the German investments refer to rail projects; also in Austria the major share of project costs can is allocated to rail, whereas Romania, Slovakia and the Czech Republic also show a considerable or even higher share of road related project costs.

Figure 8: Total number of corridor projects by country



Source: HaCon, based on project list, status 05/2017

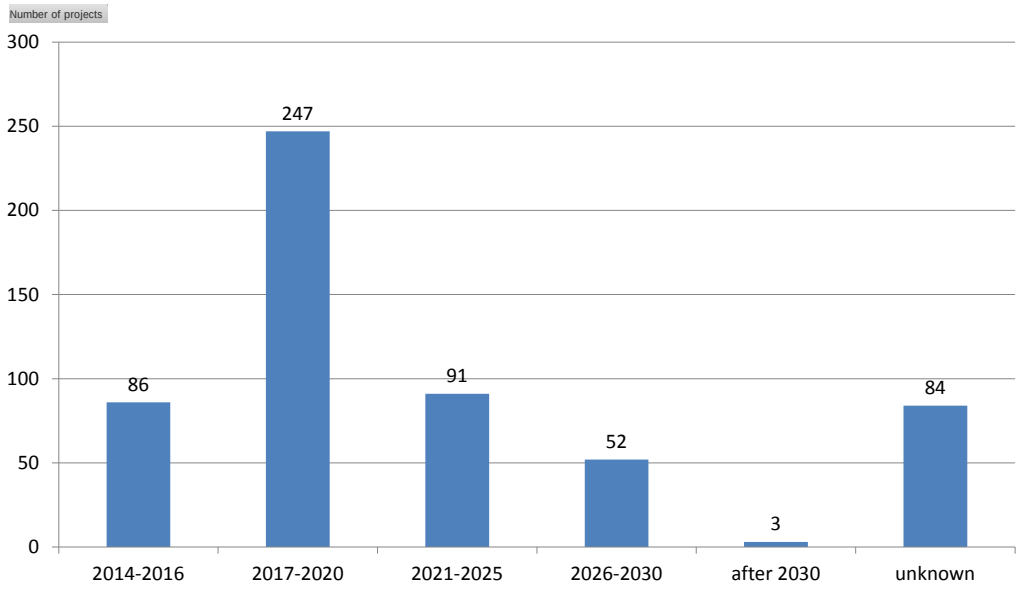
Next to the country assignment, the following aspects complete the "geographical picture" of the project list:

- 315 out of the overall 563 projects (=56%) are located on the Rhine-Danube Corridor exclusively; another 145 projects (=26%) have common sections with one and 73 projects (=13%) with two other corridors. Further 30 projects (5%) are allocated to four or more corridors. Most common projects can be found on the Orient/East-Med (152 projects) and on the Baltic-Adriatic Corridor (91 projects).
- 149 Rhine-Danube Corridor projects are related to a cross-border section. 23 out of these 149 projects were also marked as bilateral or multilateral projects.
- 116 projects refer to last-mile infrastructure between the corridor lines and transhipment or interchange points (ports, terminals, airports, main stations). Urban nodes with particularly numerous last-mile projects are Bratislava (19 projects) and Wien (13 projects).
- 277 projects (= 49% of all RD projects) are allocated to "pre-identified sections including projects" according to Regulation 1316/2013 Annex I, Part I. These pre-identified CEF projects show a clear affinity to rail, waterway and multimodal transport: about half of these RD projects is allotted to rail and rail ERTMS category, followed by Ports, IWW (without ports) and Multimodal projects.
- 299 projects (= 53 % of all RD projects) belong to countries receiving financial assistance from the Cohesion funds: Bulgaria, Czech Republic, Croatia, Hungary, Romania and Slovakia.

The expected or achieved year of finalisation of the projects is shown in Figure 9. 86 projects have already been concluded between 2014 and 2016 (see also chapter 2.3). They are however listed here to document the progress made on the corridor since the implementation of both EU Regulations. With dedicated view on the year 2030 it can be stated that - except for two road and one rail projects - all projects with a known end date are expected to be completed before then. Moreover, a majority of projects (333 projects) should have been concluded by 2020 at the latest. Between 2026 and

2030, only few (mostly rail and road) projects are still to be finalised. 84 projects (= 15%) are lacking information about the completion date. This missing information is partially due to actual uncertainty about the end date and partially due to not existent data.

Figure 9: Total number of corridor projects by completion time class



Source: HaCon, based on project list, status 05/2017

To conclude it can be asserted that the hereunder presented list of projects is one of the main inputs needed to assess the level of achievement of objectives and to identify the bottlenecks and non-compliant sections along the Corridor (gap analysis). In this regard, the project list is one of the main pillars of the updated Work Plan.

4.2 Analysis per mode

4.2.1 Rail

The Rhine-Danube project list contains 141 rail projects (excluding pure ERTMS projects). The vast majority of these activities (113 projects = 80%) involves infrastructure works at different development stages: „rehabilitation, upgrade or new construction". Most of these projects (94) comprise "upgrade" measures; in 34 cases new construction works are foreseen and 19 projects deal with rehabilitation actions. Many projects consist of several infrastructure work types (e.g. rehabilitation and upgrade). 35 rail projects combine infrastructure works with the implementation of ERTMS; this particularly applies for new construction or large scale upgrade measures of rail lines, which normally include ERTMS line components by default.

Besides the infrastructure related works, two projects deal with rolling stock issues (new brakes for freight wagons and information systems in Bratislava to support the integration between railway and local public transport services). Furthermore, nine projects are assigned to improvement of signalling, interlocking and dispatching technique or to the implementation of data exchange systems. Finally, 17 rail projects consist of the pure elaboration of a study, where no follow-up works are known, at least not within the same project timeframe and budget.

49 rail projects contain components of innovation, all referring to telematics applications. Most of these projects are combined with infrastructure works; this particularly applies for ERTMS, which is part of 35 infrastructure rail projects. One

further project, dealing with an information system of the integrated transport system of the Bratislava region, has been assigned to “ITS”. The remaining 13 projects with innovation components are related to signalling systems, dispatching centres and tools/procedures on data transfer and exchange.

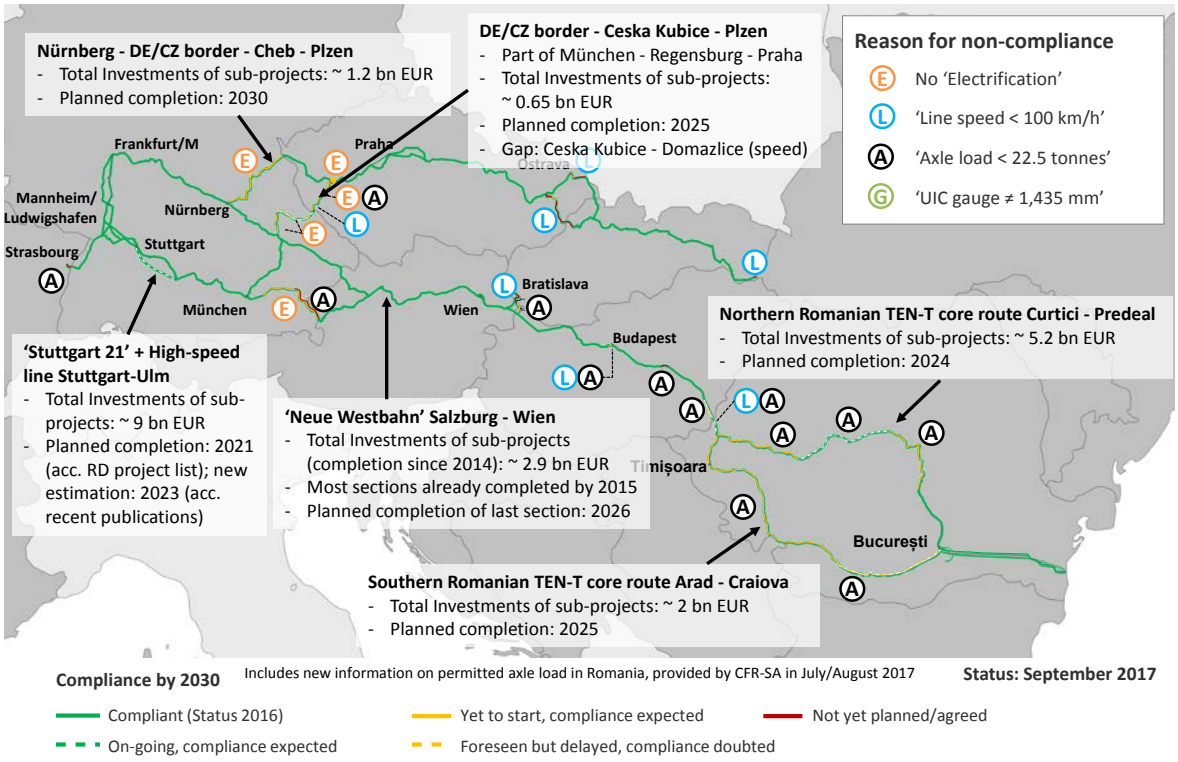
Overall, the rail projects of the Rhine-Danube Corridor show that substantial progress can be expected until 2030 on most corridor sections; this applies for the impact on the KPIs (line speed, electrification, axle load, train length) as well as on other parameters (line capacity, single track sections, strong inclines). In this context, the following global projects, which will provide large, connecting and compliant corridor sections, can be highlighted (see also Figure 10):

- “Stuttgart 21” + High-speed line Stuttgart – Ulm,
- High-speed line Salzburg – Wien (“Neue Westbahn”)[8]
- Northern Romanian TEN-T core route Curtici – Predeal (Brasov-Sighisoara),
- Southern Romanian TEN-T core route Arad – Craiova,
- Nürnberg - DE/CZ border Cheb – Plzeň and
- DE/CZ border – Ceska Kubice – Plzeň (with exception of section Stod - Česká Kubice, where line speed will not be compliant according to current status of project data).

With exception of Stuttgart – Ulm, all these corridor parts are cross-border sections at the same time.

[8] *Section Linz – Wien already completed*

Figure 10: Large corridor sections expected to be compliant by 2030[9,10,11]



Source: HaCon, status 09/2017

However, despite these undoubtable advances, total rail compliance of the corridor with the requirements of the Regulation will not be achieved by 2030. This will be explained in detail in section 5.2.1.

4.2.2 Inland Waterways

The scope of ongoing and planned IWW projects of the EU Member States comprises 21 ongoing and planned studies, which form the basis for coming works and often includes the coordination with neighbouring countries: public consultation, environmental impact assessments or detailed designs. This number increased since 2016, when the number of studies was only 18.

Another twelve projects contribute to infrastructure rehabilitation (compared to ten projects with this scope in the 2016 project list). Infrastructure rehabilitation projects aim at re-establishing a good navigation status, and also include the renewal of locks, the removal of obstacles (e.g. sunken vessels), etc. A higher number of activities (15) deals with the upgrade of infrastructure in order to comply with waterway class IV or higher. Another ten inland waterway projects aim – at least partly - at the construction of new infrastructure; this comprises the building of new barrages or winter shelters for vessels as well as the construction of the Danube-Bucharest Canal.

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[9] *The electrification of line Regensburg – Schwandorf –DE/CZ border will be shifted from further to highest priority in the German Transport Master Plan following the outcome of actual in-depth project appraisal (according to German MoT (BMVI); new status 10/2017).*

[10] *The railway project ABS München – Mühldorf – Freilassing also includes the increase of the axle load to 22.5 tonnes (according to German MoT, data update 01/2018).*

11 Reg. "Neue Westbahn": Sect. Linz-Wien already completed; Linz-Salzburg in planning process with expected completion horizon of 2033 (depending on financial resources and legal processes)

Further projects contribute to “Maintenance equipment” (7) and “Telematics applications”, which are in terms of inland waterways, River Information Services (4). The remaining two projects refer to “Sustainable freight transport services”.

Germany implements the deepening of the Main, the reconstruction of locks and the activities between Straubing and Vilshofen with national financial resources. Hungary implements four projects with the support of CEF-funding, the improvement of the marking system, the enhancement of RIS and a preparatory study for the improvement of navigation conditions. In Romania three projects are approved: the Rehabilitation of locks on the Danube-Black Sea Canal and the Poarta Alba-Midia Navodari Canal, the banks consolidation on the Danube–Black Sea Canal and the banks consolidation on the Poarta Alba–Midia Navodari Canal. In Serbia River Training and Dredging Works on critical sectors between Bačka Palanca and Beograd and the implementation of AtoNs is supported by IPA and the upgrade of the Iron Gate I lock is supported by CEF. In Slovakia the upgrade of the Gabcikovo locks is approved.

The project list contains a larger number of common projects (two concluded, eleven ongoing and four planned) which is due to the fact that 42% of the navigable Danube constitutes a state border. The number of common projects increased compared to last year’s report by four (from 13 to 17). Not only the number of common IWW projects is comparably high but also the number of projects located on a cross-border section. Out of the 65 the vast majority of 49 projects deal with the improvement of cross-border sections. In addition, most projects (47) are situated on pre-identified sections as identified by the CEF regulation, Annex I.

Most projects, for which funding was approved are common projects (15). The category comprises the two FAIRway Danube studies (one grant for the Cohesion countries involved and one for Austria), the Komárom-Komarno Bridge, the FAST Danube study on the Romanian-Bulgarian border section, the RIS COMEX project (two project grants), SWIM - SMART Waterway Integrated Management and the DTP funded projects Danube STREAM, Danube SKILLS, DANTE and Green Danube.

Projects related to alternative clean fuels, telematics applications or sustainable freight transports services are considered to have an innovative character. In terms of IWW six projects with such innovative aspects are ongoing. They include the construction of a LNG terminal in Ruse, the horizontal project RIS COMEX and other national activities focusing on RIS. To tackle the lack of data exchange and differences in the extent and quality of offered River Information Services, CEF is co-financing a broad European initiative called RIS COMEX, which is going to implement harmonized information services at European level.

Including the costs of already completed projects of 192 Mio EUR the overall project costs amounts to some 4.2 bn EUR. The total costs of ongoing and planned projects related to the development of inland waterways of the Rhine-Danube Corridor sum up to 3,964 Mio EUR.

- The largest investment refers to the Danube-Bucharest canal (1.38 billion EUR), actually scheduled for some time after 2030.
- Integrated river engineering projects, rehabilitation and maintenance equipment and River Information Services would require 1.3 billion EUR as foreseen at the moment although not all projects are running and many are still in a feasibility study phase.
- The rehabilitation and upgrading of several locks in Obernau, Erlangen, Kriegenbrunn, Gabčíkovo, at the Iron Gate I and II and at the Danube - Black

Sea Canal including the Poarta Alba – Midia Navodari Canal would require 935 mio EUR.

Next to the implementation of infrastructure projects the Joint Statement Process, the METEET initiative and the study to substantiate the concepts of “Good Navigation Status” and “Good Ecological Status” play an important role related to the Inland Waterways of the Rhine-Danube Corridor.

- In the last years the Joint Statement process proofed again to provide an important and useful Danube-wide platform for exchange and discussion in order to align inland waterway transport projects with the environmental requirements stemming from EU legislation;
- Important steps were taken and continuous progress in approaches and processes for the involvement of relevant actors and stakeholders can be observed. A shift in paradigm is taking place from process oriented exchange towards the presentation of real projects thanks to CEF. More technical and practically oriented topics (e.g. which practical measures work, what are the impacts of certain engineering solutions to improve navigation and on the environment, etc.) might therefore be needed for the future to ensure the continuous added value of the process;
- The new METEET initiative, jointly launched by MOVE, ENV and REGIO, and implemented together with the DC, ICPDR and ISRBC, is generally well accepted. A discussion and decision on the follow-up will be needed after the pilot training workshop in Vukovar (28-29 September 2017);
- A coherent approach for Good Navigation Status (TEN-T) and Good Ecological Status (WFD) (but also other relevant EU environmental legislation like the Habitats Directive), and the application of respective exemptions is needed for the finalisation of the GNS study. A specific exchange needs to be organised on this issue between MOVE, ENV and the GNS project consortium based on the already existing exchange.

4.2.3 Ports

Out of a total of 118 port projects (including inland ports of the Western Balkans) 87 projects (=74%) are related to pure (standard) infrastructure works and only 6 projects (=5%) are reported as mixture of studies and works. These infrastructure works involve various categories of works, ranging from infrastructure rehabilitation and upgrade to completely new construction works. A small share of the port projects belongs to telematics project (1 project) and clean fuels supply facilities (4 projects). The remaining projects concern studies, vessels and barges and administrative/operational issues.

The total costs of all 118 identified and reported port projects reached 2,638 Mio EUR. The largest share of the projects (=54%) and their costs (=78%) comes from Romania. This is due to the fact that Romania has the largest number of ports per country (6) and the only seaport on the Rhine-Danube Corridor. The Port of Constanţa is the largest seaport in South-East Europe and is frequently considered as “the Rotterdam of the East” due to its comparative importance in the global trade for South-East Europe and the density of shipping lines connecting it with major ports in the world. Consequently, the largest share of projects in terms of numbers (49 projects or 41%) and in terms of project costs (1,729 Mio EUR or 66%) belongs to this seaport.

Out of 118 port projects, 68 of them are on pre-identified sections (projects in Constanţa, Giugiu, Galaţi and Slavonske Brod). Aiming at an improvement of their

hinterland connections, ports undertook and planned a total of 27 projects related to the last mile connection.

It is important to note that, although no LNG-fuelled ships are currently operating on the Danube and its tributaries, a number of ports have already undertaken measures towards the facilitation of LNG bunkering for future vessels. Port of Ruse (BG) has already completed such terminal which provides facilities for LNG bunkering for vessels, while ports of Constanta, Bratislava and Enns have reported planned projects for LNG bunkering facilities. In addition, LNG bunkering facilities for vessels are also planned in the port of Budapest (CEF project: 2015-HU-TM-0349-M). This project is not listed in the category of inland waterway projects ("IWW" in the projects database), but it is listed in the "Innovation" category of projects in the overall database of projects and therefore is not included in the aforementioned 118 port projects.

The majority of ports comply with most of the key performance indicators. However, this does not completely reflect the qualitative situation of ports. It is recommended that the aspects of port modernization, infrastructure efficiency and greening of port development and operations shall be taken into account in future spatial planning and policy documents.

4.2.4 Road

With regard to road infrastructure 113 projects were collected in the phase of the update of the project list 2017. Out of the total number of projects 10 were completed in the period between 2014 and 2016. With regard to the scope of the projects 18 projects are studies, 10 projects are rehabilitation projects, 64 projects (the majority) include infrastructure upgrade works, 31 projects are new construction works and 15 projects are dealing with telematics applications and 4 projects with the provision of clean fuels along the Corridor.

