



Study on Rhine – Danube TEN-T Core Network Corridor

2nd Phase

Executive Summary

December 2017

EN

Abstract

The TEN-T Regulation 1315/2013 foresees that the European Coordinator for the Rhine–Danube Corridor, Ms. Karla Peijs, transmits the Corridor Work Plan to the Member States. In this respect, the Coordinator was supported by a Team of consultants led by iC consulenten, for carrying out the Core Network Corridor (CNC) Study between September 2015 and December 2017. The results of this study serve as the major technical input to the updated Second and Third Work Plan, which were presented and discussed in seven meetings of the Corridor Forum.

In this second phase of the CNC Study, the analyses focused on the identification of bottlenecks, missing links and issues concerning the compliance of existing infrastructure with the requirements of the TEN-T Regulation 1315/2013. The aims of the study were to identify measures to close the missing links on cross border sections, to remove infrastructure bottlenecks as well as administrative and operational barriers and to improve the efficiency and sustainability of all transport modes. Compared to the original tasks in the previous years this Work Plan deals in addition with the potential of innovation deployment, emission reduction and decarbonisation, as well as climate change related impacts of infrastructure development.

Disclaimer

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Executive Summary of the Study

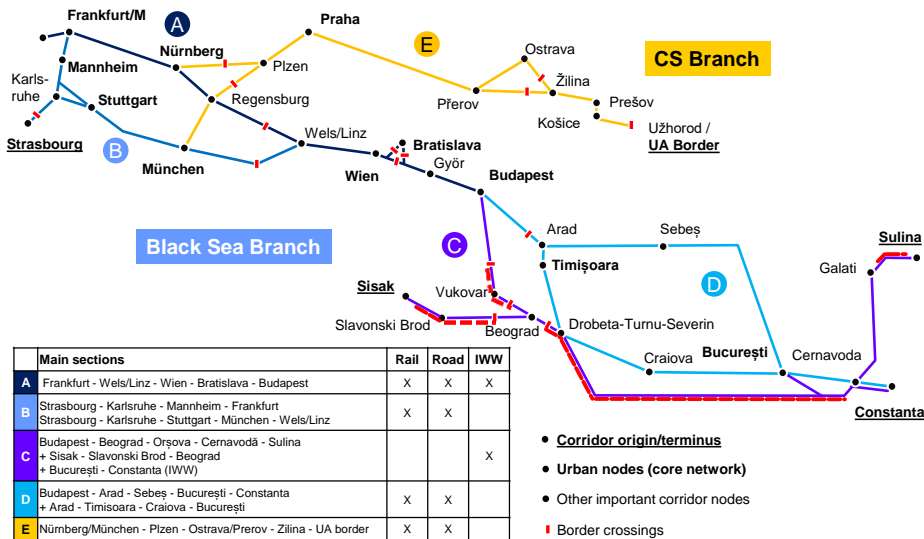
This study contributes to the further refinement of the Corridor Work Plan for the TEN-T Core Network Corridor Rhine–Danube (RDC) that is to be updated regularly according to TEN-T Regulation 1315/2013¹, taking also into consideration CEF Regulation 1316/2013². It was elaborated during 2015-2017 by a multi-national study team led by iC consultants on behalf of the Directorate-General for Mobility and Transport of the European Commission.

The results of the study established the basis for the European Coordinator of the Rhine – Danube Corridor, Ms. Karla Peijs, to draw up the Corridor’s Second and Third Work Plan, benefiting also from the support mechanism of the Corridor Fora and dedicated Working Group meetings, whereby topics of specific interest to the Corridor were presented and discussed on a regular basis.

The Alignment of the Rhine–Danube Corridor

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 connect them to four non-EU Member States. The Corridor has two branches (see Figure 1): The “Black Sea” branch between France/Germany and Romania includes Rail, Road and IWW networks. It has two different routes in Germany and Romania. The Czech-Slovak “CS” branch in the north between Germany and the Slovak-Ukrainian border is only related to Rail and Road. The mode specific networks are connected by numerous (multimodal) nodes: 18 inland ports, 1 seaport, 11 airports as well as 16 tri-modal and 27 rail-road terminals. Moreover, 13 urban nodes are located on the Rhine-Danube CNC.

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



Source: HaCon, status 09/2017

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

¹REGULATION (EU) No 1315/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 on Union guidelines for the development of the trans-European transport network...

²REGULATION (EU) No 1316/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 11 December 2013 establishing the Connecting Europe Facility...

- OEM Corridor (starting at Vidin/Bulgaria, the western part in Romania, Hungary, in the Czech Republic between Brno and Praha, Vienna node/Austria and Bratislava node/Slovakia)
- BA Corridor (in Czech Republic between Přerov and Ostrava, Žilina/ Slovakia, Wien node/Austria)
- Scan–Med Corridor (in Germany Würzburg – Nürnberg, München - Rosenheim)
- RALP Corridor (in Germany on the Rhine between Frankfurt and Strasbourg/France)
- MED Corridor (Budapest node/Hungary)

Rhine-Danube Corridor at a glance

In 2014, more than 94 million people were living in the catchment area of the Rhine-Danube Corridor, generating a GDP of about 2,009 bn EUR.

The existing transport pattern indicates that transport by 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%.

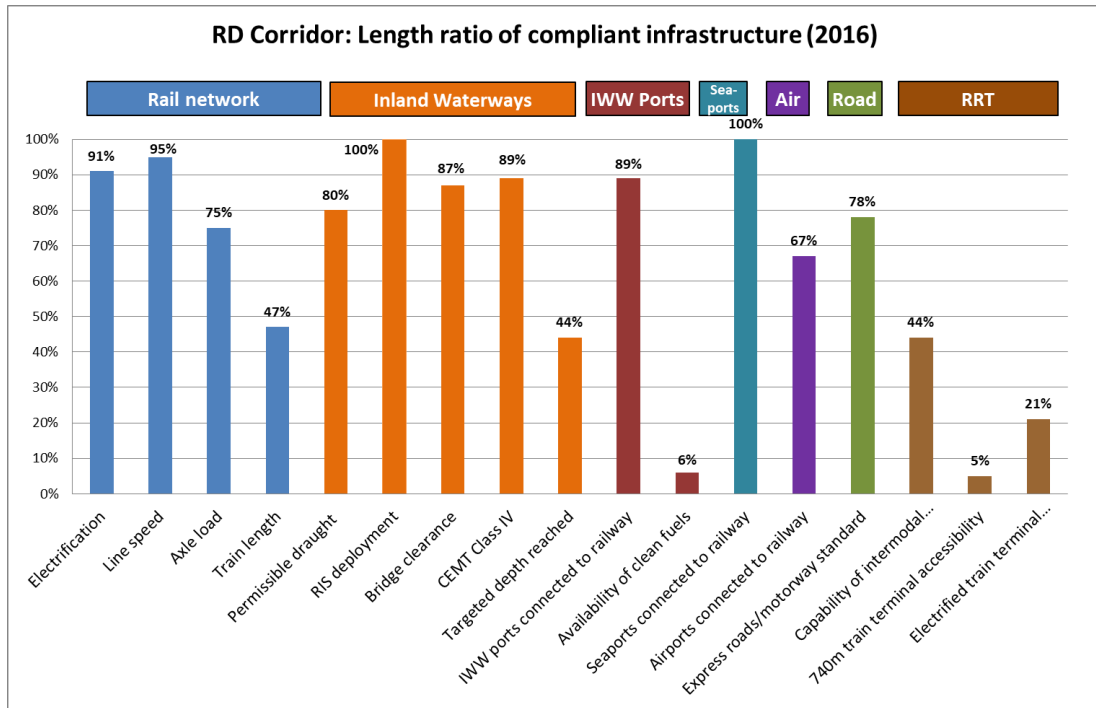
The **freight transport** volume in tonnes within the Rhine-Danube Corridor is also dominated by road. However, the share of road is lower compared to passenger transport. In percentages the modal freight shares are: 56% for road, 27% for rail and 17% for IWT³.