According to national master plans all Member States plan to proceed with their ambitious upgrading/construction programme on their motorway network in the upcoming years. The identified on-going and planned projects will improve the KPI on motorways/express road to 92% up to 2030.

Critical sections or bottlenecks due to high traffic utilisation, capacity reasons and safety reasons, but also need for rehabilitation of the aged infrastructure are existing on the motorways in Germany, Austria, Czech Republic, in Hungary around Budapest and in Romania around București.

With status of April 2017 (update of project list) missing sections of the core parameter motorway/express way exist in the CZ, in Slovakia and in Romania.

While the missing section in CZ is related to the cross-border project Zlin – Žiliná, the situation in Slovakia regarding the corridor alignment is as follows:

The connection from the CZ border to the motorway D1 is the R6 at Lysá pod Makytou – Púchov to Beluša. The R6 is classified as express way, has a length of approximately 26km, whereby 7.5km are in operation. The project is under study–> Status: unfinished EIA process;

The corridor alignment follows then the D1 motorway up to the border with the Ukraine. The preparation and construction of the following missing sections is envisaged:

- D1 Bidovce via Dargov and Pozdisovce to Border with the Ukraine,
- D1 Branisko to Beharovce,
- D1 Hričovské Podhradie – Lietavská Lúčka (2nd phase),

- D1 Lietavská Lúčka – Višňové – Dubná Skala (2nd phase),
- D1 Hubová – Ivachnová (2nd phase),
- D1 Turany – Hubová,
- D1 Budimír – Bidovce,
- D1 Prešov, West – Prešov, South

In Romania the situation is as follows:

- A1 motorway between Bucuresti and Nadlac: 66% of total length of the A1 (576km) is in operation, 11% under construction and 23% are planned. The section between Deva and Lugoj (length 99.5km) is partially open, partially under construction. The main missing links are the sections between Sibiu and Pitesti and Dumbrava – Deva[12].
- A6 motorway between Lugoj and Calafat, length 260km, 4% of the motorway are open (section Balint and Lugoj), the remaining 96% are planned.

Regarding the requirements of Directive 2010/40/EU setting the framework for the deployment of Intelligent Transport Systems in the field of road transport and interfaces with other modes of transport, for the moment, the existing systems do still not sufficiently provide real-time traffic and weather information (RDS-TMC), facilitating seamless corridor road traffic. Within the CROCODILE project (funded by CEF), traffic information service providers of RDCN-countries (Austria, Czech Republic, Germany, Hungary, and Romania plus the associated members Bulgaria and Slovakia) have been setting up a data exchange infrastructure with the goal to provide harmonized cross-border real-time traffic information services along the whole corridor. A specific focus within the CROCODILE project lies on safety-related and truck parking information services in order to meet the requirements in relevant European Commission delegated regulations (885/2013, 886/2013 and 2015/962). Two Memoranda of Understanding on improvement of information exchange were signed in 2014 and 2015 among Austria, Hungary, Romania and other MS.

Another innovative Intelligent transport system receiving CEF funding is Cooperative Intelligent Transport Systems (C-ITS), allowing vehicles to communicate with other vehicles, with traffic signals and roadside infrastructure as well as with other road users. With alerts generated from the increased information available, these systems have a strong potential to improve road safety and the efficiency of the road transport as well as continuity of traffic. For example, information about traffic congestion ahead can be displayed to the drivers inside the car.

C-Road is a platform of Member States working on the deployment of C-ITS services. C-ITS pilot sites will be installed across the EU for testing and later operation of "Day-1" applications as recommended by EC "C-ITS platform".

Member States will invest in their infrastructure, while the industry will test components and services. Technical and organisational issues will be tackled by the C-Roads platform to ensure interoperability and harmonisation of C-ITS between pilots. Austria is coordinator of the overall C-Roads platform.

The Austrian C-ITS pilot includes test sites in the Vienna area, the motorway section from Vienna to Salzburg, as well as around Innsbruck and the greater Graz area. Cross-border tests will also be conducted with other C-Roads Member States. The Austrian C-ITS pilots will implement several C-ITS applications, including "Traffic jam ahead warning", "Road works warning", "Weather conditions" and "In-vehicle

[12] *From the total length of 28,6 km, 15,08 km was opened in March 2017 (Information provided by CFR-SA to consultant team, 01/2018)*

signage". Austria is cooperating with Germany and the Netherlands to establish the ITS Corridor Rotterdam – Frankfurt – Wien.

Another C-ITS project is taking place in the Czech Republic. The Czech Pilots will take place on motorways, urban nodes, and on two railway crossings. ITS-G5 and 4G mobile networks will be used to provide C-ITS services, like hazardous location notification or road works warning to all road users, thus fostering widespread deployment of C-ITS.

“Ursa Czech Republic” is a CEF co-funded project, with the aim to allow a high-quality and reliable freight transport information by implementing C-ITS applications. This project is part of a global project and it will develop close cooperation with the European URSA MAJOR projects to harmonise heavy good vehicle (HGV's) transport services. “Ursa Czech Republic” will deploy intelligent truck parking and real-time traffic information for trucks in 4 parking areas of the motorway D1 which is the most important Czech motorway.

Hungary is an associated member of the C-road platform.

In Romania a project receives CEF funding, which shall contribute to a network of certified safe and secure parking areas and optimize its use by designing and delivering an Intelligent Transport System (ITS) tool.

First investments are done in Germany, Austria, Hungary, Czech Republic and Romania in equipping truck parking areas along the motorways with intelligent infrastructure (towards safe and secure truck parking).

Toll systems along the corridor are not harmonised, hampering in particular the freight transport; the only cross-border cooperation system is established between Austria and Germany, extended now with Hungary. Distance or time based charging schemes exist in all countries of the Rhine-Danube Corridor, but only five use an electronic fee collection system.

4.2.5 Rail-Road Terminals

The 38 projects included in the updated Project List concern the upgrading or new construction of 18 intermodal terminals and one CEF-application for establishing a multimodal door-to-door service along the Rhine-Danube Corridor.

Six of the projects consist of (only) studies, 31 relate to infrastructure works and one is said to treat administrative procedures (Ruse project, Bulgaria).

Infrastructure work projects cover several interventions: one project addresses rehabilitation, 21 include upgrades and 12 new constructions; none of the projects includes telematics applications as explicitly defined in Article 31 of the TEN-T Regulation although it can be expected that some type of hard- and software for terminal management and data sharing with related modes of transport will be included in the scope of works. However, it can be assumed that the costs will be negligible compared to construction costs. To conclude none of the multimodal projects has been flagged to be “innovative” in the sense of the Regulation.

Five projects, namely in Enns, Linz (2 projects), München-Riem and Žilina have already been completed since the adoption of the Regulation, 12 projects are planned to be completed by 2020, further 10 until 2025 and 2 until 2030. For the remaining 9 projects no timing was indicated by the stakeholders. With the hub terminals Wien – South and Budapest of Metrans (subsidiary of the German HHLA group) building activities for two additional large size Rail-Road terminal projects are in progress. Both shall become fully operational in the year 2017.

For the measuring of progress with respect to the TEN-T objectives it can be concluded that:

- 23 terminals will be capable of handling all types of intermodal transport units;
- Projects will lead to accessibility with 740m trains in 10 terminals. In another 11 terminals the permitted train length will be improved, however without achieving the 740m target.
- Electrified rail access will be achieved in 12 terminals; another 5 projects will contribute to an improvement of the situation.

Moreover, 16 (out of 38) projects do not contribute to any of the KPI at all while the other projects address at least one KPI. After completing the respective works, nine terminals will be capable of handling all

After all, only the terminals Karlsruhe Rbf, Kornwestheim Rbf, München (new terminal), Linz Stadthafen, Enns, Bratislava and Žilina will be capable of handling intermodal transport units and be accessible by electrified trains with a length of 740m in 2030. Next to these, seven terminals will fulfil the requirements of the Regulation to a higher degree in 2030 than they do now but are still expected to lack the compliance with all three parameters. In addition, it is to be noted that for the majority of terminals no project is foreseen at all. A detailed overview about the expected compliance status of the rail road terminals is provided in chapter 5.2.5 (Figure 17).

4.2.6 Airports

The project list contains 29 projects, 5 projects are indicated as concluded and finished, 9 will be finished until 2020 and 5 between 2021 and 2025. For 10 projects no information on the implementation time is available. From the remaining 24 projects in progress, 9 seek to improve the connection of the core airports in Frankfurt, Stuttgart, München, Praha and Budapest with the rail and road infrastructure of the TEN-T network (KPI). However, the airports of Praha (Václav Havel International) and Budapest (Ferenc Liszt International) shall be connected to heavy rail by 2050. For both airports studies are ongoing to connect them to railways.[13]

Vienna airport has improved the rail connection to Vienna Main station. There are studies to connect Vienna Airport with the "Ostbahn" in easterly direction by double track heavy rail, thus filling the missing link to the east, specifically to Slovakia and Hungary. 5 projects are seeking to improve the connection of the other airports in Timisoara, and Bucuresti. Ostrava airport connection, although not required, has been completed.

10 projects out of the total number of projects are studies and construction projects on capacity extension or innovation (SESAR).

Regarding the capacity of airport infrastructure to make available alternative clean fuels (KPI) to air services, the core airports are in the position to provide capacity when airline operators request clean fuels for their airplanes. With regard to provision of clean fuels to ground services some of the core airports already offer it and have plans to modify their ground fleet.

4.2.7 Innovation

Projects with innovation components can be found in the category “Innovation”, but also in the mode specific categories where an innovation component can be associated to infrastructure (e.g. upgrade of a rail line plus ERTMS installation). Projects with

[13] *Construction works in Budapest might be started and finished during the next MFF (Information provided by Hungarian Ministry for Development, 01/18)*

innovation components include those whose scope covers “Clean fuels”, “Telematics application” or “Sustainable freight transport services”. This leads to the identification of 142 RD projects (=25% of all RD projects). The majority of these refer to Telematics applications (ERTMS, ITS, RIS, SESAR and others). 19 further projects deal with the provision of clean fuels.

A brief analysis of the projects listed with innovative project components associated to a larger infrastructure project shows the following:

- 50 projects include telematics applications such as ITS (road), RIS (IWW), SESAR (airport) or “other telematics applications”, except ERTMS;
- 15 of them are telematics applications (ITS and other telematics applications) categorised under road projects, nine are RIS projects under IWW projects, three (SESAR, ITS and other telematics application) are under airport projects and one (other telematics application) is categorised under maritime projects;
- 19 projects include ITS, nine projects belong to RIS, one project refers to SESAR and 21 projects relate to other telematics applications;
- 7 projects are related to the promotion of alternative fuels, mainly LNG. These projects belong to the categories Road (4), IWW (2) and Airport (1).

Only 22 projects are directly classified under the category “innovation” in the project list. Looking at the scope of work the 22 projects belong to:

- Clean fuels: 12 projects;
- Telematics applications (ITS): 5 projects;
- Other telematics applications: 3 projects;
- Sustainable freight transport services: 1 project in connection with clean fuel provision and one project for IT application in logistic chain supply.

For innovative projects no Key Performance Indicators are defined and no compliance check is performed. Nevertheless it can be concluded that the projects have an impact on capacity enhancement of the respective modes, on the reduction of CO_2 emissions and on improvement of multimodality. A larger number of projects are allocated to more corridors than the Rhine-Danube Corridor; they are often grouped under common project category.

In chapter 5 the results of the analysis of the identified projects is presented, whether the projects will resolve the bottlenecks or not. Based on the compliance check for 2016 in comparison to the information on the projects in the project list 2017 the non-compliant sections for 2030 were identified thus leading to the critical issues, where a need for action exist.

4.3 Urban Nodes

The Rhine-Danube corridor core network contains 13 urban nodes, located in seven Member States (France, Germany, Czech Republic, Slovakia, Austria, Hungary and Romania): Strasbourg (FR), Mannheim (DE), Frankfurt/M (DE), Nürnberg (DE), Stuttgart (DE), München (DE), Ostrava (CZ), Praha (CZ), Bratislava (SK), Wien (AT), Budapest (HU), Timişoara (RO) and București (RO). Regulation 1315/2013 states that “those nodes are the starting point or the final destination ("last mile") for passengers and freight moving on the trans-European transport network and are points of transfer within or between different transport modes.”

In order to scrutinise the status of the Rhine-Danube urban nodes against these requirements, a comprehensive check has been performed referring to (1) CNC infrastructure line sections (rail, road, inland waterway) inside the urban nodes and (2) the connection of access points (ports, terminals, airports) to these corridor line

sections (“last-mile”). These compliance checks also include new information on permitted axle load in Romania, provided by CFR-SA in July/August 2017.

Check of CNC infrastructure line sections

In Table 7 the overall corridor network compliance check for the Rhine-Danube urban nodes is displayed. It is obvious that particularly rail lines within the nodes present several bottlenecks. Rail parameters with the lowest level of compliance are “train length” and “capacity utilisation”, that are partly compliant or non-compliant in 45-50% of the nodes. Moreover, the “axle load” criterion of 22.5t is completely fulfilled in 70% of the urban nodes only. In contrast, most of the rail corridor sections within the urban nodes are electrified; only two of them show some non-electrified sections. With the exception of the train length parameter, several projects for the total or partial resolution of the above mentioned issues have been identified. Projects with the purpose of allowing for 740m train length have been planned in one urban node only (Timișoara).

The status of inland waterways has been analysed for eight urban nodes along the Corridor. The most problematic parameters are “draught” and “good navigation status” being compliant in 50% of the analysed nodes only. On the contrary, requirements referring to the “ECMT class”, “height under bridges” and “RIS implementation” parameters are fulfilled in almost all nodes. With regards to the resolution of inland waterway bottlenecks, various projects have been foreseen principally for the improvement of the navigation status and for the fulfilment of the minimum draught requirement of 2.5m.

The road network inside the Rhine-Danube nodes is totally compliant with the Regulation.

Summing up all modes, the analysis shows different compliance results in Western and Eastern Europe. Urban nodes with a particularly high share of red and yellow fields in Table 7 are Bratislava, Budapest, Praha and Ostrava. In contrast, München, Frankfurt, Mannheim and Stuttgart are compliant regarding almost all checked parameters.

Table 7: Corridor lines compliance check within the Rhine-Danube urban nodes, status 2016

	Parameters	Strasbourg	Mannheim	Frankfurt	Nürnberg	Stuttgart	München	Ostrava	Praha	Bratislava	Wien	Budapest	Timişoara	București
Rail	Train length (≥ 740m)	n.i.											P	
	Axle load (≥ 22,5t)											P	P	P
	Speed (≥ 100km/h)							P		P		P		
	Electrification				P									
	Capacity utilisation		P	P	P			P		P		P		
IWW	ECMT class (≥ IV)						n.a.	n.a.					n.a.	n.a.
	Draught (≥ 2.5m)						n.a.	n.a.	P	P			n.a.	n.a.
	Height (≥ 5.25m)						n.a.	n.a.	P				n.a.	n.a.
	RIS implementation						n.a.	n.a.					n.a.	n.a.
	Good navigation status	n.a.	n.a.			n.a.	n.a.	n.a.		P		P	n.a.	n.a.
Road	Express road / motorway													

GREEN	Compliant	GREY	Not applicable (n.a.)
YELLOW	Partly compliant / non-compliant	WHITE	No information (n.i.)
RED	Non-compliant	P	Project for the improvement of a non-compliant parameter (according Project list 2017)

Source: HaCon, 09/2017

Technical parameters of ("last-mile") connections in urban nodes

The underlying question for this check was whether it is possible to perform a continuous, seamless traffic from the CNC lines via the last mile connection to the respective access points and vice versa. This requirement can be considered as generally fulfilled for road connections. As inland waterways are usually not used for these purposes, the check of last mile connections has been done only for rail.

The rail connections of inland ports, trimodal terminals and rail-road terminals to the core network have been analysed for the three parameters "axle load" (≥ 22.5 tonnes), "electrification" and "train length" (≥ 740 m), since these criteria decide whether a seamless transport from/to the access point along the last mile is possible or not. For rail connections to airports, the availability of heavy rail is relevant.

The analysis shows that half of the analysed last-mile sections (23 out of 45) fulfil completely the above mentioned parameters (see Table 8). The remaining 22 out of 45 last-mile connections do not fulfil at least one parameter compliant and require respective improvement works.

Insufficient technical standards of last-mile rail connections in urban nodes are predominantly a matter of low train length (40-45% of the last-mile connections). The parameter on axle load is not sufficient in 20-25% of the cases, while just about 10% of the last-mile connections are not electrified. In total, 11 airports have been inspected and 4 of them are not connected to heavy rail.

As Table 8 points out, only few projects are currently planned or ongoing, which are designed to enhance compliance on the last-mile connections within the urban nodes. Two of them will establish rail connections of airports; another project shall enable 740 m trains to and from Ostrava Paskov terminal.

No projects with the purpose of achieving the line electrification and axle load (22.5 t) requirements on the non-compliant sections have been identified. A project in Ostrava to achieve the 740 m train length parameter at the rail-road terminal Ostrava Paskov is planned. Two projects aiming at connecting the airport in Praha and in Timișoara to heavy rail have been recognised.

Table 8: Technical parameters of last-mile rail connections between the CNC network lines and access points[14], status 2016

Urban node	Access point		Connection to CNC			
	Infrastructure	Type	Axle load (≥ 22,5t)	Electrifi-cation	Train length (≥ 740m)	Connected to rail
Strasbourg	**Strasbourg CT Nord**	Trimodal terminal	X	ok	X	n.a.
	Strasbourg CT Sud	Trimodal terminal	X	ok	X	n.a.
Mannheim	**M. Handelshafen (DUSS)**	Rail-road terminal	ok	X	ok	n.a.
	Ludwigshafen KTL	Rail-road terminal	ok	ok	ok	n.a.
	M. Handelshafen (Contargo)	Trimodal terminal	ok	X	ok	n.a.
	Mannheim MCT	Trimodal terminal	ok	X	ok	n.a.
	Ludwigshafen Kaiserwörthhafen	Trimodal terminal	ok	ok	ok	n.a.
Frankfurt	**Frankfurt-Osthafen**	Inland	ok	ok	ok	n.a.