Forecasts indicate that road transport will remain to be dominant in the future market. This is the case for international and national traffic, passenger and freight transport.

Compliance with the technical infrastructure requirements (2016)

Regulation 1315/2013 sets out the transport infrastructure requirements for each of the transport modes and the connected infrastructure components. The progress of each Corridor has been measured compared to the infrastructure requirements of the core networks identified in the TEN-T Regulation.

³ Source: Study on the Rhine – Danube Corridor, 2014

Figure 2: Key Performance Indicators and compliance rates (all modes)

Source: RD CNC Final report, November 2017

Rail: The entire rail infrastructure of the Corridor provides for standard gauge (1,435 mm). 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. An operating speed of at least 100 km/h for freight traffic is enabled in 95% 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). Lower compliance rates relate to axle load (22.5t) with 75% of the rail network. Line sections not fulfilling the requested standards are mostly located in Hungary and Romania. A maximum train length of 740m is permitted for 47% of the rail infrastructure. Sections which only provide for shorter trains are located on the “CS branch”, in Austria and in Romania. Operational ERTMS is rather rare in the overall corridor.

IWW: 89% of the inland waterway network, including Serbia, is classified as a class IV waterway or higher; only the Sava River is assigned a lower class. A draught of 2.50m is permissible in 80% of the inland waterways. Shortfalls relate not only to the sections of the Sava but also to the Upper Main and the Danube between Straubing and Vilshofen (1.6m over 94% of days per year). Four bridges offer a clearance below 5.25m; 87% of the sections length does comply with the requirement. River Information Services are available along the entire Corridor (100%) but to a different extent and quality. Achievement of targeted depths varies dynamically in free flowing river sections and was met at 40% of the time in 2016.

Inland and maritime ports: The majority of the Corridor inland ports comply with the requirements. Only two ports, Vidin (BG) and Cernavodă (RO), do not meet the minimum depth and therefore require dredging activities (89% compliance of inland ports). All core ports⁴ have a road connection but of varying quality in terms of

⁴ Rhine ports are tackled in the study on Rhine-Alpine Corridor, while the Czech ports are tackled in the Orient-East Med Corridor study.

number of lanes and capacities. The situation is similar as regards railway connections, as only two ports, Komarom (HU) and Cernavodă (RO), have no fully functional rail connection to the hinterland and the rest of the network (89% of inland ports). The availability of intermodal facilities in ports is varying and, generally, declines further downstream (72% of inland ports). Plans for alternative clean fuel facilities have been reported by the ports of Constanța, Bratislava and Enns (6% of inland ports). The Port of Ruse constructed a LNG terminal with fuelling facilities for future LNG vessels. 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 (89% of inland ports).

The infrastructure of the maritime port of Constanța complies fully with the KPIs.

Rail-Road Terminals: 44% of the intermodal terminals are able to handle all three requested types of loading units (containers, swap bodies, trailers). Moreover, limited electrified rail access to the terminals (21% of the sites) and insufficient length of the handling tracks (only two sites compliant) 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 track, non-electrified, annex to shunting yard or port railway line) and the limitation of the (wagon) train length by either the entering/departure siding or by the transshipment track(s).

Road: About 78% of the total length of roads is classified as motorways (express ways) and 22% are conventional roads. The majority of conventional roads are located in Slovakia and Romania. The availability of alternative clean fuels along the road corridor is given; possibilities for compressed natural gas (CNG) and liquefied petroleum gas (LPG) are available in all Member States at different levels. A good coverage of LPG supply stations already exists. For CNG supply along the corridor route a limited coverage exists. Electric charging stations are available to a larger extent in Southern Germany, Austria and Slovakia; supply stations are not available in the Czech Republic, Hungary and Romania.