[14] *In service/operation*

Urban node	Access point		Connection to CNC			
	Infrastructure	Type	Axle load (≥ 22,5t)	Electrifi-cation	Train length (≥ 740m)	Connected to rail
		port				
	Frankfurt-Gutleuthafen	Inland port	ok	ok	ok	n.a.
	Frankfurt-Ost	Rail-road terminal	ok	ok	ok	n.a.
	Frankfurt-West	Trimodal terminal	ok	ok	ok	n.a.
	Frankfurt-Osthafen	Trimodal terminal	ok	ok	ok	n.a.
	Frankfurt-Airport	Airport	n.a.	n.a.	n.a.	ok
Nürnberg	Nürnberg Hafen	Inland port	ok	ok	ok	n.a.
	Nürnberg Hafen	Trimodal terminal	ok	ok	ok	n.a.
	Nürnberg Airport	Airport	n.a.	n.a.	n.a.	X
Stuttgart	Kornwestheim	Rail-road terminal	ok	ok	ok	n.a.
	Stuttgart Hafen	Rail-road terminal	ok	ok	ok	n.a.
	Stuttgart Container Terminal	Trimodal terminal	ok	ok	ok	n.a.
	Flughafen Stuttgart	Airport	n.a.	n.a.	n.a.	ok
München	München-Riem	Rail-road terminal	ok	ok	ok	n.a.
	München Flughafen	Airport	n.a.	n.a.	n.a.	ok
Ostrava	Ostrava Paskov	Rail-road terminal	ok	ok	X	n.a.
	Ostrava Šenov	Rail-road terminal	ok	ok	X	n.a.
	Letiště Leoše Janáčka Ostrava	Airport	n.a.	n.a.	n.a.	ok
Praha	Praha Holešovice	Inland port	X	X	X	X
	Praha Uhrineves	Rail-road terminal	n.i.	ok	X	n.a.
	Václav Havel Airport Prague	Airport	n.a.	n.a.	n.a.	X
Bratislava	Bratislava-Palenisko	Inland port	ok	ok	X	n.a.
	Bratislava ÚNS	Rail-road terminal	ok	ok	X	n.a.
	Bratislava-Pálenisko	Trimodal terminal	ok	ok	X	n.a.
	Letisko Bratislava	Airport	n.a.	n.a.	n.a.	X
Wien	Wien Freudenau Hafen	Trimodal terminal	ok	ok	X	n.a.
	Vienna Airport	Airport	n.a.	n.a.	n.a.	ok
Budapest	Port of Csepel	Inland port	ok	ok	ok	n.a.
	Budapest Soroksár (BILK)	Rail-road terminal	ok	ok	ok	n.a.
	Budapest MCC	Trimodal terminal	ok	ok	ok	n.a.

Urban node	Access point		Connection to CNC			
	Infrastructure	Type	Axle load (≥ 22,5t)	Electrifi-cation	Train length (≥ 740m)	Connected to rail
	Budapest Airport	Airport	n.a.	n.a.	n.a.	ok[15]
Timişoara	**Timişoara Semenic**	Rail-road terminal	X	ok	X	n.a.
	Aeroportul Internaţional Traian Vuia	Airport	n.a.	n.a.	n.a.	X
București	**Bucuresti Intermodal Terminal**	Rail-road terminal	X	ok	X	n.a.
	Bucuresti Noi	Rail-road terminal	X	ok	X	n.a.
	Bucuresti Sud	Rail-road terminal	X	ok	X	n.a.
	Aeroportul Internaţional Henri Coandă - Bucureşti	Airport	n.a.	n.a.	n.a.	ok

	All technical parameters of last-mile connection fulfilled
	Technical parameters of last-mile connection not or partly not fulfilled
ok	Technical parameter fulfilled
X	Technical parameter not fulfilled
X	Technical parameter not fulfilled, but project for improvement existing
n.a.	Not applicable
n.i.	No information

Source: HaCon, 09/2017

5 Future challenges

5.1 How do we identify critical issues

Regulation 1315/2013 sets the objectives and requirements for the development of the core and comprehensive networks of the Trans-European Transport Network.

The analyses of the status of infrastructure performed in 2014 and in the period 2015-2017 entailed a combination of the Multimodal Transport Market Study and the compliance check of the Corridor's technical parameters with the standards set by the Regulation No.1315/2013, in order to identify bottlenecks that could hamper the operational efficiency and functionality of the Corridor. These were subsequently compared against the list of on-going and planned infrastructure projects, assessed accordingly in terms of their ability to:

1. Address technical non-compliance and alleviate other identified critical bottlenecks
2. Fill in missing links/infrastructure gaps
3. Contribute to the realisation of the principles and general objectives of the Corridor/TEN-T Network, as set out in Regulation 1315/2013 (*Cohesion*, *Efficiency*, *Sustainability* and increasing the *Benefits for its Users*), as well as a number of specific objectives tailored to reflect the specificities of the RD Corridor.

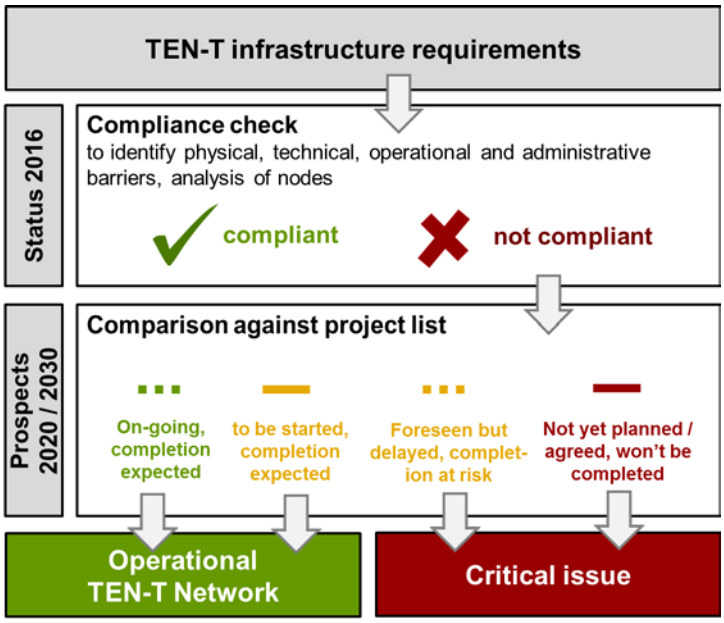
[15] *Only for rail freight services, passenger railway line is still missing*

Based on the gathering of project data from Member States, infrastructure managers and other stakeholders the projects are analysed with regard to their contribution to the Corridor's development:

1. Identify the projects that are planned in order to reach compliance with regulation 1315/2013 by 2030;
2. Reveal critical issues, which demand counter-measures, if a section is doubted or unlikely to be compliant with regulation 1315/2013 by 2030.

Figure 11 describes the approach for identifying the gaps and critical issues in the corridor deployment. The adopted approach leads to the identification of persisting bottlenecks and remaining infrastructure gaps -*Critical Issues*- that were either not or insufficiently addressed (due to unknown timelines/lack of agreement and/or unknown financing) by any project submitted in accordance with information known until the end of 2016.

Figure 11: Approach for the analysis of identified planned projects



Source: viadonau, May 2017

A critical issue was attested if a measure on a section of the TEN-T network will not be completed before 2030 or if no measures are planned or agreed yet to resolve a non-compliant section.

The outcome of the analysis is presented in the next chapter on the persisting infrastructure bottlenecks by 2030.

5.2 Infrastructure bottlenecks

The Study on the Rhine-Danube Corridor has led to identify a number of critical issues. The plan for the removal of physical and technical barriers outlines a *need for action* of all parties involved to the Corridor's development.

5.2.1 Rail

The analysis of the identified rail projects and their impact on the KPIs revealed the following deficiencies or risks concerning achievement of the target values 2030:

- Missing projects or projects without reliable finalisation date, leaving KPI compliance gaps on large, connected corridor parts (compare Figure 12). Main sections and corridor parts affected are
  - Schwandorf – DE/CZ border (electrification)[16],
  - DE/CZ border – Domazlice (speed),
  - large parts of Slovakia and Czech Republic (train length),
  - München- Freilassing (axle load)[17],
  - Rajka – Heyeshalom (axle load, train length),
  - Sections in Hungary on the line between Budapest and Lökösházа (axle load).
  - Predeal – București (axle load, train length),
  - Craiova – București (axle load),
  - București – Constanta - existing line (train length),
- Missing link București – Constanţa (new high-speed line): According to EU Regulation 1315/2013, this new line shall be part of the TEN-T Core Network (Rail Passenger) and the Rhine-Danube Core Network Corridor (CNC); the existing line is defined as a CNC freight rail. However, according to information provided by CFR-SA to the consultant team in July/August 2017, it is not planned to realise this new line before 2030.[18]
- Single track lines, which currently show no capacity problems with mostly regional traffic, but might become severe bottlenecks with the envisaged (long-haul) increase of traffic by 2030. In this respect, the following line sections should receive particular attention:
  - Germany: Marktredwitz – border DE/CZ, Regensburg - DE/CZ border, Mühldorf - Freilassing[19];
  - Czech Republic: DE/CZ border – Plzeň (both lines from Nürnberg and Regensburg);
  - Slovakia: border-crossing sections between Bratislava and Austria/ Hungary;
  - Hungary: Békescsaba – Lőkösháza.
- Not yet approved, incomplete financing of projects or missing respective information. As all information has been gathered from official documents and furthermore approved by the Ministries of Transport or other stakeholders, the envisaged dates for realisation have been taken for granted even in case of (partially) missing or unknown financing.
- Projects with a foreseen end date until 2030. In case of delays, projects might not be implemented before 2030 as requested by Regulation 1315/2013. This could apply for the electrification of the lines München – Mühldorf - Freilassing and Nürnberg – DE/CZ border.

[16] *The electrification of line Regensburg – Schwandorf –DE/CZ border will be shifted from further to highest priority in the German Transport Master Plan following the outcome of actual in-depth project appraisal (according to German MoT (BMVI); new status 10/2017).*

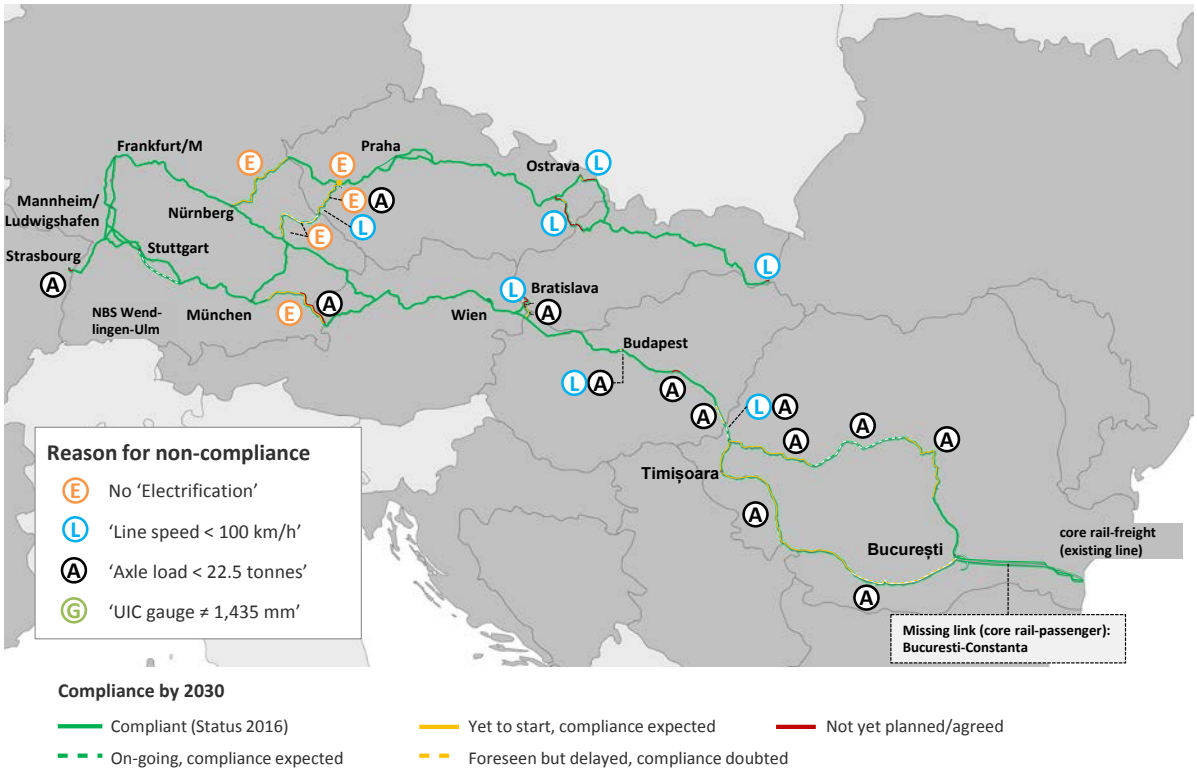
[17] *The railway project ABS München – Mühldorf – Freilassing also includes the increase of the axle load to 22.5 tonnes (according to German MoT, data update 01/2018).*

[18] *The existing railway line București – Constanta allows mixed traffic of passenger and freight trains. This line has been upgraded until 2013; the maximum line speed for passenger trains is 160 km/h.*

[19] *The Mühldorf – Tüßling section has been upgraded with a 2nd track and went into operation in 12/2017; the upgrade of the entire line to two tracks is under investigation as part of the overall upgrade project ABS München – Mühldorf – Freilassing (according German MoT (BMVI), 01/2018).*

Figure 12 gives an overview on the expected compliance situation of the corridor in 2030. Critical sections are marked in red and yellow-dotted. The figure also contains new information on action increasing the permitted axle load in Romania, provided by CFR-SA in July/August 2017.

Figure 12: Rail compliance by 2030[20]

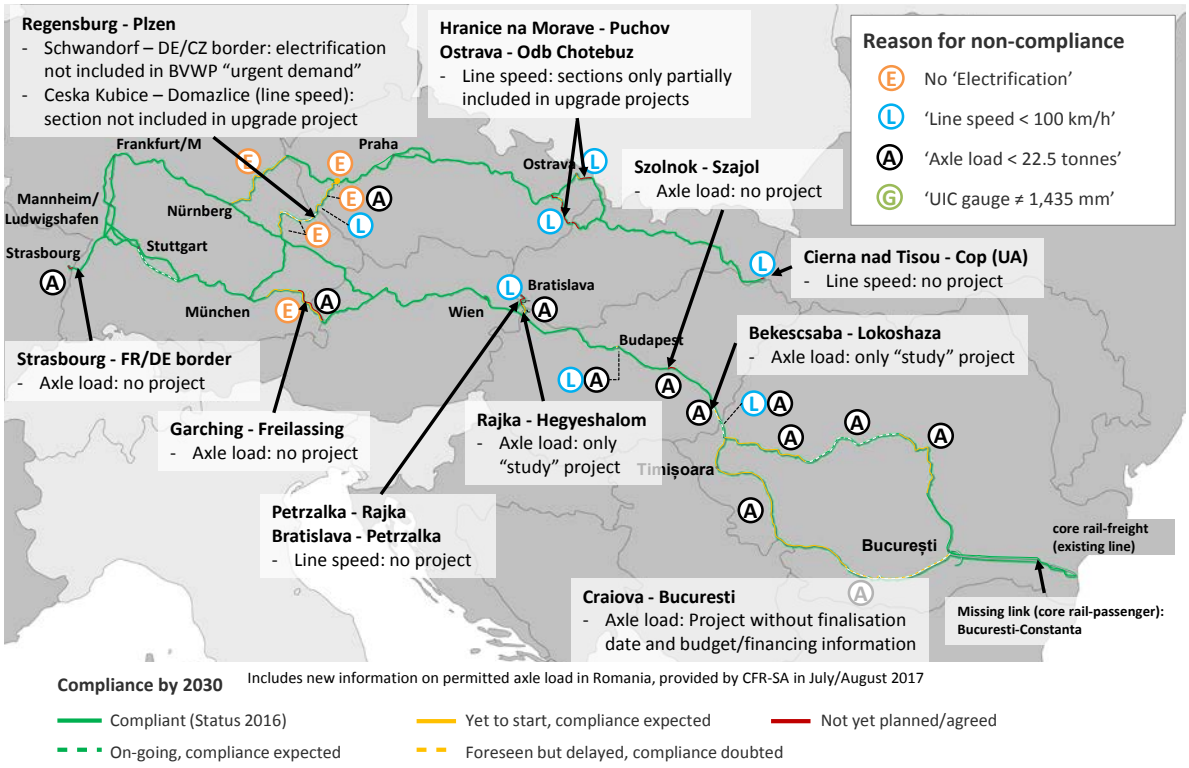


Source: HaCon, status 09/2017

The red and yellow-dotted sections represent compliance gaps that are expected to remain after 2030. These gaps and their reasons are described in Figure 13. With the exceptions of the Craiova – Bucuresti line and the missing link Bucuresti - Constanţa, all displayed compliance gaps refer to cross-border sections.

[20] *The railway project ABS München – Mühldorf – Freilassing also includes the increase of the axle load to 22.5 tonnes (according to German MoT, data update 01/2018).*

Figure 13: Explanation of rail compliance gaps expected by 2030



Source: HaCon, status 09/2017

In order to further specify the need for action, the compliance gaps of Figure 13 have been listed in Table 9, supplemented by the "Train length" criterion that had not been included in Figure 12 and Figure 13. Moreover - and in addition to the final status of the project list - the non-compliant sections were also checked against the funded projects of the 2016 CEF call.[21]

Table 9: Corridor sections with particular need for action

Corridor section	Pre-ident. section / project (y / n)	Non-compliant parameter(s)	Project gaps	Remarks
France				
Strasbourg - FR/DE border	y	Axle load	No project	
Germany				
Garching (Alz) - Freilassing	y	Axle load	Upgrade project does not tackle axle load[22]	
Schwandorf –	y	Electrification	No project[23]	Section is included in BVWP, but not as

[21] *This impact of the 2016 CEF projects on the incompliant sections has been considered only within the Table 9 listing! In total, these effects are rather small and do not change the main conclusions.*

[22] *The railway project ABS München – Mühldorf – Freilassing also includes the increase of the axle load to 22.5 tonnes (according to German MoT, data update 01/2018).*

[23] *The electrification of line Regensburg – Schwandorf –DE/CZ border will be shifted from further to highest priority in the German Transport Master Plan following the outcome of actual in-depth project appraisal (according to German MoT (BMVI); new status 10/2017).*

Corridor section	Pre-ident. section / project (y / n)	Non-compliant parameter(s)	Project gaps	Remarks
DE/CZ border				"urgent demand"
Czech Republic				
Ceska Kubice – Domazlice	y	Line speed	Section is not included in upgrade projects DE/CZ border - Ceska Kubice - Plzen	
Ostrava-Kunice - Odb Chotebuz	n	Line speed	No project[24]	
Hranice na Morave – CZ/SK border	y	Line speed	Section is only partially covered by upgrade projects[25]	
CZ corridor rail network	n.a.	Train length	Several projects designed to improve, but not to fulfil the parameter requirements[26]	Sections compliant by 2030: Čelákovice- Lysa n. Labem*); Lysa n. Labem - Kolin; Usti nad Orlici - Chocen; Dluhonice - Přerov - Prosenice*)
Slovakia				
CZ/SK border - Puchov	y	Line speed	No project	
Cierna nad Tisou - Cop	y	Line speed	No project	
Petrzalka - Rajka	y	Line speed Train length	No project	
Bratislava - Petrzalka	n	Line speed Train length	Section is not included in Bratislava node upgrade project	Bratislava node upgrade project does not achieve line speed KPI, financing is unknown
SK corridor rail network	n.a.	Train length	Most upgrade projects do not tackle train length parameter	Sections compliant by 2030: Čadca - Krásno nad Kysucou; Púchov - Považská Teplá - Žilina; Váh - Varín -Strečno*); Liptovsky Mikulas - Poprad-Tatry
Austria				
Several sections	n	Train length	No project	

[24] *Upgrade measures – potentially improving parts of the gap - related to Český Těšin – Albrechtice u Českého Těšína line and Havirov station are currently being evaluated (according to CZ MoT, 01/2018).*

[25] *Feasibility study related to the entire line (including an option for increase of line speed is currently under preparation (according CZ MoT, 01/2018)*

[26] *Feasibility study related to 1st transit railway corridor shall be launched in 2018 8according to CZ MoT, 01/2018)*

Corridor section	Pre-ident. section / project (y / n)	Non-compliant parameter(s)	Project gaps	Remarks
in Wien node				
Gramatneusiedl – Petrzalka	n	Train length	No project	
Parndorf - Nickelsdorf	n	Train length	No project	
Hungary				
Rajka - Hegyeshalom	n	Axle load Train length	Only “study project”	
Szolnok - Szajol	y	Axle load	No project	
Bekescsaba - Lokoshaza	y	Axle load	Only “study project”	
Romania				
Curtici - Arad	y	Train length	Upgrade project does not tackle parameter “Train length”	
Brasov - Predeal	y	Train length	RD upgrade project is designed to improve, but not to fulfil the required standard	Compliance of the section will be achieved due to CEF 2016 project*)
Predeal – Bucuresti	y	Train length	“Study project” “Work project” is designed to improve, but not to fulfil the required standard	
Brasov – Bucuresti - Constanta	y	Train length	No project	
Craiova - Bucuresti	y	Axle load	Project without finalisation date and without budget/financing information	Final decision on project still pending
Bucuresti – Constanta (passenger high speed line)	y	Missing link	No project	New rail line is foreseen in Regulation 1315/2013, but not in Romanian Transport Masterplan

*) Compliance of the section will be achieved due to CEF 2016 project

Source: HaCon, status 10/2017

The expected development of the corridor shows a heterogeneous picture (see Table 10): on the one hand, the KPIs ‘Electrification’ and ‘Line speed’, which have a high degree of compliance already today, show only small progress. On the other hand, the parameters ‘Axle load’ and ‘Train length’ will improve notably until 2030; however, from today’s perspective, the target value of 100% will be missed (see Table 10).

In summary, it can be stated that from today´s point of view an overall compliance with the core rail parameters will probably not be achieved by 2030. Additionally, some projects with a planned end date close to 2030 are based on verbal

commitments or feature unsecure financing. This might lead to further delays in the project realisation.

Table 10: Prospects for the evolution of Rail KPIs until 2020 and 2030

Rail KPI	Status 2016	Prospects 2020	Prospects 2030	Target 2030
Electrification	91%	91%	97%	100%
Line speed ≥ 100 km/h	95%	96%	96%	100%
Axle load ≥ 22.5 tonnes	75%*)	79%*)	92%*)	100%
UIC track gauge = 1,435 mm'	100%	100%	100%	100%
Train length ≥ 740 m	47%	52%	68%	100%
ERTMS	7%	n.a.	n.a.	100%

*) *Compliance figures modified due to new information on permitted axle load in Romania, provided by CFR-SA in July/August 2017*

Source: HaCon based on RD compliance analysis and project list, status 09/2017

ERTMS

In the course of the updating of the project list in 2017, 37 projects on Rail-ERTMS (finalization date 2014 or later) including a number of common projects (10) were reported. Regarding the ERTMS deployment plan we refer to the relevant update of the Work Plan of the ERTMS Coordinator, providing an overview on the deployment of ERTMS in the Corridor.

The deployment of an interoperable Single European Rail Area has faced numerous barriers to the implementation of ERTMS over the last 10 years. However, an ERTMS Deployment Action Plan, adopted by the Commission as a Commission Staff Working Document on 14 November 2017 (SWD (2017)375 final), has been officially introduced. It defines the actions to remove all identified obstacles with the responsible parties in the frame of well-defined timelines. This Action Plan is the last step in a thorough analysis of the ERTMS deployment in the European Union, followed by detailed negotiations with the Member States and the Rail Sector, including their commitment in terms of actions and execution times.

On 5 January 2017 the European Commission adopted the Implementing Regulation (EU) 2017/6 on European Rail Traffic Management System European Deployment Plan (ERTMS EDP) that replaces the old deployment plan of 2009. The reviewed ERTMS EDP adapts the geographical scope of deployment to the TEN-T Regulation, and sets new targets for ERTMS deployment on CNC's until 2023. These target dates are firm commitments made by Member States and Infrastructure Managers during the consultation and negotiations, led by Mr Vinck, European ERTMS Coordinator, between 2014 and 2016.

In 2023, the ERTMS European Deployment Plan will be updated again setting out the precise implementation dates for the remaining part of the Corridors between 2024 and 2030. ERTMS Coordinator proposed this two-step approach for defining the consistent deployment of CNC's by 2030 which was appreciated by all affected stakeholders. This approach ensures that the reviewed EDP sets out more realistic dates and therefore it can serve as the basis for business planning of railway undertakings.

5.2.2 IWW

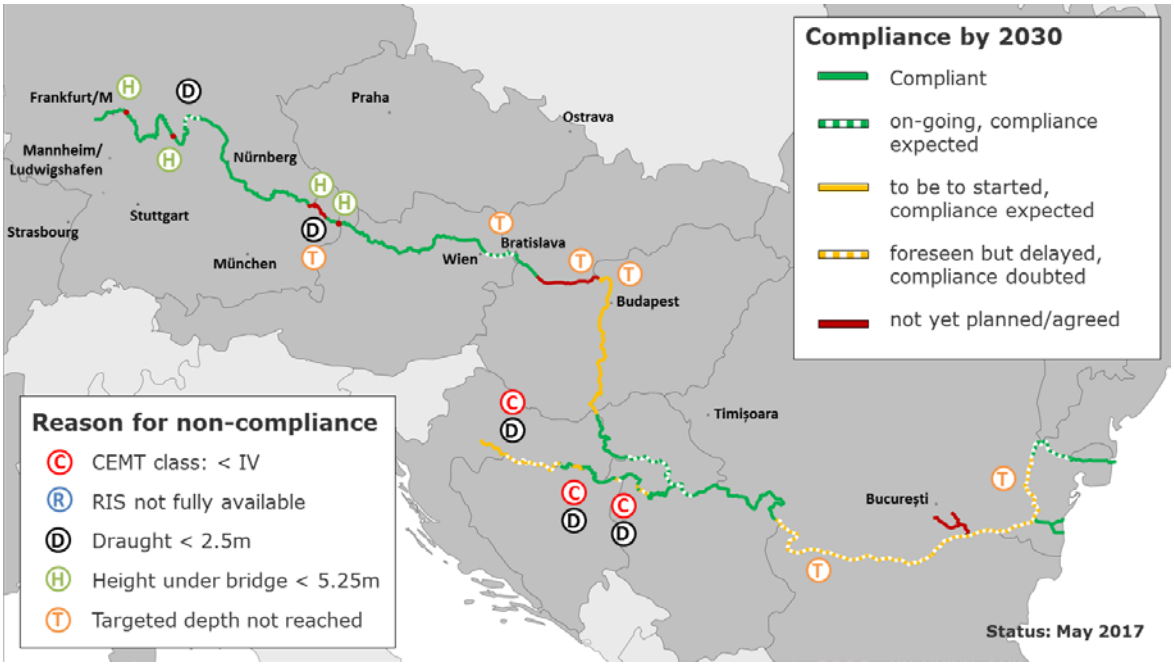
Chapter 4.2.2 presented the identified planned projects related to the inland waterways of the Rhine-Danube Corridor.

This chapter explains the impact of these projects and their influence on the compliance with the technical parameters set out by the TEN-T regulation and gives an overview on the deficiencies and possible risks.

In terms of KPIs, the permissible draught of 2.5m is expected to be met after the deepening of the Upper Main (Germany). In addition, targeted depths are expected to be reached through the implementation of improvement measures East of Vienna. A follow-up project to implement the study results on improving navigability on the Hungarian section of the Danube will contribute to reach targeted fairway depths between Wien and Devin (Austria/Slovakia) as well as between Szob and Budapest (Hungary).

The following figure shows the expected level of compliance of inland waterways by 2030.

Figure 14: IWW compliance by 2030



Source: viadonau, May 2017

In contrast to the before mentioned projects that contribute to increase the level of compliance, works planned at the section between Straubing and Vilshofen follow a political decision at federal state level that sets targets below the draught requirements of Regulation 1315/2013.

Activities related to the upgrade of the Sava are under way at two sections, but the timing and financing is still unclear at others, therefore the completion is considered to be at risk. Intentions to increase the bridge clearance are missing for all of the bridges not complying with the Regulation. An improvement is expected for the KPI “Targeted depth reached”, which relates to the goals set by the waterway administration itself. Stable water levels lead to compliance with this KPI at the Main, the Main-Danube Canal and the Danube-Black-Sea Canal. The non-compliant sections are free-flowing and include Straubing-Vilshofen, the Slovak-Hungarian, the Bulgarian-Romanian border sections and the section between Călăraşi and Brăila. Further downstream on

the Danube, only the section between Brăila and the Black Sea is expected to be compliant. As a consequence, this KPI is estimated to reach only 54% in 2030.

To reach the targeted fairways depth and thereby increase navigation reliability a joint solution at the Slovakian-Hungarian border section needs to be foreseen. In Hungary and at the Bulgarian-Romanian border section the implementation steps taking up the results of ongoing studies are required. Between Călăraşi and Brăila an environmental and technical consensus is needed in order to complete the network.

The Danube-Bucharest canal is now not planned to be realized before 2030 and is expected to remain a missing link.

In the following table the non-compliant sections in 2030 from today's point of view are summarised:

Table 11: Non- compliant IWW sections by 2030

Corridor Section	Pre-identified	Project	Reason for non-compliance	Comments by MS / IM
Germany				
Straubing - Vilshofen	Y	Upgrade of the Danube between Straubing and Vilshofen: Pursuing Variant A (ID 9256)	A permissible draught of 2.5m at low navigable water level is not achievable.	The Federal Government and Bavaria agreed on the realization of Variant A, increasing the possible draught loaded at low navigable water level by 20 cm, from 1.60m to 1.80m.
Rail and Road Bridge Auheim (Main-km 59.55)	Y	No project	Bridge clearance of 4.85m is below Regulation requirement of 5.25m	Two bridge segments have already been raised to the current height in 2005.
Alte Mainbrücke Würzburg (Main-km 252.32)	Y	No project	Bridge clearance of 4.45m is below Regulation requirement of 5.25m	National assessment of options is on-going.
Rail bridge Bogen (Danube-km 2,311.27)	Y	No project	Bridge clearance of 5m is below Regulation requirement of 5.25m	National assessment of options is on-going.
Luitpoldbrücke Passau (Danube km 2,225.75)	Y	No project	Bridge clearance of 5.15m is below Regulation requirement of 5.25m	In the middle of the suspension bridge sufficient bridge clearance is available so that the Luitpoldbrücke in Passau is no obstacle to navigation.
Slovakia - Hungary				
Sap-Szob	Y	DaReM project - Danube Rehabilitation Measures (ID 9262)	Targeted depths are regularly not met. Joint, comprehensive solutions for the SK-HU cross-border stretch are not planned.	
Hungary				
Szap - Mohacs port / Batina	Y	Improving navigability on the Hungarian section of the Danube in the Rhine-Danube	Targeted depths are regularly not met. The extended study needs to be followed up by works implementing the study	

Corridor Section	Pre-identified	Project	Reason for non-compliance	Comments by MS / IM
		corridor: Extended study to prepare implementation (ID 9251)	results.	
Croatia – Bosnia Herzegovina - Serbia				
Sava	Y	Detailed design and EIA for the sections Jaruge – Novi Grad and Puska – Preloščica (ID 9509 and ID 9508)	Partly classified as class III, several sections of the Sava do not comply with the requirement to reach class IV.	Implementation steps after the EIA and complementary actions at other sections need to be implemented.
Romania - Bulgaria				
Porţile de fier II (Iron gates) - Călăraşi	Y	FAST Danube (ID 9248) and SWIM (ID 9510)	Targeted depths are regularly not met. Complexity of river engineering works at highly dynamic, free flowing rivers which are mostly classified as Natura 2000 areas makes a plausible EIA over a distance of 470 km highly challenging. Completion of works at all critical sectors until 2030 is considered overly ambitious and entails many risks.	
Romania				
Călăraşi - Brăila	Y	Improving Danube Navigation Conditions between Calarasi and Braila (ID 9289)	Targeted depths are regularly not met. Implemented construction works do not satisfy environmental or nautical demands.	
Danube–București Canal (Bucureşti – Olteniţa)	Y	Systematization of Argeş and Dâmboviţa Rivers for navigation and other uses (ID 9290) Scheduled for after 2030, financing of costs amounting to 1.38 billion Euros is not secured.	Missing link	

Source: viadonau, project list May 2017

This leads to the conclusion, that infrastructure gaps in the development of the IWW corridor will remain in 2030 as the target value of the various IWW KPIs will not be met. The following table shows the prospects on the compliance measured by KPIs.

Table 12: IWW – KPI development and prospects – Member Sates only (2030)

IWW KPI	Baseline 2013	Status 2015	Status 2016	Prospects 2020	Prospects 2030	Target 2030
CEMT class: > IV	89%	89%	89%	89%	89%	100%
Permissible Draught > 2.5m	80%	80%	80%	86%	86%	100%
Permissible Height under bridges > 5.25m	83% (5)	87% (4)	87% (4)	87% (4)	87% (4)	100% (0)
RIS fully available	100%	100%	100%	100%	100%	100%
Targeted depth reached	51%	43%	44%	45%	54%	100%

Source: via donau, 05/2017

The most important step for the improvement of the infrastructure conditions is to enhance fairway rehabilitation and maintenance on the Danube and its navigable tributaries. The majority of the concerned Member States committed themselves to increasing their efforts in order to provide a more reliable waterway infrastructure and re-confirmed their commitment in Conclusions signed by the Transport Ministers (except Hungary) in June 2016. With the CEF-co-financed study FAIRway Danube and the regular elaboration of National Action Plans first progress has been made in order to accelerate the removal of bottlenecks. Nevertheless, subsequent steps are desperately needed to complete the inland waterway network of the Rhine-Danube Corridor in line with the provisions of the Regulation by 2030.

Next to improvable technical infrastructure conditions, the operational and administrative barriers described below undermine the development of inland waterway transport along the corridor.

Waterway administrations are often not provided with the necessary resources to fulfil their duties, particularly concerning maintenance of good navigability conditions; they struggle with limited human and financial resources and inadequate organisational structures. Therefore state of the art approaches, inclusive service-oriented project implementation are taken up only slowly. Often stated by environmental stakeholders, waterway administrations sometimes have only limited experience with the integrated approach – taking into account the interests of inland navigation and ecology at the same time.[27] As a result, projects do not reach the set targets, are designed and implemented inefficiently or lack acceptance which leads to delays in the provision of a reliable and high-quality inland waterways. Exchanges between experts of the waterway administrations as supported by several initiatives (e.g. METEET, Danube STREAM, FAIRway Danube) address these issues. Still, all Member States would need to assure the availability of sufficient financial and personnel resources.

Administrative processes and paperwork are seen as a competitive disadvantage for inland waterway transport on the Rhine-Danube Corridor as they cause time losses and operational costs. Besides differences between national rules, it has to be taken into account that not all Danube riparian states are EU Members and not all EU states are part of the Schengen area. The most needed measures can be summarised into

[27] *Guidance Document "Inland waterway transport and Natura 2000 – sustainable inland waterway development and management in the context of the EU Birds and Habitats Directives"*

the following main areas: harmonisation, simplification and digitalisation of border controls in order to increase both effectiveness and efficiency. In the upcoming years, a dedicated flagship initiative to alleviate administrative red tape (see chapter 7) will address these issues.

5.2.3 Ports

Based on the identified port development projects, their contents and major intervention fields, as well as the gap analysis, it can be concluded that certain bottlenecks remain to be addressed in the future. Currently, no projects tackling the missing functional railway connections in the ports of Komarom (HU) and Cernavodă (RO) are planned, thus impeding the development of intermodality in these ports and the Corridor itself and not contributing to the improvement of the railway connection KPI. Nevertheless, according to the list of approved projects from CEF Transport 2016 Call, a project (2015-HU-TM-0152-S) will study the possibilities for railway connection in the port of Komarom (HU).

Concerning the provision of alternative clean fuels supply facilities, the ports of Frankfurt (DE), Nürnberg (DE), Regensburg (DE), Wien (AT), Komarno (SK), Komarom (HU), Budapest (HU), Vukovar (HR), Slavonski Brod (HR), Drobeta Turnu Severin (RO), Calafat (RO), Giurgiu (RO), Galati (RO), Cernavoda (RO) and Vidin (BG) have not reported any projects with plans to provide such facilities. However, according to the latest information, based on the list of approved projects from CEF Transport 2016 Call, a project (2015-HU-TM-0349-M) will realize the provision of alternative clean fuels (LNG) supply facilities in the port of Budapest (HU). Although selected as a KPI, availability of alternative clean fuels currently does not have any target value, due to the setup of the current legislative framework for alternative clean fuels. Currently, Directive 2014/94/EU imposes only the time horizon (31 December 2030) for the provision of an “appropriate” number of refuelling points for LNG for inland and maritime vessels (Article 6), while the TEN-T Regulation 1315/2013 does not venture into the determination of the number of such refuelling stations. Therefore, no targets in terms of numbers of refuelling points have been established. The decision on the location of the LNG refuelling points at ports will be based on a cost-benefit analysis including an examination of the environmental benefits. In this view, an action towards the realistic assessment of the demand and prospects of utilization of LNG-powered vessels is strongly recommended, following a cost-benefit and environmental analyses.