Airports: The airports of Frankfurt, Stuttgart, München, and Wien, Bucuresti and Ostrava have a rail connection. The airports of Nürnberg, Praha, Bratislava, Budapest and Timișoara do not have a rail connection. The airports of Praha and Budapest are to be connected to rail by 2050.

The RDC project list – future challenges and need for action

At the end of March 2017, the Rhine-Danube project list included 563 projects altogether. This figure comprises all projects that have been concluded between 2014 and 2016 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 of 225 projects (+67%).

The projects in the project list can be grouped as follows:

- 315 out of the overall 563 projects (=56%) are located on the Rhine-Danube Corridor exclusively. Most common projects are shared with the Orient/East-Med Corridor (152 projects) and the Baltic-Adriatic Corridor (91 projects).
- 149 Rhine-Danube Corridor projects are related to a cross-border section.
- 116 projects refer to last-mile infrastructure.
- 277 projects (=49% of all RD projects) are allocated to “pre-identified sections including projects” according to Regulation 1316/2013 Annex I, Part I. About half of these RD projects are 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.

Looking at the costs for developing the corridor infrastructure, all 563 projects would add up to 91.9 bn EUR which translates into an increase of 27.2 bn EUR (+42%) compared to the 2014 Work Plan.

Rail: The total investment costs for all 141 rail projects would amount to 54.7 bn EUR. When excluding the rail projects completed between 2014 and 2016 and the 15 projects with no cost information the total number of 123 ongoing and identified projects represent costs of 51.7 bn EUR with an approved financing rate of 81% (national financing and international co-financing).

IWW: 65 projects with investment costs of 4.2 bn EUR relate to the development of the inland waterway network. When excluding the costs of completed projects (7 projects, 192 mio EUR) the total number of 48 ongoing and identified projects represent 4.0 bn EUR. With project costs of 1.4 bn EUR, the new construction of the Danube-Bucharest Canal is the largest project; however it may be implemented only after 2030.

Inland and maritime ports: 118 projects concern port development, with total investment costs of 2.6 bn EUR. 86 projects are ongoing or planned with known costs of 2.3 bn EUR.

Rail-Road Terminals: 38 projects are contributing to terminal development with known costs of 1,091 mio EUR.

Roads: 113 projects contribute to the road network with investment costs of 24.6 bn EUR. 10 projects were completed between 2014 and 2016. 103 projects are ongoing or planned with costs of 23.4 bn EUR.

Airports: The project list of 2017 contains also 29 projects dedicated to airport development with investment costs of 2.9 bn EUR. 15 projects refer to the intermodal connection of the airport, thereof 14 projects to rail and one to the road. Six projects are pure studies and one project relates to SESAR.