In terms of noncompliance with the non-KPI technical parameters, the ports of Cernavodă (RO) and Vidin (BG) do not provide minimum draft of 2.5m at all water levels; however the port of Vidin will solve this non-compliance within a larger global project on inland waterways interventions. No such projects have been planned for the port of Cernavodă.

As regards to the plans for provision of intermodal facilities, the ports of Komarom (HU), Calafat (RO) and Cernavoda (RO), have not reported any plans for construction/provision of such facilities, by the cut-off date for project database formation (March 2017). However, according to the list of approved projects from CEF Transport 2016 Call, two projects (2015-SK-TM-0116-S and 2015-HU-TM-0152-S) will study the possibilities for construction of intermodal facilities in the ports of Komarno (SK) and Komarom (HU), respectively. Although not strictly a requirement in terms of TEN-T Regulation, but being one of the corridor objectives, the provision of shore-side power supply facilities is still not provided in the ports of Wien (AT) and Galati (RO) and no such plans have been reported yet. As per information received from the port infrastructure manager (CN APDM SA, Galati, Romania) during the Corridor Forum 9 and 10, projects of construction of shore-side power supply are too small to be standalone projects. In this view, the consultant has been informed that all projects

involving quay wall construction and/or modernization will include construction of shore-side power supply facilities.

The analysis of the already completed, the on-going and planned port projects (118 projects in total with an investment volume of 2.6 bn Euro) leads to the conclusion that gaps in development of the ports in the corridor will remain in 2030 as the target value of the various port KPIs will not be met.

Moreover - and in addition to the final status of the project list - the non-compliant sections were also checked against the funded projects of the 2016 CEF transport call. The results are summarized in the below Table 13.

Table 13: Non- compliant ports by 2030

Corridor Section	Pre identified	Project	Reason for non-compliance	Comments by MS / IM
Germany				
Frankfurt (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities	No targets in terms of numbers of refuelling points have been established. The decision on the location of the LNG refuelling points at ports should be based on a cost-benefit analysis including an examination of the environmental benefits. In this view, an action towards the realistic assessment of the demand and prospects of utilization of LNG-powered vessels is strongly recommended, following a cost-benefit and environmental analyses. Directive 2014/94/EU imposes only the time horizon (31 December 2030) for the provision of an "appropriate" number of refuelling points for LNG for inland and maritime vessels (Article 6), while the TEN-T Regulation 1315/2013 does not venture into the determination of the number of such refuelling stations.
Regensburg (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities	Same as comment for Frankfurt (port)
Nürnberg (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities	Same as comment for Frankfurt (port)
Austria				
Wien (port)	N	No project	No existing and/or planned alternative clean fuels	Same as comment for Frankfurt (port)

Corridor Section	Pre ide ntif ied	Project	Reason for non-compliance	Comments by MS / IM
			supply facilities	
Wien (port)	N	No project	No existing and/or planned shore-side power supply	
Slovakia				
Komarno (port)	N	No project	No existing and/or planned intermodal facilities	According to the list of approved projects from CEF 2016 Call, a project 2015-SK-TM-0116-S will study the possibilities for construction of intermodal facilities.
Komarno (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Hungary				
Komarom (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Komarom (port)	N	No project	No existing and/or planned intermodal facilities.	According to the list of approved projects from CEF 2016 Call, a project 2015-HU-TM-0152-S will study the possibilities for construction of intermodal facilities.
Komarom (port)	N	No project	No railway connection.	According to the list of approved projects from CEF 2016 Call, a project 2015-HU-TM-0152-S will study the possibilities for provision of railway connection.
Croatia				
Vukovar (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Slavonski Brod (port)	Y	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Romania				
Drobeta Turnu Severin (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Calafat (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Calafat (port)	N	No project	No existing and/or planned intermodal facilities.	
Giurgiu (port)	Y	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Cernavoda (port)	N	No project	No existing and/or planned alternative clean fuels	Same as comment for

Corridor Section	Pre ide ntif ied	Project	Reason for non-compliance	Comments by MS / IM
			supply facilities.	Frankfurt (port).
Cernavoda (port)	N	No project	No existing and/or planned intermodal facilities.	
Cernavoda (port)	N	No project	No railway connection.	
Cernavoda (port)	N	No project	No minimum depth.	
Galati (port)	Y	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).
Galati (port)	Y	No project	No existing and/or planned shore-side power supply	As per information received from the port infrastructure manager (CN APDM SA) during the Corridor Forum 9 and 10, projects of construction of shore-side power supply are too small to be standalone projects. In this view, the consultant has been informed that all projects involving quay wall construction and/or modernization will include construction of shore-side power supply facilities.
Bulgaria				
Vidin (port)	N	No project	No existing and/or planned alternative clean fuels supply facilities.	Same as comment for Frankfurt (port).

Source: iC consulenten, based on project list 05/2017 and updated info received during Corridor Fora

Figure 15: Port incompliances by 2030

Source: iC consulenten, based on port survey and project list analysis, status 05/2017

Compliance of inland and sea ports with established ports KPI, in a simplified form (percentages) is summarized in the following two tables.

Table 14: Inland Ports – KPI development and prospects (2030)

Port KPI	Baseline 2013	Status 2016	Prospects 2030	Target 2030
CEMT Class IV waterway connection	100%	100%	100%	100%
Connection to rail	89%	89%	89%	100%
Availability of clean fuels	0%	6%	22%[28]	TBD
Freight terminal open to all operators and transparent charges	100%	100%	100%	100%

Source: iC consulenten, 05/2017

[28] *Compliance rate was changed after information provided by Ministry of National Development, 01/2018)*

Table 15: Seaports – KPI development and prospects (2030)

Seaports KPI & TP	Baseline 2013	Status 2016	Prospects 2030	Target 2030
Connection to rail (KPI)	100%	100%	100%	100%
CEMT Class IV waterway connection (KPI)	100%	100%	100%	100%
Availability of clean fuels (KPI)	0%	0%	100%	TBD
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges (KPI)	100%	100%	100%	100%
Facilities for ship generated waste (KPI)	100%	100%	100%	100%

Source: iC consulenten, 05/2017

Based on the findings of the Rhine-Danube Core Network Corridor study and the clearer overview of the objectives of the corridor development gained after eleven meetings of the Corridor Forrum, it is realistic to expect that the missing projects, needed to deal with the remaining bottlenecks, would be tackled in the forthcoming period. In this view, a CEF 2 is seen as a very useful tool that could be a game-changer for the port development until 2030.

5.2.4 Road

The analysis of identified projects in chapter 4.2.4 leads to the conclusion that some road sections are expected to remain noncompliant in 2030:

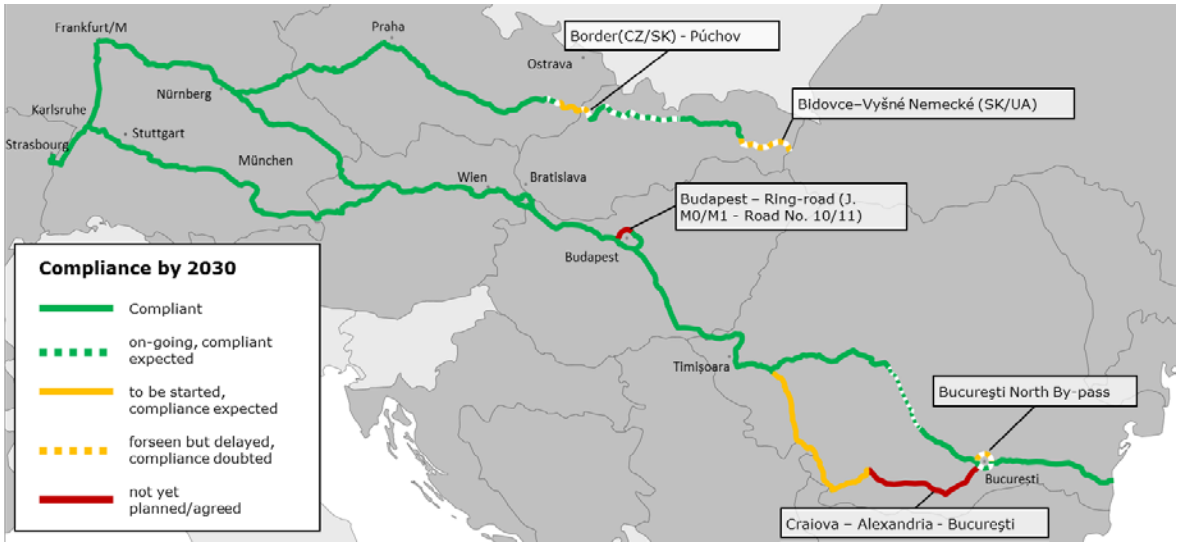
- in Slovakia (from Bidovce towards the Ukraine border with, approximate length of 74km),
- the section between Beluša and Lysá pod Makytou (SK/CZ) border, length 26km,
- the closing of the ring road around Budapest (approx. length 30km) and
- in Romania (between Craiova and București with a length of 218km and
- sections of the ring road around Bucuresti[29]

High traffic utilisation and capacity constraints are an issue at some road sections in Germany, Austria, and Czech Republic and in Hungary around Budapest as well as in Romania around București. In the Czech Republic there are additional critical sections regarding over-ageing of construction parts, bridges and in Slovakia regarding safety.

The analysis of the already completed, the on-going and planned road projects (103 projects in total with an total estimated investment volume of 23.4 bn Euro) leads to the conclusion, that a small gap in development of the road corridor will remain in 2030 and the target value of the road KPI on motorway/express way will not be met by about 8%.

[29] *Southern section (km 52-770- km 100+765): the tender procedure was launched in 07/2017 and the contract should be signed during Q3 2018; Northern section (km 0+000 – km 52+770): the call for design and construction is planned for Q2/2018. The contract for design and construction will be signed during Q4 2018 (Information provided by CFR-SA to the consultant team in 01/2018).*

Figure 16: Road compliance by 2030



Source: iC consulenten, status 05/2017

Table 16: Road – KPI development and prospects (2030)

Road KPI	Status 2015	Status 2016	Prospects 2030	Target 2030
Motorway/Express Road	77%	78%	92%	100%

Source: iC consulenten, 05/2017

The following table provides the results of the gap analysis for sections and nodes where a project is missing or project data are not available thus limiting the project majurity by the year 2030.

Table 17: Non-compliant sections by 2030

Sections with a need for action	Project identified	Reason for non-compliance by 2030
Slovakia		
Bidovce via Dargov and Pozdisovce to Border	D1 Bidovce – Dargov - Pozdišovce – border SK/UA	Project end date unknown, no funding source
R6 Border CZ/SK – Mestećko	construction of new section	EIA not started, construction date unknown, no funding source
R6 Mestečko – Púchov	R6 Mestečko – Púchov,	feasibility study, no construction details
Hungary		
Budapest ring road	M0 motorway around Budapest: Western section between main roads No. 10. and motorway M1	Design study for 18km section (2017-19), no construction details, no costs
Budapest ring road	M0 motorway around Budapest: North-Western section between main road No. 10. and No. 11	Design study for 8km section (2016-18), no construction dates, no costs

Sections with a need for action	Project identified	Reason for non-compliance by 2030
Romania		
Craiova – Bucuresti	Craiova – Bucuresti - Upgrade - TransRegio on TEN-T Core Corridor	No financing source available, end date by 2031

Source: iC consulenten, project list May 2017

With regard to the availability of clean fuels along the motorways it can be concluded that the provision is a dynamic commercial process, which will accelerate in the future. Alternative fuels are widely available along the motorways, although the density of stations differs from member state to member state. There is a good coverage of LPG stations along the whole corridor. CNG stations have a limited coverage on the whole corridor. Electric charging stations are available to a larger extent in Germany, Austria and Slovakia, but not in the Czech Republic, Hungary and Romania.[30]

With regard to other infrastructure requirements such as the availability of safe parking and resting areas on motorways and ITS a number of projects are under implementation or planned improving the situation for the truck driver and the safety on the road. Further investments in ITS test infrastructures are done by the Czech Republic, Germany, Austria and Hungary for connecting the vehicle with the infrastructure (C-ITS). Here traffic information services will be transmitted directly from the infrastructure operators into the vehicles and vice versa vehicles will be used as "driving sensors" to improve the data necessary for traffic management.

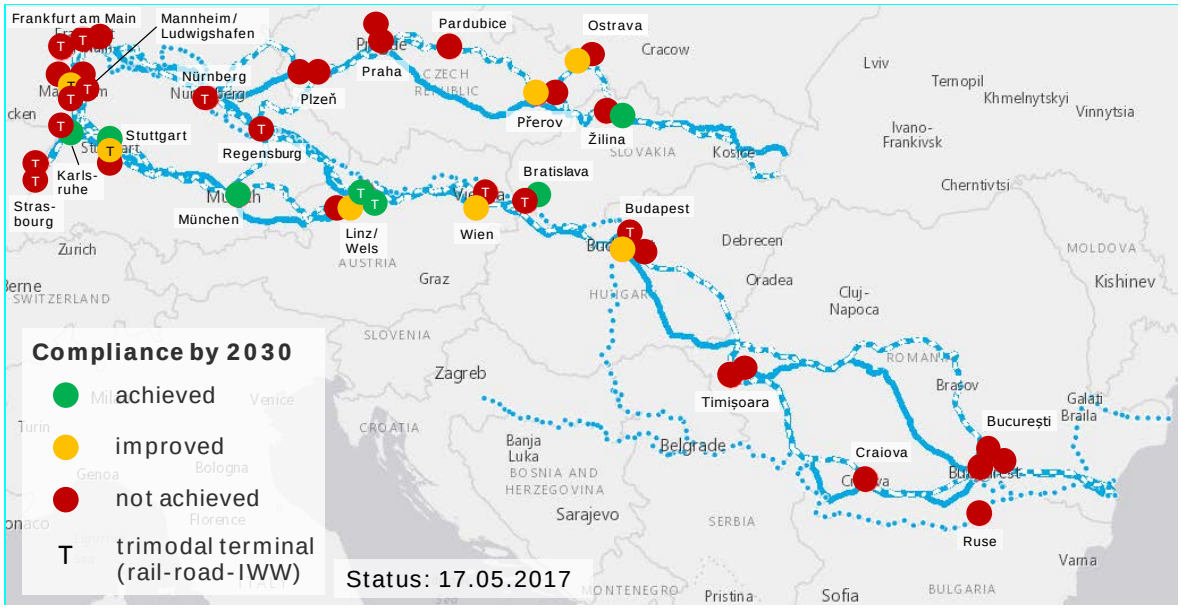
5.2.5 Rail-Road Terminals

The analysis of the contributions of the identified terminal projects on the improvement of the 3 commonly defined KPIs as described in chapter 4.2.5 are visualized in Figure 17. It reflects that only seven terminals namely Karlsruhe Rbf, Kornwestheim Rbf, München (new terminal), Linz Stadthafen (trimodal terminal in the port), Ennshafen, Bratislava ÚNS and Žilina Teplička will fulfil with all three criteria after implementing the projects by 2030. Several terminals are “improved” after their planned projects have been concluded, but they will not reach all three parameters, though. For most sites no projects are defined, yet.

While the focus on specific types of intermodal transport units, e.g. containers, might be explained by the present market orientation, the low level of meeting the electrification and track length is a real burden for the development of efficient intermodal transport services. Thus, the largest challenge for the present sites is their historically grown access to the rail infrastructure (single sided, non-electrified, annex to shunting yard or port railway line) and the limitation of the (wagon) train length by either the reception/departure siding or the transhipment track(s) which will prevail until 2030. After completion of the planned projects in 2030, ten terminals will be equipped with tracks of at least 740 m length; electrified access will be provided by 15 RRT. In order to achieve the KPI also in the other terminals, it is recommended that rail infrastructure managers and terminal managers cooperate towards realizing the track-side and terminal side improvement of these two parameters in a coordinated way.

[30] *CEF Project “2016-EU-TMC-0113-M” will build electric charging stations in every 150 km on core network corridors in Hungary. The CEF Blending project “2017-EU-TM-0065-W” (Central European ultra charging) will also build 13 new charging stations in HU (Information provided by Hungarian Ministry of National Development, 01/2018)*

Figure 17: KPI Achievement of the Rail/road terminals by 2030



Source: KombiConsult analysis, 05/2017

Table 18 lists all RRT which are expected to miss at least one of the three KPI targets for the year 2030. For each of these terminals it is indicated which KPI will not be met as well as the identified reason for non-achievement.

Table 18: Reasons for expected non-achievement of RRT concerned by 2030

Terminal name	Expected KPI achievement 2030			Reason for non-achievement			
	KPI: Capability of handling intermodal units	KPI: 740m train terminal accessi-bility	KPI: Electrified train terminal accessi-bility	No improve-ment measure defined	Unclear if KPI will be achieved or only improved	KPI only impro-ved, but not achie-ved	Other (comment)
France							
Strasbourg CT Nord	yes	no	no	x			
Strasbourg CT Sud	no	no	no	x			
Germany							
Karlsruhe Hafen	no	no	no	x			
Mannheim Handelshafen	yes	no	no	x			
Mannheim MCT	no	no	no	x			
Mannheim-Mühlauhafen	yes	no	no		x		
Ludwigshafen KTL	yes	no	yes	x			
Ludwigshafen Kaiserwörthhafen	no	no	no	x			
Stuttgart Container Terminal SCT	yes	no	no		x		
Stuttgart-Hafen	yes	no	no	x			
Frankfurt/Main FIT	no	no	no	x			
Frankfurt/Main-Ost	yes	no	yes		x		
Frankfurt/Main-Osthafen	no	no	no	x			
Nürnberg-Hafen TriCon	yes	no	yes	x			

Terminal name	Expected KPI achievement 2030			Reason for non-achievement			
	KPI: Capability of handling intermodal units	KPI: 740m train terminal accessi-bility	KPI: Electrified train terminal accessi-bility	No improve-ment measure defined	Unclear if KPI will be achieved or only improved	KPI only impro-ved, but not achie-ved	Other (comment)
Regensburg Hafen	no	no	no				Project does not improve these parameters
Austria							
Wien Nordwest CCT/ Wien South (Inzersdorf)	yes	no	yes			x	
Wien Freudenau Hafen	yes	no	yes	x			
Wels Vbf	yes	no	yes			x	
Wels RoLa	no	no	yes				RoLa terminal with dedicated RoLa operating conditions
Slovakia							
Bratislava Palenisko	no	no	no	x			
Žilina	yes	yes	yes				
Hungary							
Budapest (Soroksár)	yes	yes	no	x			
Budapest Mahart Container Center	no	no	no	x			
Budapest (Metrans)	yes	no	no			x	
Romania							
București Intermodal Terminal	yes	no	no	x			
București Noi	no	no	no	x			
București Sud	no	no	no	x			
Timișoara Semenic	no	no	no	x			
Timișoara Remetea Mare	no	no	no		x		
Craiova	no	no	no		x		
Czech Republic[31]							
Ostrava-Paskov	yes	yes	no		x		
Ostrava-Šenov	yes	no	yes		x		
Plzeň-Nýřany	yes	no	no		x		
Praha (Uhříněves)	yes	no	yes	x			
Pardubice	yes	no	no			x	
Přerov	yes	no	yes		x		
Přerov (new)	no	yes	yes				No project promoter identified; costs not known, maturity not

31 Update of information provided by MoT in consultation with Railway Department and relevant stakeholder, 01/2018

Terminal name	Expected KPI achievement 2030			Reason for non-achievement			
	KPI: Capability of handling intermodal units	KPI: 740m train terminal accessi-bility	KPI: Electrified train terminal accessi-bility	No improve-ment measure defined	Unclear if KPI will be achieved or only improved	KPI only impro-ved, but not achie-ved	Other (comment)
							advanced
Bulgaria							
Ruse Tovarna	no	no	no		x		

Source: KombiConsult, project list May 2017

In quantitative terms it means the KPI for RRT are expected to be improved compared to the status in 2016 but the terminals are far from reaching compliance if the present speed of implementation is not improved. For an orientation, a brief assessment on the impact of the six projects to be completed by the year 2020 was made in the following table.

Table 19: Evolution of KPI for RRT since 2013

Rail Road Terminals	Baseline 2013	Status 2015	Status 2016	Expected 2020	Expected 2030	Target 2030
Capability of handling intermodal transport units	44%	44%	44%	44%	49%	100%
Accessibility by trains of 740m train length	2%	2%	5%	11%	21%	100%
Accessibility by electrified trains	16%	16%	21%	21%	32%	TBD
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	100%	100%	100%	100%	100%	100%

Source: KombiConsult, based on desk research, KombiConsult knowledge base and project list 2017

5.2.6 Airports

The analysis of the identified projects as summarised in chapter 4.2.6 leads to the conclusion that the KPI on connection to rail for the dedicated main airports along the corridor (Frankfurt, München, Stuttgart, Praha, Wien and Budapest) will reach the target value of 100% by 2050.

First activities started in the provision of alternative clean fuels on airports for ground vehicles and of electric charging stations for passenger cars.

However the provision of alternative clean fuels for airplanes has not yet started, no project has been identified.

5.3 Persisting Administrative and Operational Barriers

In addition to physical and technical barriers, also administrative and operational barriers hinder the seamless transport on the Rhine-Danube Corridor. Both have an important impact on the choice of transport routes and modes and thus influence transport demand and modal share.

Administrative and operational barriers mostly consist of changing infrastructure standards at borders, extensive border waiting times and diverging and non-transparent charging systems.

But not only transport itself has to cope with administrative and operational barriers, also hindrances within responsible organisations effect the progress in the Corridor's

development. Inefficient organisational structures, a lack of human and financial resources often impede the successful implementation of already approved projects.

Continuity of passenger and freight flows by **rail** is jeopardized at cross-border sections, due to changing technical parameters. Full exploitation of train capacities is particularly impacted for long-haul train runs, as they have to cope with frequent changes and multi-system locomotives are needed. Also, deviating infrastructure parameters at last mile connections or missing interconnections hamper the increase of rail transport.

Regarding **administrative** barriers border control procedures influence transport/travel times, costs and resource efficiency of rail transport negatively thus creating barriers such as:

- Border-control and customs clearance in both sides on the same cross-border point;
- Schengen border – **principle of trust** does not work, resulting in time-consuming double-checking, although Schengen/Non-Schengen status should be irrelevant;
- Certain traditional national **operational rules** are existing with no specific purpose at cross-border points that should be jointly identified and eliminated (non-sense rules);
- Normative differences between Corridor countries, although common regulations (UIC,COTIF,TSI) exist, these are not applied similarly, thus harmonization is required;
- Lack of coordination of operations and current modernisation and rehabilitation works along the Corridor, especially between neighbouring national IMs;
- Lack of consistent and updated information exchange system for capacity planning, train operations and document transfer across cross-borders;
- Information gaps and barriers in communication, which have high impact on the planning of activities, personnel and rolling stock, as well as on current operation of international freight trains;

Inland waterway transport might be improved by realising soft measures in order to achieve results, which are tangible and visible in a shorter period of time, such as:

- Providing waterway infrastructure managers with adequate budget to fulfil their national maintenance duties;
- Well qualified human resources for the preparation and implementation of complex, integrated waterway management and engineering projects is not sufficiently available in some countries; Several projects (e.g. METEET, Danube STREAM and FAIRway Danube) address these issues.
- As Member States struggle with providing the required fairway depths at free flowing river sections, intentions to legally relieve themselves from their responsibilities have been observed (e.g. Restrictions of vessel draught, Force Majeure Certificates);
- Administrative processes and paperwork are seen as a significant competitive disadvantage for inland waterway transport on the Rhine-Danube Corridor, which typically runs long distances crossing several borders and administrative areas of competence;
- Information on current fairway conditions is often not available or difficult to access; therefore planning of inland waterway transports is overly complex;

- Fees on the Danube-Black Sea Canal are calculated according to loading capacity and doubly punish shipping companies in case of bad fairway conditions.

Besides differences between national rules, it has to be taken into account that not all Danube riparian states are an EU Member State and not all EU states are in the Schengen area. Therefore, for instance, border checks for passengers and crews are necessary, as well as required customs clearance procedures for imports and exports. Delays are significant and do weaken the competiveness of inland waterway transport in comparison to other transport modes.

Ports set their charges autonomously and may differ substantially in line with the applied organisational scheme. Increased transparency, e.g. by an obligation to publish tariffs on the ports websites would support inland waterway transport. Non-harmonized administrative procedures in ports delay or prolong transports significantly. Harmonization of requirements for vessel, crew and cargo related documents for vessels' calling in ports is highly recommended. In the very near future, efficiency of ports, their climate change resilience and the greening of port operations will become crucial aspects of the port development. In this view, further planning and policy documents must take these aspects into account.

Road tolling systems along the Corridor remain fragmentised and non-harmonized, distance or time based charging schemes exist in all countries of the Rhine-Danube Corridor, but only five use an electronic fee collection system. Non-interoperability of diverse road tolling systems between Member States is an obstacle and burden for the road hauliers and freight forwarders on long distance transport.

The systems for the provision of real-time traffic and weather information are not yet capable of offering cross-border traffic information. Thus, it is explicitly recommended that special attention is paid to the deployment of intelligent transport systems, especially in the MS where basic IT infrastructure for data transmission is not yet in place.

Provision of safe and secure parking areas is also an issue to be considered. Although the provision of such facilities is market-driven, some regulation might be needed especially in setting clear definitions of the "safe and secure parking" notion. This would facilitate disputes between road hauliers and insurance companies and might trigger private initiative in offering adequate parking services. First investments were done in Germany, Austria, Hungary, Czech Republic and Romania in equipping truck parking areas along the motorways with intelligent infrastructure (towards safe and secure truck parking).

Since the managers of **rail/road terminals** as well as the terminal users were not directly involved in the Corridor Forum and the analysis, detailed administrative or operational bottlenecks for the terminals cannot be reported yet. Since the terminals are under the legislation for railways and roads and of inland waterways (trimodal terminals) as well as those governing transport in general, the mode-related obstacles identified above apply also to the terminals.

The European Parliament[32] has adopted the update of the Directive 96/53 on weights and dimensions in international road transport, which needs to be implemented into national law by mid of 2017. There will be an impact on terminals due to the new rules

[32] *Directive (EU) 2015/719 of 29 April 2015 amending Council Directive 96/53/EC laying down for certain road vehicles circulating within the Community the maximum authorised dimensions in national and international traffic and the maximum authorised weights in international traffic.*

for longer vehicles and aerodynamic devices, as well as the – anticipated – increase of the allowed container size to 45 feet.

The Directive 92/106 of 7 December 1992 on the establishment of common rules for certain types of combined transport of goods between Member States, which is of equal importance for combined transport, still needs to be improved. The consultation process[33] started in early 2017 and should involve also terminals so that proper definitions as regards e.g. “nearest appropriate terminal” can be agreed upon which are easily applicable by the market parties and the authorities.

5.4 Links to Western Balkan

In June 2015, WB6 Transport Ministers and EU Transport Commissioner, Violeta Bulc, identified three core network corridors to be extended to the Western Balkans as well as priority projects for possible EU funding. Subsequently the scope of the studies on the Mediterranean Corridor, the Orient/East-Med Corridor and the Rhine-Danube Corridor was broadened.

To ensure continuity on transport and the need for a safe and reliable navigation within the Rhine-Danube Corridor the inland waterways and ports of Serbia and Bosnia Herzegovina are of uttermost importance. Therefore neighbouring third countries have already been included in the first phase of the Corridor studies.[34] After the extension, the study on the Rhine-Danube Corridor now covers the following infrastructures in the Western Balkan:

Inland waterways:

- Danube in Serbia
- Sava in Serbia and Bosnia and Herzegovina
- Tisa in Serbia

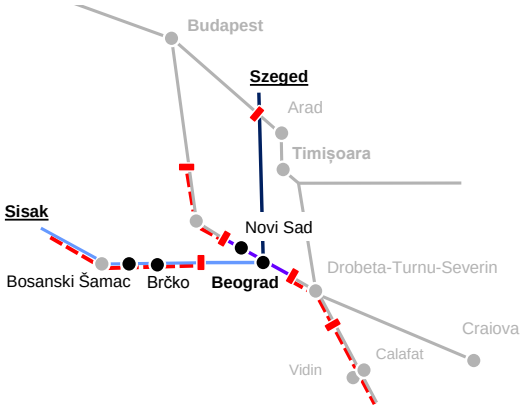
Ports:

- Brčko and Bosanski Šamac in Bosnia and Herzegovina
- Novi Sad and Beograd in Serbia

[33] *https://ec.europa.eu/transport/themes/urban/consultations/2017-CTD_en*

[34] *The cooperation with third countries is described in Article 8 of the TEN-T Guidelines. Projects of common interest in order to connect the TEN-T network with networks of neighbouring countries may be supported, including financially by the Union.*

Figure 18: Links to Western Balkan



Western Balkan		Rail	Road	IWW
F	Danube in Serbia			X
G	Sava in Serbia and Bosnia Herzegovina			X
H	Tisa in Serbia until Szeged in Hungary			X

Corridor origin/terminus

- **Urban nodes (core network)**
- Other corridor nodes
- Border crossings
- Node not part of the Western Balkan

Source: viadonau, 2016

About 70% of the Inland Waterway Network of the Western Balkan countries Serbia and Bosnia Herzegovina consist of the Sava and Tisa River, which are tributaries to the Danube, the backbone of the waterway network. In comparison to the EU Member States, KPI values on the less frequented Western Balkan Inland Waterways are lower than on the Danube river.

Low compliance values mainly result from the classification of the Sava below class IV and the non-availability of RIS at the Tisa. On the Danube, the targeted fairway depth varies along with the hydrological circumstances and was repeatedly not reached at the critical section Futog (Serbia). Information on the compliance with the targeted depth is not available for the Sava or the Tisa, since there are no publically available statistics.

The Iron Gate I and II locks have been identified as bottlenecks and need a capital overhaul. Next to the obsolete infrastructure, operational schemes favour energy production but have significant impacts on inland navigation and the environment. Starting in 2017, the CEF-co-financed Upgrade of the Iron Gate I navigational lock will improve the situation by 2020.

Inland Waterway Infrastructure improvements in the Western Balkan countries are addressed by a number of projects. The new construction of the Žeželj Bridge in Novi Sad is ongoing and will raise the bridge clearance so that compliance with the applicable waterway classification VIc is reached. River Training and Dredging Works, supervision and environmental monitoring at six critical sectors between Bačka Palanca and Beograd (Serbia) are scheduled to start in the 2nd half of 2017.

Despite of the positive developments, the Key Performance Indicators remained stable and further activities will be needed in order to reach compliance with Regulation 1315/2013 before 2030.

Table 20: Evolution of generic IWW KPI in the Western Balkan countries

IWW KPI	Baseline 2013	Status 2015	Status 2016	Target 2030
CEMT requirements for class IV IWW	65%	65%	65%	100%
Permissible Draught (min 2.5m)	65%	65%	65%	100%
Permissible Height under bridges (min. 5.25m)	100%	100%	100%	100%
RIS implementation (minimum requirements set out by the RIS directive)	71%	71%	71%	100%
Targeted depth according to waterway manager reached	17%	36%	17%	100%

Source: viadonau, based on desk research and own survey

Key performance indicators for ports in the Western Balkan (WB6) countries show high values, except for the availability of alternative clean fuel supply facilities.

All ports have railway connection to the network and they are all located on waterways of at least CEMT Class IV. Two ports on the Sava River (Šamac and Brčko, both in Bosnia & Herzegovina) are located on the sections of the Sava River having the CEMT Class IV. However, various sections of the Sava River fail to comply with the CEMT Class IV requirements, as elaborated above, thus limiting the accessibility of the two Bosnian inland ports.

In addition to this, the port of Šamac is a fully privately owned, managed and operated port, and as such serves only to the needs of the private operator. This has been confirmed to the Consultant during the 7th Corridor Forum by the Bosnian representative, Mr. Izet Bajrambašić, Assistant Minister in the Ministry of Communications and Transport of Bosnia and Herzegovina. Such confirmation has also been received by the South-East Europe Transport Observatory (SEETO). Taking this into consideration, it can be concluded that the Port of Šamac (BA), does not comply with the KPI of "Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges", which has its basis in the Article 15(2) of the EU Regulation 1315/2013. No direct or indirect contact could be established with the operators of the Port of Šamac, while no publicly available data have been found for this port.

Table 21: KPI and TP for inland ports in the WB6 countries only

Inland ports KPI and TP (WB6 countries only)	Baseline 2013	Status 2015	Target 2030
CEMT Class IV waterway connection	100%	100%	100%
Connection to rail	100%	100%	100%
Availability of clean fuels	0%	0%	TBD
Availability of at least one freight terminal open to all operators in a non-discriminatory way and application of transparent charges	75%	75%	100%
Intermodal facilities (TP)	75%	75%	100%
Minimum draft (TP)	100%	100%	100%
Shore-side power supply facilities (TP – non-compulsory)	75%	75%	N/A

Source: iC consulenten, based on desk research and own survey

6 Infrastructure implementation by 2030 and the environmental, socio-economic effects

6.1 What has still to be done

In parallel with the infrastructure requirements, the consequences of the TENT-T requirements for the corridor and the overall infrastructure status by 2030, wider elements in terms of innovation, climate change adaptation and decarbonisation have been addressed in the corridor work.

The decarbonisation impact for the corridor (i.e. realizing the projects of the project list), is estimated in a modelling exercise common for all corridors to address climate change adaptation and mitigation measures' impact to the corridor development. Funding gaps on this sector should be analysed to.

6.2 Innovation deployment

Innovative projects are defined as projects which incorporate new technologies designed to improve the current transport system. In the RD corridor around 18% of the projects are classified as innovative. The share of innovation projects of the RD corridor is relatively low (18%) compared to the corridor average of 23.5%; however the total number of projects is around the average.

The highest amount of innovative projects relate to road and IWW. More than half (50 projects) are categorised as “Catch-up innovation” or otherwise defined as projects related to transferable innovation across the EU. These have already been implemented in other sections of the Corridor or other Member States. “Radical and Incremental innovation” account for a bit more than 40% (38) of all innovative projects, with seven projects being categorised as “Radical innovation”. Radical innovation defined as project which involve new technologies for the EU, for instance in the RD these are projects involving alternative fuels in areas where this has never been done before (e.g. LNG infrastructure in port areas). Incremental projects are in between “Catch-up innovation” and “Radical innovation”, a common example being ERTMS level 3. The majority of projects (80) are classified as transferable, meaning that they can be implemented in different regions on the same corridor or other corridors.

The innovation projects were categorized according to their contribution in the framework of the TEN-T Regulation:

- Telematic applications,
- Sustainable freight transport initiatives,
- Safety improvement,
- Contribution to development of European technological industry and
- Transport efficiency improvement through data sharing.

All 5 policy objectives are being addressed by innovation projects in all corridors. For the RD Corridor it can be observed that the focus is on safety improvement and transport efficiency improvement through ITS and e-mobility applications.

Innovation in freight and passenger transportation is mostly related to Data sharing and safety & security projects. Although the budget dedicated to innovation projects is small, their impact is important. Funding has been found a strong enabler in projects from all types of transport modes (road, rail, maritime and IWW) and various scopes of work – from infrastructure to studies Innovative projects for rail and road account for more than 80% of the total costs of innovative projects. Furthermore, CEF contributions to these projects are 6% which is higher/lower compared to the CEF investments in the RD corridor.

Regarding the specific issue of the contribution of innovation projects to transport decarbonisation a more detailed assessment was performed. It makes it very clear that innovation projects in all CNC are leading efforts for the use of Natural Gas and Biofuels in transport, and that a large number of projects for electricity and hydrogen are also being implemented. Decarbonisation is addressed by a third of the innovative projects (22) in the RDC, with a vast majority of them being related to the use of alternative fuels. These types of projects are found in each of the member states, with the most in Romania (7). The maritime projects are mainly new infrastructure works related to increasing the use of alternative energy (specifically LNG, solar and wind power). The road projects also aim to incentivize the use of alternative fuels through an increase in the number of electric supply stations for vehicles and deployment of CNG stations. The remaining decarbonisation projects (outside of Romania) are 16 and mainly focus on increasing the incentives for the usage of electric and hydrogen energy and constructions of LNG stations. There is also one project concerning the sustainability of the Vienna airport through providing clean fuels and renewal of electric lighting system.

CNC innovative projects show a very high level of transferability, meaning that the TEN-T can potentially position as a space for deploying transport innovations in a larger scale, helping project promoters better develop their innovations before transferring them to wider environments. The RD corridor has an average number of projects that are transferable and an average number that is scalable compared to the other corridors.