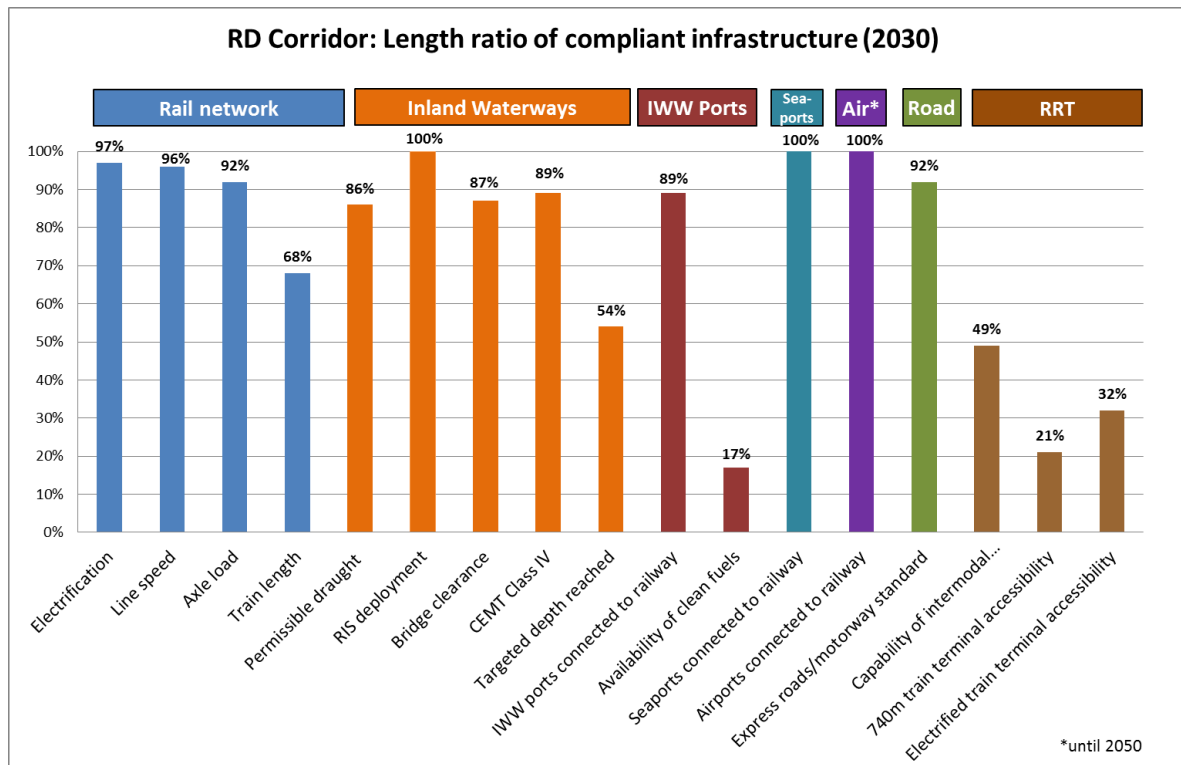
Furthermore 22 projects in the project list with investment costs of 273 mio EUR focus on innovation.

During the first four years of CEF Transport implementation, the RDC had a very intensive period of launching new infrastructure and study projects: within the three transport calls 2014 – 2016, 117 projects allocated to the RDC received a total CEF funding of 4.9 bn EUR (=56% of the total eligible project costs). Considering individual transport categories, particularly ERTMS projects received a high share of CEF funding (82%), followed by IWW/RIS (78%) and rail projects (51%).

Projects with known cost figures and planned completion before 2030 were evaluated regarding their impact on jobs and economic growth. In total, the implementation of these projects will increase the corridor's GDP by 725 bn EUR during the period 2016-2030. Moreover, the investments will also stimulate additional employment: direct, indirect and induced job creation of these projects will amount to about 2 million additional job-years over the period 2016-2030. It can be expected that also after 2030 further job creation will be induced by the projects.

Future challenges and persisting bottlenecks

When considering the implementation of all projects with mature project information the Corridor infrastructure would reach the compliance levels in 2030 shown in the following figure.

Figure 3: Key Performance Indicators and compliance rates 2030

According to current planning status, several persisting bottlenecks require further actions until 2030:

Rail: Necessary actions relate to the following gaps and missing links that are – according to the current status – not expected to be solved before 2030:

- KPI compliance gaps on the following large, connected corridor parts require the definition of new projects or the addition of reliable finalisation dates for already defined projects:
 - Schwandorf – DE/CZ border (electrification),
 - DE/CZ border – Domazlice (speed),
 - large parts of Slovakia and Czech Republic (train length),
 - München- Freilassing (axle load),
 - Rajka – Heyeshalom (axle load, train length),
 - Sections in Hungary on the line between Budapest and Lököshaza (axle load).
 - Predeal – București (axle load, train length),
 - Craiova – București (axle load),
 - București – Constanța - existing line (train length),
- Missing link București – Constanța (new high-speed line); it is not planned to realise this new line before 2030;
- 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 volumes by 2030;
- Not yet approved, complete financing of projects or missing information on detailed project implementation, e.g. electrification of the lines München – Freilassing and Nürnberg – DE/CZ border;

- ERTMS deployment: Operational ERTMS is deployed on only 7% of the CNC rail network and restricted to some line sections in Austria and Hungary. The roll-out of ERTMS on the corridor shall be done in accordance with the 2017 ERTMS European Deployment Plan (and its next revision in 2023).