6.3 Impact to decarbonisation and climate change adaptation

6.3.1 Decarbonisation and emissions

According to the calculations on decarbonisation and emissions conducted for the period 2015 – 2050 the emissions for road and rail will decrease, while at the same time their number of passengers and tonnes of freight will increase. The emissions from rail will slightly rise in 2030 but would decrease in 2050. For Inland waterway transport (IWT) the emissions will increase slightly. Aviation is a sector where the

number of passengers will almost double and as a result the emissions will increase but only slightly.[35]

The EU REFERENCE scenario 2016 is applied for the calculations of emissions in 2030 and 2050:

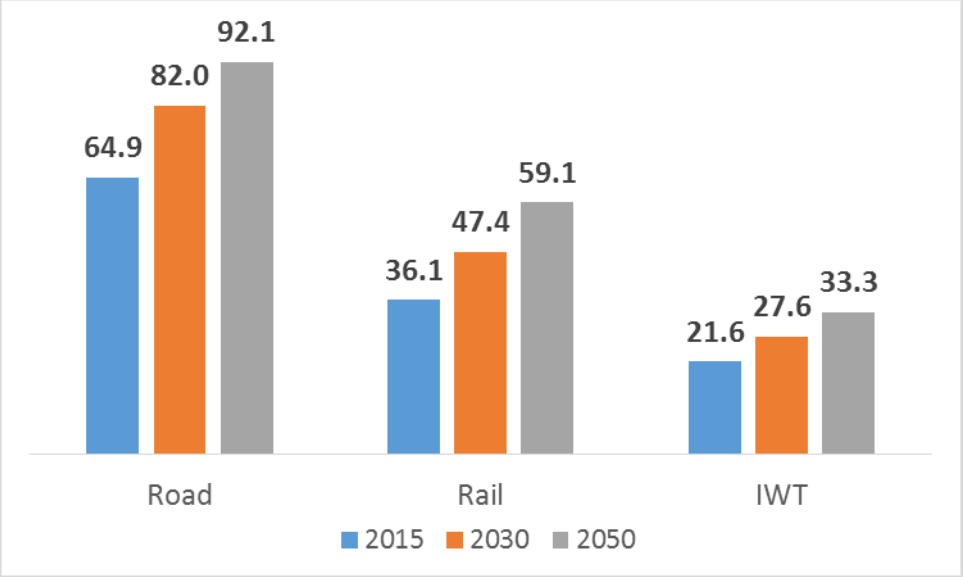
RD Member States account for around 25% of the EU28 total on current socio economic & transport. However, growth rates of population, GDP and passenger traffic growth up to 2030 are lower compared to EU-28 average. Passenger traffic is forecasted to increase from 114 billion pkm today to 135 billion pkm by 2030 (road, rail and aviation) - fastest growing sector in the REFERENCE scenario is aviation (at 2.6% per annum).

Freight traffic is forecasted to increase from 149 billion tkm today to 189 billion tkm by 2030 (road, rail and inland waterway) - fastest growing sector in the REFERENCE scenario is rail (at 1.8% per annum).

Based on the REFERENCE scenario the emissions (2015) are 20.4 million tonnes of CO2 equivalent. Energy efficiency is forecasted to increase over the 2015-2030 time period. According to the forecasted traffic growth and the increase of energy efficiency emissions of 19.6 million tonnes of CO2 equivalent in 2030 for the REFERENCE scenario are forecasted.

This is illustrated in the figures 19 – 21.

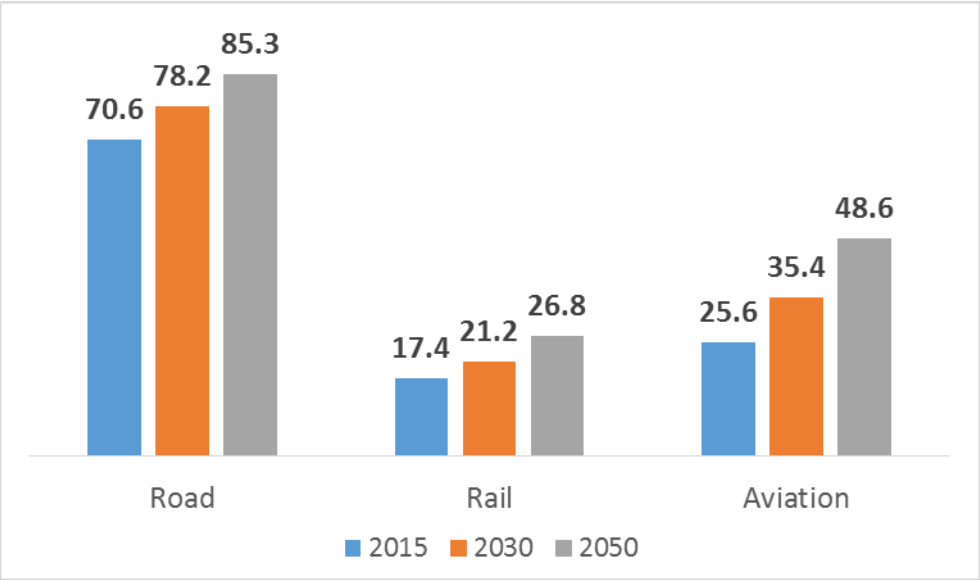
Figure 19: Tons of freight (bn) per kilometer per mode of transport



Source: Panteia, Wider elements study 06/2017

[35] Source: *Panteia, 'Wider elements of the Work Plan' study, 06/2017*

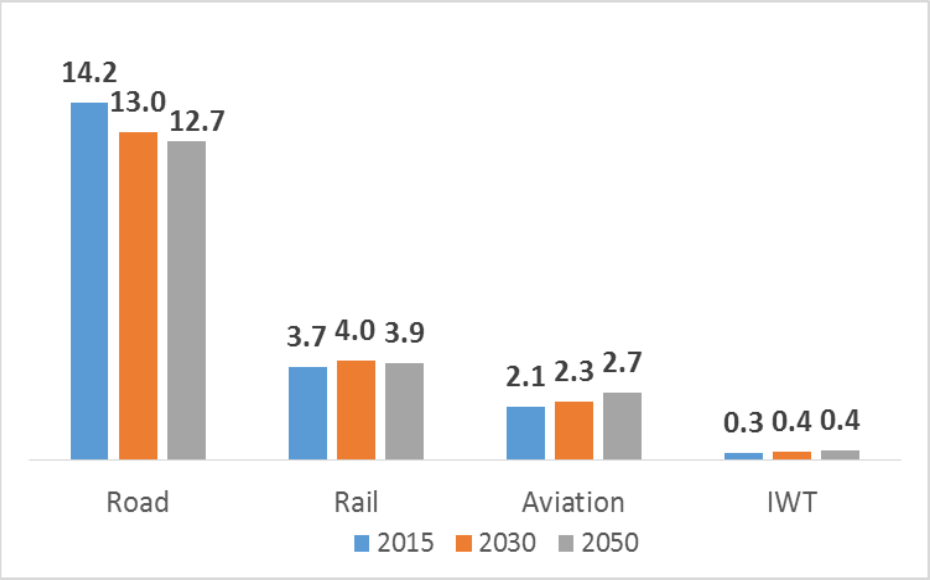
Figure 20: Number of passengers (bn) per kilometer per mode of transport



Source: Panteia, Wider elements study, 06/2017

As a result of modal shift and various decarbonisation initiatives, energy efficiency is forecasted to increase over the time period between 2015 and 2030, and emission factors are estimated to fall. This is an observation seen also in other corridors. Most of the 2030 decrease in CO_2 is attributed to greater efficiency in the passenger road sector, whereby relatively low expected growth is outweighed by increases in efficiency. In the freight sector and aviation, traffic growth outweighs efficiency gains.

Figure 21: Emissions from freight and passenger transport



Source: Panteia, Wider elements study, 06/2017

6.3.2 Climate Change Adaptation

The Rhine Danube corridor has a temperate oceanic climate in the West with gradually transitions into a continental climate. In the southern part of Germany, Austria, Slovakia, Hungary, and eastern Romania there will be a large increased vulnerability when heat stress of road pavement occurs. The other parts of the corridor will

experience a smaller increase in heat stress vulnerability in the upcoming century. The eastern part of Austria, Southern Romania, and to lesser extent southwest Germany will become more vulnerable to rail track buckling. In the eastern parts of the Czech Republic and Austria as well as southern Romania, bridges are expected to become more exposed to bridge scour. The areas surrounding the most outer parts of the corridor are likely to be exposed to droughts more often in the next century. The centre part of the corridor (southeast Germany and the Czech Republic) will become wetter.

Against this background there have been 4 projects identified on the project list, directly contributing to Climate Change Adaptation. Further during the study, national climate change adaption strategies have been evaluated. This indicates that this topic is only just beginning to mature for transport infrastructure.

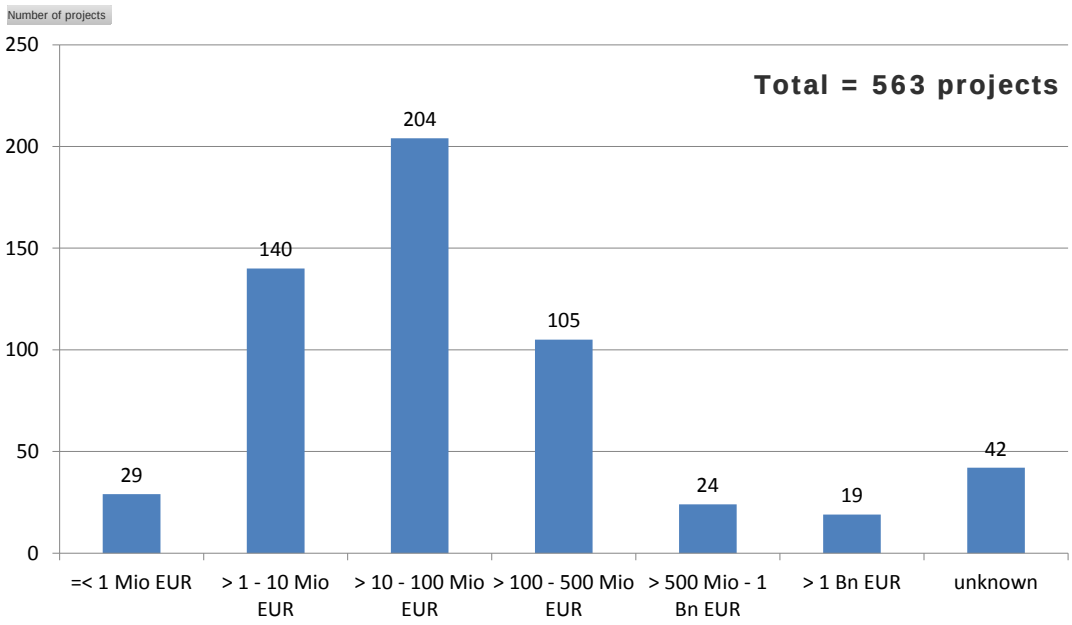
6.4 Infrastructure investments and funding

6.4.1 Financial requirements

Looking at the costs for developing the corridor infrastructure, the total costs for all 563 projects amount to 91.9 bn EUR, which means an increase by 22 bn EUR (+31%) compared to the 2016 project list version and even by 27.2 bn EUR (+42%) compared to the 2014 work plan. The average cost per project is the same as in 2016 (163 Mio EUR), but notably lower than in 2014 (193 Mio EUR). This is due to the fact that some particular high-cost projects had been finalised before 2014 and are thus not included in 2017 project list any more. Furthermore, it must be observed that for 42 projects no information about costs is available.

The project specific costs show a large variety, reaching from 50,000 up to 6.4 bn EUR per project. As Figure 22 points out, most of the projects are attributed to the cost classes “>10 – 100 Mio EUR” (204 projects = 36%), “>1 – 10 Mio EUR” (140 projects = 25%) and “>100 – 500 Mio EUR” (105 projects = 19%). Particularly Innovation, IWW, Port and Multimodal projects are mostly assigned to the lower costs classes (max. 100 Mio EUR). In contrast, projects with more than 100 Mio EUR of investment are mainly on the road and rail sector. In total, about 60% of the overall projects costs refer to rail, followed by road (27%).

Figure 22: Number of corridor projects by cost class



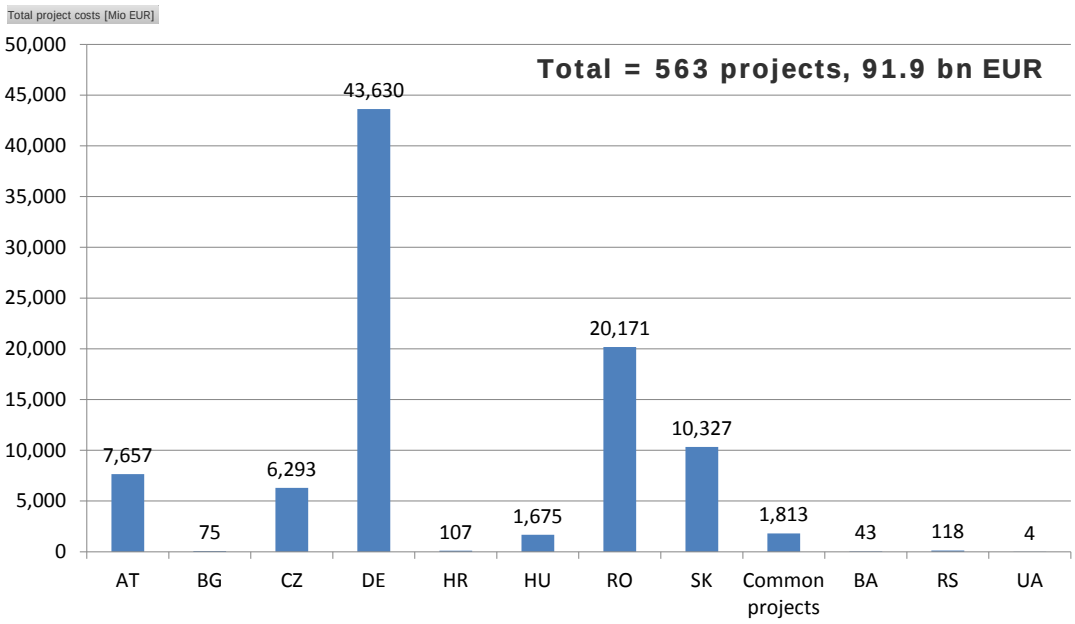
Source: HaCon, based on project list, status 05/2017

As Figure 23 shows, 47% of these overall costs are allocated to Germany (with only 20% share of project quantity) meaning that particularly German projects show an above-average volume. About 80% of the German investments refer to rail projects; also in Austria the major share of project costs is allocated to rail, whereas Romania, Slovakia and the Czech Republic also show a considerable or even higher share of road related project costs.

About 86 projects were completed between 2014 and 2016 with an investment volume of 5.27 bn EUR (5.7% of total investment requirement).

241 projects are on-going projects, thus considering that the financing is secured. The investment volume is 37.8 bn EUR or 41% of total investment requirement,

Figure 23: Total project costs by country [Mio EUR]



Source: HaCon, based on project list, status 05/2017

From the total number of projects about 75% of the projects contains full set of information on the investment costs (equal to investment volume of 68.8 bn EUR), for 25% of the projects the information are not complete (equal to an investment volume of 23 bn EUR).

The financial sources of the projects, which contain complete information of financing, are identified as follows:

- Financing by MS/public grant: 64.7% or 44.8 bn EUR
- EU grants: 23.5 % or 16.2 bn EUR
- IFI bank loan: 25 Mio EUR (negligible)
- Private financing/own resources: 6.3% or 4.3 bn EUR
- Other financing sources: 5.5% or 3.7 bn EUR

The breakdown of funding by EU grants shows following situation:

- Cohesion Fund, CEF, OPT: 13.1 bn EUR or 81%
- CEF/TEN-T: 1.9 bn EUR or 12%

- ERDF: 685 Mio EUR or 4%
- ESIF: 432 Mio EUR or 3%
- IPA: 40 Mio EUR
- Not specified: 26.6 Mio EUR

When analysing the financing of projects through EU grants, a share of 51.5% of the investment volume is approved (equal to 8.3 bn EUR) and the share of 48.4% can be considered as potential for funding (equal to 7.8 bn EUR).The investment analysis of the RD CNC and the structure of the EU grants breakdown reflect the typical situation of the RD CNC, which has a high share of Member States receiving financial means under the Cohesion Fund.

Would the same EU funding ratio (i.e. 23.5%,) be applied to the entire corridor work plan investment amount of 91.9 bn EUR, it can be expected that over the next years, 11.1 bn EUR (calculated on basis of approved EU grants) and 21.6 bn EUR (calculated on basis of entire EU grants) will be demanded from project promoters and Member States.

The assessment of the Rhine-Danube project pipeline regarding the potential of projects for EIB/EFSI support depicts the following:

- Of the 316 projects about 100 projects or approximately 18% are identified as financially sustainable. All projects with the indications of potential revenue generating by the promotors are summarised in the share of 18%.
- It was also deemed that additional 49% of the projects or 276 projects could be a potential for financial sustainability, if properly structured (i.e. potentially financially sustainable). Here the projects are summarised by following the guidelines for the distinction between non-financially sustainable and potentially financially sustainable projects as given by EC in email of 9 January 2017.
- The remaining 187 projects or 33% are considered as non-financially sustainable.
- Would the same percentages apply to the investment amount relative to all the projects included in the work plan, approximately, 7.1 bn EUR capital expenditure would be relative to financially sustainable projects and 82.5 bn EUR would be relative to projects, which could be sustainable, if properly structured.

6.4.2 Project funding under CEF (2014 – 2017)

During the first 4 years of the CEF Transport implementation period, the RDC had a very intensive period of launching new infrastructure and study projects. 117 projects receive CEF funding of total 4.9 bn EUR in the RDC from the 3 Transport calls 2014 - 2016. The disbursement of funding to the different sectors is summarised in the following table.

Table 22: Investment and CEF funding 2014 – 2016

No projects	Mode / sector	Total eligible costs	CEF funding	Share of funding (%)
117	Total projects	8,833.8 mio	4,923.9 mio	56
32	Rail	7,054.8 mio	3,625.8 mio	51
17	ERTMS	723.5 mio	590.6 mio	82
22	IWW/RIS	415.8 mio	324.3 mio	78
31	Road/ITS/clean fuel	504.1 mio	296.7 mio	59
3	Innovation	16.8 mio	8.4 mio	50
4	Airport/SESAR	43.1 mio	21.5 mio	50
8	Multimodal, ports	75.5 mio	56.4 mio	75

Source: INEA, 2017

These concerned 117 projects are 43 studies, 27 mixed projects (studies + works) and 47 infrastructure works.