IWW: Most critical is the section between Straubing and Vilshofen, where projects are ongoing but the set targets are below the requirements of regulation 1315/2013. Activities related to the upgrade of the Sava are planned but the timing and financing are still unclear.

Intentions to increase bridge clearance are missing for all 4 non-compliant bridges (Auheim, Alte Mainbrücke, Bogen, Luitpoldbrücke).

In order to reach the targeted fairway depth and thereby increase navigation reliability, studies and pilot projects at the Slovakian-Hungarian border section (Sap-Szop), in Hungary (Szap- Mohacs port/Batina), the Bulgarian-Romanian border section (Porțile de fier II (Iron gates) – Călărași) and in Romania (Călărași - Brăila) need to be followed-up by subsequent steps, mainly rehabilitation and upgrading of the physical infrastructure, in order to complete the network.

Inland and maritime ports: Currently, no projects tackling missing functional railway connection in the port of Cernavodă (RO) are planned.

In terms of incompliance with technical parameters, the ports of Cernavodă (RO) and Vidin (BG) do not provide minimum draft of 2.5m at all water levels, but the port of Vidin aims to solve this incompliance within a larger global project on inland waterways interventions. No such projects have been planned for the port of Cernavodă. Concerning the provision of alternative clean fuels supply facilities, the ports of Constanta (RO), Bratislava (SK) and Enns (AT) have reported projects involving construction of such facilities. Projects combating the lack of intermodal facilities have been reported and identified by the ports of Slavonski Brod (HR) and Drobeta Turnu Severin (RO). Ports of Calafat (RO), Cernavodă (RO) and Komarom (HU) have not planned any actions related to provision of intermodal facilities.

Rail-Road Terminals: Although several terminals will improve their compliance level with the requirements of TEN-T Regulation 1315/2013, the majority of terminals will not achieve all KPI target values by 2030. Especially the terminal accessibility for trains with a length of 740m will only be fulfilled by 21%.

Road: Still some road sections in Slovakia (towards the Ukrainian border), in Hungary on the ring road around Budapest and in Romania (between Craiova and București and sections of the ring road around București) are expected to remain incomplete concerning the KPI "Express road/motorway". On the cross-border section between France and Germany no project is foreseen for road connection Strasbourg – Illich FR/DE border – Offenburg (ordinary road, L98).

Administrative and operational barriers

Continuity of passenger and freight flows by rail is jeopardized at cross-border sections due to changing technical parameters. Particularly long-haul freight trains are affected by capacity limitations due to sections with low train lengths or axle loads along the route and by additional operation costs due to the need for multi-system locomotives. Border control procedures influence transport/travel times, costs and resource efficiency of rail transport negatively. Also deviating infrastructure parameters at last mile connections or missing interconnections hamper the growth of rail transport.

Inland waterway transport might be improved by providing waterway infrastructure managers with adequate budget to fulfil their national maintenance duties. Also the

well qualified human resources for the preparation and implementation of complex, integrated waterway management and engineering projects is not sufficiently available in some countries. Some Member States struggle with providing the required fairway depths at some particular free flowing river sections. Administrative processes and paperwork are seen as a significant competitive disadvantage for inland waterway transport on the Rhine-Danube Corridor, which typically covers long distances. Real-time information on fairway conditions is often not available or is difficult to access, making transport planning overly complex. Fees on the Danube-Black Sea Canal are calculated according to loading capacity, not to the actual cargo load. This creates additional costs for shipping companies especially under bad fairway conditions.

Ports set their charges autonomously and may differ substantially depending on the applied organisational scheme. 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.