An important pipeline of mature projects has been identified and has translated into a huge success of all calls for proposals. This has led to a fast and efficient use of the available CEF financial means. The average co-funding rate of all projects is 56%. The co-funding rates for rail is 51%, for ERTMS 82% and for IWW/RIS projects 78%.

74% of the CEF funding supports rail projects, 12% goes to ERTMS projects, 7% to IWW projects and 6% to road/ITS/clean fuel projects.

6.4.3 Infrastructure funding and innovative financial instruments

The projects to be developed can be ranked in three different categories from the point of view of funding and financing needs:

1. For several revenue generating projects "closer to the market" in terms of development (technological components, including on large infrastructure of key European Interest, brownfield upgrade) or service provision (terminals for freight/passengers, enhancement of infrastructure capacity / performances), a substantial component of the project funding can come from own resources (e.g. equity) and financing resources gathered by the project promoters on the market (e.g. in the form of equity, loans or bonds). The private investors would need to recover their initial costs of capital and receive a reward for the risk born (the higher the risk the higher the return required).

   The project may look at conventional lending from public and private banks, alternative financing from institutional investors (e.g. bonds) and at financial instruments for instance to cope with the unbalances of cash-flow during its construction and rump-up phase until a sustainable flow of revenues is secured, and to address particular risks and market failures, and to secure lending with long maturity. Financial instruments could be provided in the form of credit enhancing and guarantees (be it a specific legal guarantee or a financial guarantee to ease access to financing).

2. Hard-infrastructure, greenfield, risky, long-term projects such as the majority of cross-border railway connections as well as inland waterways navigability improvements might require a substantial public support through public funding, even if innovative approaches can apply to project development and/or to specific components of the investment. Public funding can be structured in different ways (also depending on the budgetary constraints of

the public authorities) such as lump sum subsidy (grant), fiscal incentives, and operational deficit coverage and availability payment schemes.

3. In a variety of intermediate cases the project will require a more limited funding component in order to reinforce its financial viability – these projects could be supported through a blending of funding (e.g. grants) and financing.

   In this respect, beside the national budget, the funding contribution can effectively come from the EU centralized managed funds, such as the Connecting Europe Facility (CEF) and from decentralized managed funds such as the European Structural and Investment Funds (ESIF) while the financing resources may come from the EU financial instruments, such as the CEF Debt Instruments and financial products available under the European Fund for Strategic Investment (EFSI).

For all these 3 different categories of projects the public intervention with the different degree of intensity is justified on the ground that these projects of high socio-economic and EU added value, substantially address overall public service obligations, suboptimal investment level, market failures and distortion due to externalities (positive, for the projects supported, including in terms of strategic added-value, and negative for competing modes), and therefore calls for the transfer of resources.

When considering the project funding structure in a comprehensive and multimodal setting, earmarking of revenues and cross-financing solutions, applying "Polluter-pays" and "user-pays" principles ought to be duly explored.

A project can be fully developed through project financing if the revenue stream (secured by public and/or private funding), exceeds the investment and operational costs (CAPEX+OPEX). Such an approach calls for a careful risk sharing between the Member States (project management) and private partners.

Notwithstanding the project self-financing potential linked to user fees, a cautious and innovative approach aimed at exploiting the project' life-cycle and define clear responsibilities and risk sharing between project promoters, sponsors and implementing bodies is more and more needed to deliver projects on time, cost and quality and to fully exploit the potential, while minimising future liabilities on public budgets.

A pre-condition for project financing is a conducive regulatory and legal environment, in order to set the incentives right to enhance the public and private sector involvement in the delivery of infrastructure investment.

6.5 Impact to jobs and growth

An analysis of the growth and jobs impact of the corridor development was performed by applying a multiplier methodology based on the findings of the study "*Cost of non-completion of the TEN-T"*[36]. For the analysis the projects contained in the project list of May 2017 are classified into three mutually exclusive categories:

- Cross-border projects,
- Innovation projects,
- Other and thus average projects

The projects for which cost estimates are available and that are planned to be implemented over the period 2016 until 2030 were taken into evaluation; they amount

[36] *Schade W., Krail M., Hartwig J., Walther C., Sutter D., Killer M., Maibach M., Gomez-Sanchez J., Hitscherich K. (2015): "Cost of non-completion of the TEN-T". Study on behalf of the European Commission DG MOVE, Karlsruhe, Germany.*

to an investment of 87.7 bn EUR. The implementation of these projects on the corridor will lead to an increase of GDP over the period 2016 until 2030 of 725 bn EUR in total. Further benefits will occur also after the year 2030.

The investments will also stimulate additional employment. The direct, indirect and induced job effects of these projects will amount to 2,002,000 additional job-years created over the period 2016 to 2030. It can be expected that also after 2030 further job-years will be created by the projects.

7 Flagship Initiative

Taking up the topics of the Issues Papers by the European Corridor Coordinators and translating the basic work of the issue Papers into concrete actions, the Commission wants to boost the generation of innovative flagship projects/initiatives on the core network corridors. Such a flagship initiative may be characterized by:

- Additionality: the initiative would not have seen the light without the stimulation by the Corridor Coordinator
- Regional suitability: it matches the particularities of the Corridor, supports its development by taking up existing limitations and bases on solid grounds (e.g. preparatory activities)
- Short term implementation: it can be realized in near future
- Corridor wide: Deployment on the whole Corridor, the Corridor shall take the ownership.
- Forerunner: other Corridors may follow the example of a successfully implemented pilot initiative

During summer 2017, the flagship initiative named "**Digital solutions to alleviate administrative red tape"** was developed. This thematic cluster aims at improving border control procedures in Danube navigation.

Administrative processes in Danube navigation are currently not harmonised in some areas and lead to partly avoidable controls and to delays in waterway operations. This causes significant competitive disadvantages for Danube navigation. The overall aim of the flagship initiative is to simplify, harmonise and digitalise administrative processes (in this specific order) in Danube navigation, in order to raise efficiency and effectiveness of administrative control procedures, while at the same time reducing costs and delays for shipping companies. The focus is on simplification and harmonisation for the coming 2-3 years.

The Working Group on „Administrative Processes „of the Priority Areas 1a and 11 of the **EU Strategy for the Danube Region** in combination with the project „Removal of administrative barriers along the Danube"(nationally financed within the Austrian Action Programme on Danube Navigation) as well as the DTP-financed DANTE project have already done important preparatory work, which was aimed at the simplification and harmonisation of the border control processes and forms along the Danube.

A first step towards simplification was provided by the „Practical manual on border controls along the Danube and its navigable tributaries", which increases transparency and offers guidance to waterway users. By the end of 2017 a first set of harmonised control forms (Danube Navigation Standard Forms – „DAVID forms") shall be elaborated by PA1a and accepted by border control authorities of PA11. The first set of harmonized forms pertains to arrival and departure reports, crew lists and passenger lists (based on IMO FAL forms).

The flagship initiative is complementary to existing initiatives and shall cluster and consolidate working groups and projects. Most importantly it shall accelerate the

necessary implementation steps towards simplification, harmonisation and digitalisation of border control procedures.

In 2018 the flagship initiative shall show its effect during the preparation of technical content for recommendations on administrative level which is expected to facilitate the application of the harmonised forms on national level. The flagship initiative raises the importance of the issue in all concerned countries and may therefore lead to a faster agreement on the actual use of new forms and procedures.

Depending on the progress of simplification and harmonisation in the previous steps possibilities for digitalisation and the effective use of River Information Services in administrative processes shall be explored.

The flagship initiative has been accorded and coordinated with the main stakeholders involved: the EUSDR Priority Area 1a (Inland Waterways) and PA11 (Security) Coordinators, viadonau (as project coordinator of nationally financed project „Removal of administrative barriers along the Danube „and the CEF-financed project RIS COMEX) as well as Pro Danube International (Lead Partner for DANTE project).

8 Recommendations and outlook by the European Coordinator

Multimodal and interoperable corridor

The Rhine-Danube corridor develops from east to west along two main streams of traffic converging towards the central part of the European Union providing two important lines of connection with south-eastern Europe.

The more northern branch starting at the Slovak-Ukrainian border is bimodal in its strict definition, although it runs in parallel with the Orient-East Med corridor and its component of inland waterway on the Elbe River in Czech Republic. This stream also runs in parallel with the Rhine-Alpine corridor and the Rhine River between France and Germany.

The other branch, from the ports on the Black Sea in Romania crosses all Balkan States along the river Danube until the central Member States. It is a multimodal connection with a strong inland waterway component developed through the Danube River, its tributaries Sava and Tisa, the canal Main-Danube and the river Main until the Rhine River.

This geographical connotation underlines the importance of setting up a multimodal, interoperable, interconnected and reliable transport system in the region.

Rail and road infrastructures are the architecture of connectivity both for passengers and for freights; however particularly in this Core Corridor, the inland waterways transport can perform an important role for the development of the region.

The above statement is conditional to the political will to develop navigability. If its development is not done at all or not done properly, it will have a damaging effect on the economic development and on the living habitat of the rivers.

As we have seen in the analysis of the present situation and in the evaluation of the projected situation in 2030 as studied in these last two years and reported in the previous chapters, it clearly appears that the goal of achieving a fully developed Rhine-Danube Core Network Corridor will not be achieved in many aspects, unless targeted measures will be put in place timely. As noted in this report, severe

bottlenecks affecting rail, road and inland waterways infrastructure still remain and hinder the completion of the projects listed in the Work Plan.

The Regulation for the Guidelines on the development of the Core Corridors clearly states which are the performances required for a high standard level structure; that it has to be interoperable despite the crossing of national borders and the use of different technologies and finally that it has to make the best use of each single mode of transport as this will best relate in each specific region: and all this has to be achieved by 2030.

The success of this operation depends on the available budget, international, national or private and on the political will to develop each infrastructure. Two aspects that are not and cannot be included into the Regulation: they are subject to the budget requirement and availability as well as on the approach undertaken to use available resources to develop a homogeneous and reliable transport system.

In these aspects comes the role of the Coordinator who, together with national and regional authorities, with the Commission and all involved stakeholders can help identifying the necessary steps keeping into account the limitation of funding, the various forms of funding and the respects of righteous constraints like the one imposed to achieve a sustainable transport system.

MoS standard

In parallel to my work programme, Brian Simpson, the European Coordinator for Motorways of the Sea, delivered on the second version of the Motorways of the Sea (MoS) Detailed Implementation Plan (DIP).

The document, following extensive consultations with stakeholders and Member States, presents a number of recommendations to shape the MoS programme of tomorrow in close coordination with other European Coordinators.

The DIP singles out the key three future development priorities:

- Environment
- Integration of maritime transport in the logistic chain
- Safety, Traffic Management and Human Element

The MoS work programme is instrumental in identifying future TEN-T policy maritime objectives and it clarifies the main areas that would require EU financial contribution in order to help the maritime industry to improve its environmental and safety performance. It also includes a number of suggestions with the objective to contribute to the increased efficiency of the logistic chain within the 9 Core Network Corridors by pointing out to gaps in terms of maritime links.

Brian Simpson's work programme comprises also a set of recommendations defining possible future funding objectives with regard to maritime dimension of the TEN-T policy paying particular attention to future trends in Short Sea Shipping in Europe and the crucial MoS contribution to better connectivity with peripheral and outermost regions.

The document is supported by a full set of data on ports characteristic, which are an integral part of the TEN-TEC database and in the form of annex it consists of a detailed analysis on ports and shipping operations with regard to all 331 seaports included in the TEN-T core and comprehensive network. The document makes an effort to characterize the main bottlenecks and investment needs in the Comprehensive Network of ports as well as point out the main inadequacies when it comes to current network of MoS links.

The need for Rail breakthrough over the period 2018-2023

The Core Network Corridors, under the guidance of the European Coordinators, are a key instrument in the European Commission's policy to improve overall mobility in Europe by optimizing the transport modes, in particular through: rail, road, inland and maritime waterways and air transport.

The Core Network Corridors strive for an optimal balance and seamless connection between the different transport modes that need to be equally efficient and open to continuous technical developments in order to enhance mobility.

The modal share of rail remains below expectations. Therefore a necessary prerequisite for balance between transport modes is a competitive railway sector. Its competitiveness can be significantly improved over the period 2018 – 2023 through the execution of short-term, operational or administrative actions, requiring lower level of investments – through so called 'rail breakthroughs' targeted in particular at the CNC's and RFC's. The complementarity of Core Network Corridors and Rail Freight Corridors is therefore self-explanatory; their cooperation should be steered politically by the European Coordinators, hand in hand with the RFC Executive Boards.

The European Coordinators will seek to facilitate the CNC/RFC cooperation and ensure national high-level political support to the RFCs, so that they are able to implement the rail breakthroughs. In order to enhance this approach, future EU investments could be conditionally linked to the operational implementation of these breakthroughs.

Significant and measurable performance results of interoperability can be expected from the Rail Freight Corridors that have an integrated and regional governance structure gathering all stakeholders: the railway undertakings, the terminals, the infrastructure managers and the Ministries of Transport. They are therefore in a unique position to identify and implement the most urgent and efficient rail breakthroughs along their corridors, and should be encouraged to ensure that the entire corridor is able to allow interoperable operations. The European Union Agency for Railways has a key role to play to support this approach, for eliminating national rules which hinder interoperability and in the further development of technical specifications of interoperability (especially on operations, to support common operational procedures).

To conclude, these are my recommendations:

- We have the clear advantage of a really multimodal corridor as, besides the rail and road components, the inland waterways one is of great importance and can play a significant role in reducing the overall environmental impact of the other modes.
- The Danube River and its tributaries represent an important source of unspoiled transport capacity. The development of inland waterways needs to be done in accordance with the EU transport policy objectives and the European environmental legislation. The Joint Statement on Inland Navigation and Environmental Sustainability provides guidance on how to consider all needs during the planning and the realisation phase.
- Concerning CEF funded Actions in the field of IWW, the successful completion of several environmental assessments, in the form of pilot projects, is fundamental for the subsequent start of large scale infrastructure works aiming to guarantee a good navigation status along the Sava and Danube rivers. Thanks to CEF funded projects, important steps have been taken and continuous progress has been made to promote the involvement of all relevant stakeholders though and increased sense of ownership. A telling example in

this regard is FAIRWay Danube Action (2014-EU-TMC-0231-S), which will create a Danube-wide platform for exchange and discussion, enabling the alignment of inland waterway transport and environmental priorities.

- The Fairway Rehabilitation and Maintenance Master Plan, as developed within the EU Danube Region Strategy and as endorsed by most Transport Ministers, serve as recognized political framework. FAIRway Danube (ID 9247) monitors the implementation of the Master Plan and prepares for its full deployment; it monitors the progress in fairway rehabilitation and maintenance and tries out new ways to increase the availability of the waterway and to provide better fairway related information. Thus, it prepares for the full deployment of the Fairway Rehabilitation and Maintenance Master Plan.
- Integrated river engineering projects and maintenance dredging are carried out only in a few countries; more effort is needed in the other countries in order to meet the above mentioned objectives.
- While the EU funding instruments (CEF, ESIF, IPA, etc.) are crucial enablers for improvements in the area of riverbed monitoring and lock rehabilitation, national authorities need to provide sufficient operational budgets in order to allow unhindered navigation.
- The experience accumulated by non-Cohesion countries during the previous financial period (2007-2013) has now a favourable influence on the implementation of innovative projects in the Eastern part of the Rhine-Danube Corridor. In this field, the challenge for the Corridor Coordinator, more that the need to address technical implementation issues is to ensure that all countries develop a proactive strategy that, at the due time, prompts the necessary political support for innovation projects in the next financial period after 2020.
- On rail it has been reported that, despite important interventions and large budgets, there are still bottlenecks, particularly represented by lack of capacity in terms of axle loads availability or by missing electrification, for which plans are not yet being filed. The critical issues as listed in the Work Plan have to be removed.
- Given the fact that most ports comply with most of the key performance indicators which, in turn, do not completely reflect the qualitative situation of ports, it is recommended that the aspects of port modernization, infrastructure efficiency and greening of port development and operations is taken into account in future planning and policy documents on both national and especially supranational (EU) levels. Special emphasis should be placed on the development of infrastructure and suprastructure facilities for loading/unloading and handling of containers in ports. Apart from the positive development in the domain of construction of LNG supply facilities for vessels in ports, efforts directed towards the development and increased use of electricity powered or hybrid (diesel – electric, LNG – electric, diesel – LNG, etc.) handling equipment in ports (forklifts, tractors, handling trucks, wheel-loaders, mobile cranes, reach stackers, etc.) deserve even stronger support.
- ITS is deemed to provide more safety, capacity and energy reduction in road transport. Already now, related projects such as CROCODILE and C-ROADS are being deployed in Austria, Czechia and other Member States, but should be intensified in other parts of the Corridor, enabling smooth data transfer between Member States.
- Alternative clean fuel deployment is a strongly growing topic, fostering the emission reduction on the roads. CEF Transport 2016 call is supporting various

works and studies for LNG, CNG refuelling points and EV recharging station networks along the Corridor. More attention could be paid to the deployment of EV fast-charging station networks along the Corridor outside the urban nodes.

- Priority should be given for the development of heavy rail connection to the airports in the urban nodes of Budapest (Preliminary studies and works started under CEF Transport 2014) and Praha (CEF Transport 2015: Negrelli viaduct and planned construction of the link connecting the city centre and the airport).
- Not for all, but certainly for many of these cases there is still the possibility of undertaking necessary measures: once more political will, combined with appropriate and targeted funds are necessary to achieving the goal set for 2030.
- Political commitment from the countries involved is paramount for a timely and effective realisation of the Corridor as set out in the Regulations. This political commitment requires the support of the Member States not only at the moment of the submission of the application, but also during the implementation phases. The right co-financing part and the quality of projects have to be ensured by the Member States involved. Strong multi-lateral commitment by Member States, implementing bodies, project promoters, INEA and the European Commission is the sine qua non condition for the successful completion of CEF funded Actions. Transparent communication among national and European actors must be a priority and can facilitate necessary know-how transfers for the benefit of the projects. Adequate human resources have to be devoted to the implementation of the projects. The right governance structures will have to be put in place in the Member States and by the beneficiaries to guarantee this, allowing Member States to have an early involvement and active role in resolving problems.

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Useful links with background information:
http://ec.europa.eu/transport/themes/infrastructure/ten-t-guidelines/corridors/corridor-studies_en.htm

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