Urban nodes

The Rhine-Danube corridor core network contains 13 urban nodes: Strasbourg (FR), Mannheim (DE), Frankfurt/M (DE), Nürnberg (DE), Stuttgart (DE), München (DE), Ostrava (CZ), Praha (CZ), Bratislava (SK), Wien (AT), Budapest (HU), Timișoara (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." The analysis of the CNC infrastructure inside the urban nodes against TEN-T parameters provided heterogeneous compliance results: urban nodes with lower share of compliant parameters are Bratislava, Budapest, Praha and Ostrava. In contrast, München, Frankfurt, Mannheim and Stuttgart are compliant regarding almost all checked parameters.

Additionally the ("last-mile") rail connections of inland ports, trimodal terminals and rail-road terminals to the core network have been analysed according to the three parameters axle load, electrification and train length. Half of the analysed last-mile lines (23 out of 45) are completely compliant with regard to the above mentioned parameters. The remaining 22 last-mile connections are not totally compliant and improvement works are needed on the rail lines. The not fully compliant last-mile connections are located in the following urban nodes: Strasbourg (2 out of 2 last-mile connections), Mannheim (3 out of 5), Nürnberg (1 out of 3), Ostrava (2 out of 3), Praha (4 out of 4), Bratislava (4 out of 4), Wien (1 out of 2), Timișoara (2 out of 2), București (3 out of 4).

Environmental impact

For the analysis of emissions the EU REFERENCE scenario 2016 is applied. Passenger traffic is forecasted to increase from 114 bn pkm today to 135 bn pkm by 2030 (road, rail and aviation); the fastest growing sector in the REFERENCE scenario is aviation (at 2.6% per annum).

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

According to the analysis 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 by 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.

Total emissions (2015) on the corridor are 20.4mio tonnes of CO₂ equivalent. Based on the forecasted traffic growth and the increase of energy efficiency emissions of 19.6mio tonnes of CO₂ equivalent in 2030 for the REFERENCE scenario are forecasted.

Conclusion and outlook

The compliance analysis shows that about half of the requirements have already a fulfilment rate of 80% or more. Nevertheless there are certain indicators that need to be addressed decisively in the next years, in order to reach the goals set for 2030. Two of these parameters are the possibility of running trains with a length of 740m (2016: 47%; 2030: 68%) and reaching the targeted fairway depth (2016: 44% ; 2030: 54%) on inland waterways. There is also need for improvement in the availability of clean fuels in IWW ports as well as seaports.

The corridor development process between 2015 and 2017 has been accompanied with the corridor project list as the main basis for the various analyses within this study. This includes the technical analysis of the projects with respect to their contribution to the corridor objectives as well as the gap analysis of the corridor infrastructure regarding capacity issues and compliance with TEN-T KPIs.

The 2017 project list contains 563 projects altogether, including projects that have been concluded between 2014 and 2016 (86). Compared to the first version of the Work Plan in 2014, this means an increase by 225 projects (+67%). The lion's share of projects refers to Rail incl. ERTMS (178 = 32%) followed by Port projects (118 / 21%), Road (113 = 20%) and Inland waterways (without ports) representing 12% of corridor projects. Multimodal, Airport and Innovation projects contribute only with minor shares (<10% each) to the corridor development. Projects with innovation components can be found in the category "Innovation", but also in the mode specific categories if an infrastructure upgrade project includes innovations such as telematics applications or clean fuels. In this sense, 142 projects (25%) show innovation components.

Based on an analysis of the impact on jobs and economic growth, the implementation of projects with a completion date between 2016 and 2030 will increase the Corridor's GDP by 725 bn EUR and create about 2 million additional job-years.

In 2018, phase 3 of the Corridor Study will start. The emphasis lies on a further elaboration of the Corridor knowledge base. This includes updating the analysis of the Corridor's characteristics, the refinement of the project list regarding missing data, new projects as well as a critical review of the submitted projects.

A special task will be monitoring and analysing the state of project implementation. Concerning this matter, it is necessary to provide up-to-date information and identify those difficulties hindering the progress of projects.

The compliance check needs to be re-run. Existing and identified bottlenecks should be the starting point for defining future Corridor projects.

Another important task will be exploiting the potential of innovation deployment, through the further development of innovative flagship projects.